APPENDIX C

OIL-SPILL ANALYSIS

This appendix clarifies information presented in Appendix A of the Beaufort Sea multiple-sale final EIS (USDOI, MMS, 2003a) regarding the estimates of large oil-spill occurrence and updates those estimates specific to Sale 202. The changes in the spill-rate estimates were precipitated by a rerun of the fault-tree model incorporating some of the recommendations made by the North Slope Borough Science Advisory Committee (2003). Information regarding the source, type, and sizes of oil spills, their behavior and the estimated path they follow, and the conditional probabilities remain the same as discussed in the multiple-sale final EIS and is summarized in Section IV.A.2 of this Environmental Assessment (EA). Readers should recognize that the following analysis is based partly on assumptions of future oil production, including the size, location, and production rates from fields that are undiscovered.

C.1. Large Oil-Spill-Analysis.

The definition of a large spill is greater than or equal to (≥)1,000 barrels (bbl). The following elaborates on how the chance of one or more large oil spills occurring was derived for this EA. To estimate large oil-spill occurrence for future exploration, development, and production in the Beaufort Sea OCS, and to identify their principal causal factors and sensitivities to these, a fault-tree analysis was used.

C.1.a. Chance of One or More Large Spills Occurring. The chance of one or more large spills occurring is derived from two components: (1) the spill rate and (2) the assumed resource-volume estimates. The spill rate is multiplied by the resource volume to estimate the mean number of spills. Oil spills are treated statistically as a Poisson process, meaning that they occur independently of one another. If we constructed a histogram of the chance of exactly 0 spills occurring during some period, the chance of exactly 1 spill, 2 spills, and so on, the histogram would have a shape known as a Poisson distribution. An important and interesting feature of this distribution is that it is entirely described by a single parameter, the mean number of spills. Given its value, you can calculate the entire histogram and estimate the chance of one or more large spills occurring. The assumed oil production volume remains 460 million barrels for Alternative I, as discussed in Section II.B of the multiple-sale final EIS (USDOI, MMS, 2003a). Resource volumes for Alternatives III, IV, V, VI and VII are reduced by 1%, 5%, 3%, 3%, and 4%, respectively, from 460 million barrels. The following sections elaborate on how the spill rates were estimated and applied for Sale 202.

C.1.a(1) Spill-Rate Foundation. We derived the spill rates for large spills from a fault-tree study done by the Bercha Group, Inc. (2006). This study examined alternative oil-spill-occurrence estimators for the Beaufort Sea using a fault-tree method. Because sufficient historical data on offshore Arctic oil spills for the Beaufort Sea region do not exist, a model based on fault-tree methodology was developed and applied for the Beaufort multiple-sale EIS (Bercha Group, Inc., 2006). Using fault trees, oil-spill data from the offshore Gulf of Mexico and California were modified and incremented to represent expected Arctic performance. The Bercha Group Inc. (2006) fault-tree methodology differs from the Bercha Group Inc. (2002) work by including the non-arctic variability of spill size and spill frequency.

C.1.a(2) Fault-Tree Analysis. Fault-tree analysis is a method for estimating the spill rate resulting from the interactions of other events. Fault trees are logical structures that describe the causal relationship between the basic system components and events resulting in system failure. Fault-tree models are a graphical technique that provides a systematic description of the combinations of possible occurrences in a system, which can result in an undesirable outcome. Figure C-1 shows the generalized parts of a fault tree starting with the top event. The top event is defined as the failure under investigation. In this case, it is either a large pipeline or platform spill. A series of events that lead to the top event are described and connected by logic gates. Logic gates define the mathematical operations conducted between events.

Figure C-2 shows a typical fault tree for large pipeline spills. The most serious undesirable outcome, such as a large pipeline spill, was selected as the top event. A fault tree was constructed by relating the sequences of events that, individually or in combination, could lead to the leak or spill. The tree was constructed by deducing, in turn, the preconditions for the top event and then successively for the next levels of events, until the basic causes were identified. Figure C-2 illustrates these events included corrosion, third-party impact, operation impact, mechanical failure, natural hazards, unknown and Arctic.

These subresultant events were further elucidated to determine their base cause. For example, corrosion could be internal or external corrosion; third-party impact could be due to fishing, trawling, jackup, or anchor impact. Figure C-3 shows a typical fault tree for a large platform spill. The most serious undesirable outcome, such as a large platform spill, was selected as the top event. Events include a process facility release, a storage tank release, structural failure, hurricane or storm, collision, and Arctic. The subresultant events that make up the Arctic include ice force, low temperature, and others.

Probabilities were assigned to each event so that the probability of the top event was estimated. This required knowledge of the probable failure rates for each event. At an OR gate in a fault tree, the probabilities were added to give the probability of the next event. The fault trees in the Bercha Group, Inc. (2006) report were composed entirely of OR gates. The computation of resultant events consisted of the addition of the probabilities of events at each level of the fault tree to obtain the resultant probability at the next higher value.

In the Bercha Group Inc. (2006) study, fault trees were used to transform historical spill statistics for non-Arctic regions to predictive spill-occurrence estimates for the Beaufort Sea program area. The Bercha Group, Inc. fault-tree analysis focused on Arctic effects, but also looked at the variability in non Arctic effects such as spill size and spill frequency. Arctic effects were treated as a modification of existing spill causes as well as unique spill causes. Modification of existing spill causes included those that also occur in other OCS regions but at a different frequency, such as trawling accidents. Unique spill causes included events that occur only in the Arctic, such as ice gouging, strudel scour, upheaval buckling, thaw settlement, and other for pipelines. For platforms, unique spill causes included ice force, low temperature, and other.

The treatment of uncertainties in the probabilities assigned to each arctic event was estimated as discussed in the following.

C.1.a(3) Treatment of Uncertainties: The measures of uncertainty calculated included the Arctic effects in each fault-tree event as well as the historic variability in spill size and spill frequency. The treatment of uncertainties was examined through numerical simulation. To assess the impact of uncertainties in the Arctic effects incorporated fault trees, ranges around the expected value were estimated for all the Arctic effects, both modified and unique for Arctic effects. The numerical distributions generated through these perturbations in the expected values were modeled as triangular distributions and input to the numerical simulation analysis conducted as part of the result generation (Bercha Group Inc., 2006).

Numerical simulation methods are tools for evaluating the properties of complex, as well as nondeterministic processes. Problems can have an enormous number of dimensions or a process that involves a path with many possible branch points, each of which is governed by some fundamental probability of occurring.

A type of numerical simulation, called Monte Carlo simulation, was used to obtain the outcome of a set of interactions for equations in which the independent variables are described by distributions of any arbitrary form. The Monte Carlo simulation is a systematic method for selecting values from each of the independent variable distributions and computing all valid combinations of these values to obtain the distribution of the dependent variable. This was done using a computer, so that thousands of combinations could be rapidly computed and assembled to give the output distribution.

Consider the example of the following equation:

$$X = X_1 S + X_2$$

Where, X is the dependent variable (such as spill persistence in days), S is the size of the spill in barrels, and X_1 and X_2 are correlation coefficients. Suppose now that X_1 and X_2 are some arbitrary distributions that can be described by a collection of values X_1 and X_2. What we do in the Monte Carlo process, figuratively, is to put the collection of the X_1 values into one hat, the X_1 hat, and the X_2 values into an X_2 hat. We then randomly draw one value from each of the hats and compute the resultant value of the dependent variable, X. This is done several thousand times. Thus, a resultant or dependent variable

distribution, X, is estimated from the computations of all valid combinations of the independent variables (X_1 and X_2), for a given S.

Generally, the resultant can be viewed as a cumulative distribution function as illustrated in Figure C-4. Such a cumulative distribution function (CDF) also is a measure of the accuracy or, conversely, the variance of the distribution. As can be seen from this figure, if the distribution is a vertical line, no matter where one draws on the vertical axis, the same value of the variable will result, that is, the variable is a constant. At the other extreme, if the variable is completely random, the distribution will be represented as a diagonal straight line between the minimum and maximum value. Intermediate qualitative descriptions of the randomness of the variable follow from inspection of the CDF in Figure C-4. For example, if we are interested in confidence intervals, we simply take the value of the abscissa corresponding to the appropriate confidence interval, say 0.95 or 95%.

C.2. Fault-Tree Input Data and Their Uncertainty Variations. There are two basic approaches to the assessment of the variability of non-Arctic spill rates, and consequently the Arctic spill rates, using the fault tree method. The first method utilizes the historical variability of the non-Arctic base data and distributes it in direct proportion throughout the Arctic fault tree. This method is a relatively high level, approximate method, and is called the First Order Approach. In this method, the non-Arctic variable distribution is multiplied by a point value to obtain the Arctic variable distribution. The second method consists of systematically perturbing the variability of all the causal events, plus that of the Arctic unique effects. This method is more detailed and specific, and is termed the Second Order Approach. In the Second Order Approach, the non-Arctic variable distribution is multiplied by an adjustment or correction distribution to obtain the Arctic variable distribution. The First Order Approach, when used individually, did not adequately represent trends in the variability of the Arctic effects. The Second Order Approach, if not used in conjunction with the First Order Approach, resulted in arbitrary mean or expected values, because it was not tied directly to any real historical data. The optimal approach was to use the two methods, with the First Order Approach utilized to give the initial level of first order variability, and the Second Order Approach utilized to better reflect Arctic effects on the variability of causal events. In what follows, the discussion is based on the use of both methods in a complimentary fashion.

The arctic effects include modifications to events associated with the historical data set from other OCS regions, hereafter called arctic modified effects, and adding spill events unique to the arctic environment, hereafter called Arctic unique effects. Arctic modified effects are those changing the frequency component of certain contributions to events such as anchor impacts that could occur both in the arctic and temperate zones. Arctic modified effects for pipelines apply to external corrosion, internal corrosion, anchor impact, jack up rig or spud barges, trawl/fishing net, rig anchoring, workboat anchoring, mechanical connection failure or material failure, and mudslide events. Table C-1 shows the input rationalization of the arctic modified effects for pipelines. Arctic modified effects for platforms apply to process facility release, storage tank release, structural failure, hurricane/storm and collision events. Table C-2 shows the input rationalizations of the Arctic modified effects for platform events. The frequency increments in this table are given as the median values calculated using the Monte Carlo method with inputs as the low, expected, and high values.

Arctic unique effects are additive components that are unique to the Arctic environment. Quantification of existing events for the Arctic was done in a relatively cursory way restricted to engineering judgment. For pipelines Arctic unique effects included ice gouging, strudel scour, upheaval buckling, thaw settlement, and other. Table C-3 shows the input rationalization of the arctic unique effects for pipelines. A reproducible but relatively elementary analysis of gouging and scour effects was carried out. The ice-gouge failure rate was calculated using an exponential failure distribution for a 2.5 meter (m) cover, 0.2 m average gouge depth, and 4-gouges-per-kilometer-year flux. Strudel scour was assumed to occur only in shallow water with an average frequency of 4 scours per square mile and 100 feet of bridge length with a 10% conditional pipeline failure probability. Upheaval-buckling and thaw-settlement effect assessments were included on the basis of professional judgment; no engineering analysis was carried out for the assessment of frequencies to be expected for these effects. Upheaval buckling was assumed to have a failure frequency of 20% of that of strudel scour. Thaw settlement was assumed to have a failure frequency of 10% of that of

strudel scour. Table C-4 shows the variance in the pipeline arctic effect inputs. The existing MMS databases on pipeline mileage were used as they stood with all their inherent inaccuracies.

Arctic unique effects for platforms included ice force, low temperature, and other effects. Table C-5 shows the variance in the platform arctic unique effect inputs. No arctic unique effects were estimated for the wells, which were considered to blow out with frequencies the same as those for the Gulf of Mexico.

The above information summarizes the input data to the fault trees and their uncertainty variation. For further information the reader is directed to Bercha Group Inc. (2006).

C.3. Results for Large Spill Rates for Sale 202. Based on the Bercha Group, Inc. (2006) fault-tree analysis for Sale 202, MMS estimates the mean spill rates for platforms, pipelines, and platforms and pipelines total over the life of the project as follows:

Platforms	0.33 spills per billion barrels produced
Pipelines	0.20 spills per billion barrels produced
Total	0.53 spills per billion barrels produced

The annual rates were weighted by the annual production over the total production or the year over the total years, and the prorated rates were summed to determine the rates over the life of the project as shown above. Confidence intervals were calculated on the total spill rate per billion barrels at the 95% confidence level as follows:

Type	Mean	95%
Total	0.53	0.35-0.73

These confidence limits include the variance in the arctic effects as well as the variance in spill size and spill frequency. The recent inclusion of the variance in the spill size and spill frequency has increased the spill rate previously reported in USDOI, MMS 2003a, 2004.

C.4. Estimates for the Number of Large Spills Occurring for Sale 202. The spill rates discussed in this section are all based on spills per billion barrels. Using the above mean large spill rates, Table C-6 shows the estimated mean number of large oil spills for Alternative VII, the Proposed Action and alternatives. Using the mean spill rates for the Proposed Action and alternatives, we estimate 0.09 pipeline spills and 0.14-0.15 platform (and well) spills for a total over the life of Sale 202 production of 0.23-0.24 spills. Table C-7 shows the estimated total number of oil spills for the Proposed Action and alternatives using spill rates at the 95% confidence interval. For the Proposed Action and alternatives, total spills over the life of the Sale 202 production at the 95% confidence interval spill rates range from 0.15-0.34 spills; that is, approximately one seventh to a third of a spill. For purposes of analysis, one large spill was assumed to occur and was analyzed in the Beaufort multiple-sale EIS, Sale 195 EA and this EA.

C.5. Method for Estimating the Chance of One or More Spills Occurring. The Poisson distribution is used for estimating oil-spill occurrence. Spill occurrence has been modeled previously as a Poisson process (Smith et al., 1982; Lanfear and Amstutz, 1983; Anderson and LaBelle, 1990, 1994; 2000). Because spill occurrences meet the criteria for a Poisson process, the following equations were used in our estimation of spill occurrence. The estimated volume of oil handled is the exposure variable.

Smith et al. (1982), using Bayesian inference techniques, presented a derivation of this process, assuming the probability of n spills over some future exposure t is expected to occur at random with a frequency specified by equation (1):

$$P(\text{n spills over future exposure t}) = \frac{(\lambda t)^n e^{-\lambda t}}{n!} \quad (1)$$

where λ is the true rate of spill occurrence per unit exposure. The predicted probability takes the form of a negative binomial distribution specified by equation (2):

$$P(n) = \frac{(n+v-1)!\,t^n \tau^v}{n!(v-1)!(t+\tau)^{n+v}} \quad (2)$$

where τ is past exposure and v is the number of spills observed in the past. The negative binomial is then shown to converge over time to the Poisson, with λ estimated using equation (3) (Smith et al., 1982):

$$\lambda = v/\tau \quad (3)$$

Using the spill rate and the volume of oil assumed to be produced, the estimated mean number of spills is calculated. That number of spills is distributed as a Poisson distribution. The probability of one or more is equal to 1 minus the probability of zero spills. The probability of one or more spills occurring is calculated using the following equations.

$$P(n) = \frac{e^{-\lambda} * \lambda^n}{n!}$$

P(n) = probability of n spills occurring
n = specific number of spills
e = base of the natural logarithm
λ = parameter of the Poisson distribution (mean number of spills)

C.6. Estimates for the Chance of One or More Large Spills Occurring. The frequency distribution of large oil spills, when corrected for decreasing spill rate in more recent decades, can be modeled as Poisson distribution (see the following section). An assumption of Poisson distribution allows the calculation of the chance of one or more oil spills occurring. Using the above mean spill rates, Table C-8 shows the chance of one or more large pipeline spills is 9%, and the chance of one or more large platform spills is 13-14% for the Proposed Action and alternatives over the life of the project. The chance of no large pipeline spills is 91% and the chance of no large platform spills is 86-87%. The total is the sum of the platform and pipeline spills. The chance of one or more large spills total is 21% for the Proposed Action and alternatives based on the mean spill rate over the life of the project (Figure C-5 through C-9). Table C-9 shows the chance of one or more large spills total for the Proposed Action and alternatives using spill rates at the 95% confidence interval. For the Proposed Action and alternatives, the percent chance of one or more large spills occurring total ranges from 14-29% using the spill rates at the 95% confidence interval over the life of the project.

C.7. Background Statistical Work. The basis for using a Poisson process for determining the probability of spill occurrence is found within the peer-reviewed literature. Anderson and LaBelle (2000) is the fourth of a series of independently peer-reviewed papers presented in support of oil-spill-rate assumptions used for oil-spill-occurrence estimates, with two earlier Anderson and LaBelle efforts (1994, 1990) and Lanfear and Amstutz (1983). The Lanfear and Amstutz (1983) report examines the cumulative frequency distributions of oil spills, tests pipeline miles as an alternative exposure variable for pipeline spills, and discusses the trend analysis of offshore spills performed by Nakassis (1982). These spill-rate papers tier off earlier work performed by Department of the Interior in support of the Oil-Spill-Risk Analysis (OSRA) Model, and work performed by other oil-spill researchers, as referenced in the papers.

The Smith et al. (1982) report documents the fundamentals of the Department of the Interior's OSRA Model. It describes the approach of using lambda, the unknown spill-occurrence rate for a fixed class of spills, as a parameter in a Poisson process, with volume of oil handled as an exposure variable to predict the probability of spill occurrence (Smith et al., 1982:18-24). A Bayesian methodology, described in detail in

Appendix A of Smith et al., *Distribution Theory of Spill Incidence*, provides one way to weight the different possible values of lambda given the past frequency of spill occurrence for a fixed class of spills. Smith et al. (1982) selects volume as an exposure variable in that it is a quantity that would be more practical to estimate future exposure (a necessity for using it to forecast future spill occurrence) than the other exposure variables considered.

In support of using the Poisson process for spill occurrence and examinations of different exposure variables, Smith et al. (1982) references the works of Devanney and Stewart (1974), Stewart (1976), and Stewart and Kennedy (1978). These references, and other pertinent ones, can be found at Oil Spill Rates - Additional References on the MMS Web site located at http://www.mms.gov/eppd/sciences/osmp/spillraterefs.htm.

C.8. Summary. The chance of one or more large pipeline spills is 9%, and the chance of one or more large platform spills ranges from 13-14% for the Proposed Action and alternatives over the life of the project. The total is the sum of the platform and pipeline spills. The chance of one or more large spills total is 21% for the Proposed Action and alternatives based on the mean spill rate over the life of the project. Using spill rates at the 95% confidence interval for the Proposed Action and alternatives, the percent chance of one or more large spills total ranges from 14-29% over the life of the Proposal.

C.9. Results of the Oil-Spill-Risk Analysis: Combined Probabilities. Tables C-11 through C-21 show the annual combined probabilities for the Proposal and the alternatives for Sale 202. The combined probabilities were recalculated using the updated spill rates for Sale 202. For the most part, the chance of one or more spills occurring and contacting resources and land segments is less than (<) 0.5% for spill durations <30 days. The OSRA model estimates a <0.5-5% chance of one or more spills greater than or equal to (≥) 1,000 bbl occurring and contacting environmental resources areas (ERA's), land segments, and land within 30 days, over the production life of the Proposed Action. The OSRA model estimates a <0.5-5% chance of one or more spills ≥1,000 bbl occurring and contacting ERA's and land within 360 days, over the production life of the Proposed Action. The OSRA model estimates a 14% chance of one or more spills ≥1,000 bbl occurring and contacting land within 360 days, over the production life of the Proposed Action.

The relative risk from the Proposal and alternatives is low (<10%), because we estimate that one or more oil spills occurring and contacting environmental resource areas ranges from <0.5-5% over 360 days or coastline up to 30 days. Because the combined probabilities are similar to one another it is difficult to distinguish differences between the Proposal and alternatives based on combined probabilities.

BIBLIOGRAPHY

Anderson, C.M. and R.P. LaBelle. 1990. Estimated Occurrence Rates for Analysis of Accidental Oil Spills on the U.S. Outer Continental Shelf. *Oil and Chemical Pollution* 6(1): 21-35.

Anderson, C.M. and R.P. LaBelle. 1994. Comparative Occurrence Rates for Offshore Oil Spills. *Spill Science and Technology Bulletin* 2(1):131-141.

Anderson, C.M. and R.P. Labelle. 2000. Update of Comparative Occurrence Rates for Offshore Oil Spill. *Spill Science and Technology* 65/6: 303-321.

Bercha Group Inc. 2002. Alternative Oil Spill Occurrence Estimators for the Beaufort and Chukchi Seas – Fault Tree Method. 2 Vols. OCS Study, MMS 2002-047. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Bercha Group Inc. 2006. Alternative Oil Spill Occurrence Estimators and their Variability for the Beaufort Sea – Fault Tree Method. 2 Vols. OCS Study, MMS 2005-061. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Devanney, J.W., III and R.J. Stewart. 1974. Analysis of Oilspill Statistics. Washington, DC: Council on Environmental Quality,.

Lanfear, K.J. and D.E. Amstutz. 1983. A Reexamination of Occurrence Rates for Accidental Oil Spills on the U.S. Outer Continental Shelf. *In*: Proceedings of the 1983 Oil Spill Conference, San Antonio, Tex., Feb. 28-Mar. 3, 1983. Washington, DC: USCG, API, and USEPA, pp. 355-365.

Nakassis, A. 1982. Has Offshore Oil Production Become Safer? Open-File Report 82-232. Menlo Park, CA: U.S. Geological Survey, 26 pp.

North Slope Borough Science Advisory Committee (2003) A Review of Oil Spill Risk Estimates Based on Current Offshore Development Technologies. NSB-SAC-OR-130. Barrow, AK. North Slope Borough.

Smith, R.A., J.R. Slack. T. Wyant, and K.J. Lanfear. 1982. The Oilspill Risk Analysis Model of the U.S. Geological Survey. Geological Survey Professional Paper 1227. Washington, DC: U.S. Government Printing Office, 40 pp.

Stewart, R.J. 1976. Survey and Critical Review of U.S. Oil Spill Data Resources with Application to the Tanker/Pipeline Controversy A Report to Office of Policy Analysis. Washington, DC: USDOI, 74 pp. http://www.mms.gov/eppd/sciences/osmp/spillraterefs.htm

Stewart, R.J. and M.B. Kennedy. 1978. Analysis of U.S. Tanker and Offshore Petroleum Production of Oil Spillage through 1975: Report to Office of Policy Analysis. Washington, DC: USDOI, 115 pp. plus appendices. http://www.mms.gov/eppd/sciences/osmp/spillraterefs.htm.

USDOI, MMS. 2003. Beaufort Sea Planning Area Sales 186, 195, and 202 Oil and Gas Lease Sale Final EIS. OCS EIS/EA, MMS 2003-001. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

USDOI, MMS. 2004. Proposed Oil and Gas Lease Sale 195 Beaufort Sea Planning Area. Environmental Assessment. OCS EIS/EA, MMS 2004-028. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

LIST OF FIGURES

LIST OF TABLES

.

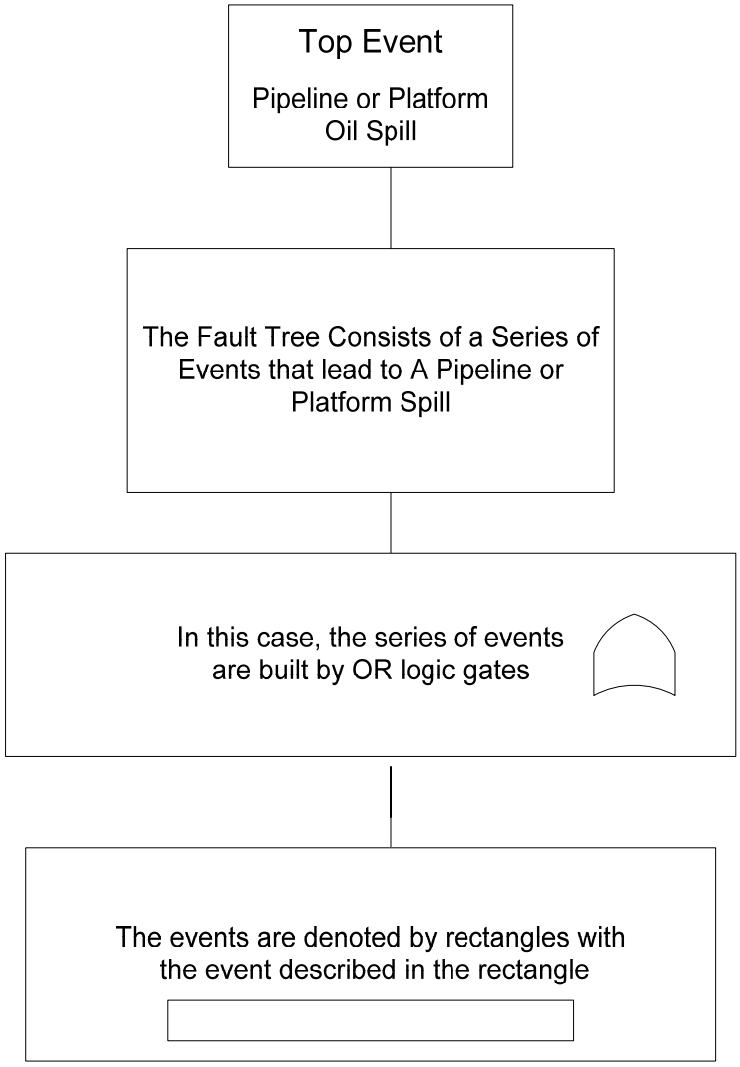


Figure C-1. Basic Parts of a Fault Tree

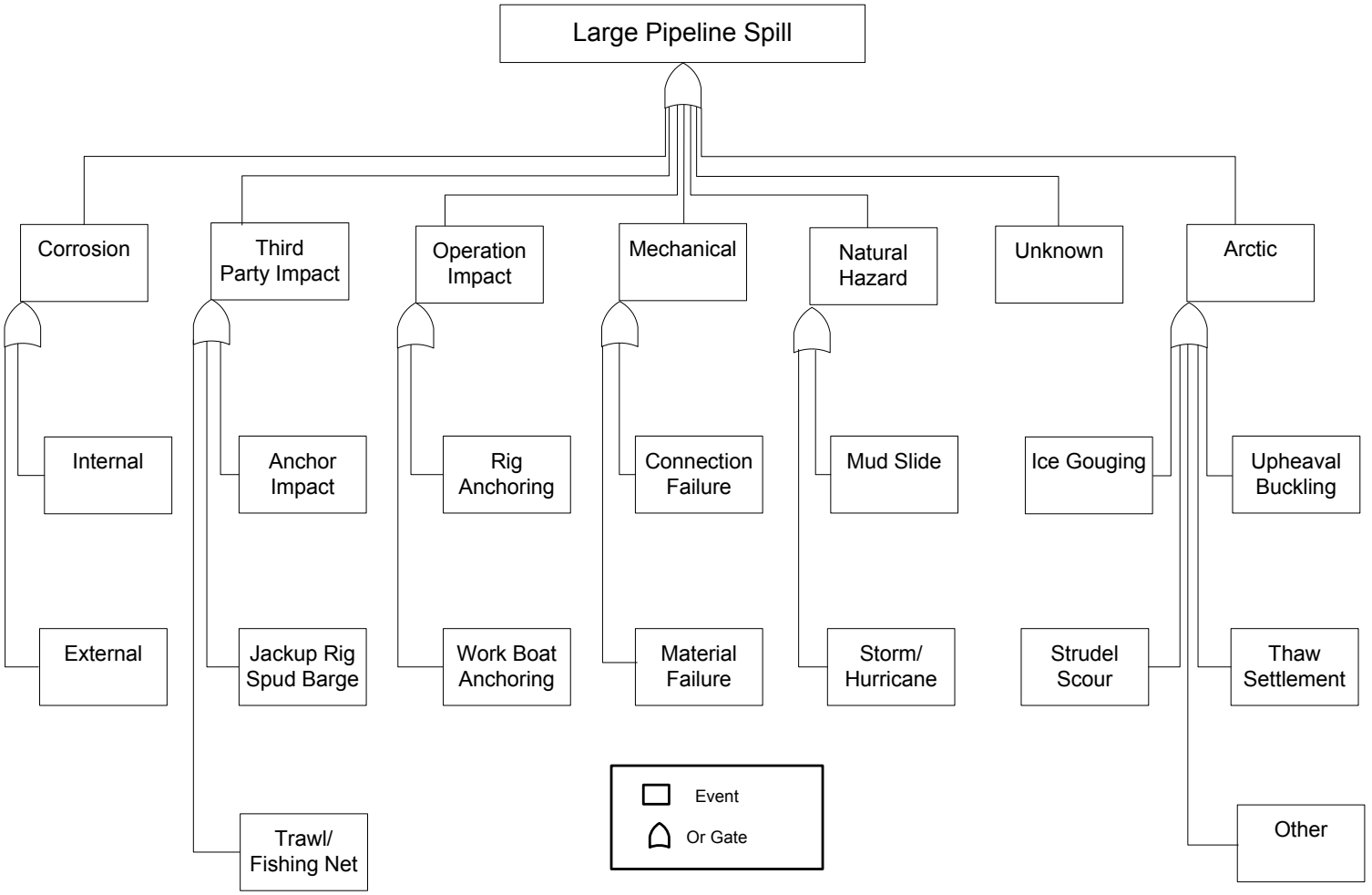


Figure C-2. Typical Fault Tree for A Pipeline Spill

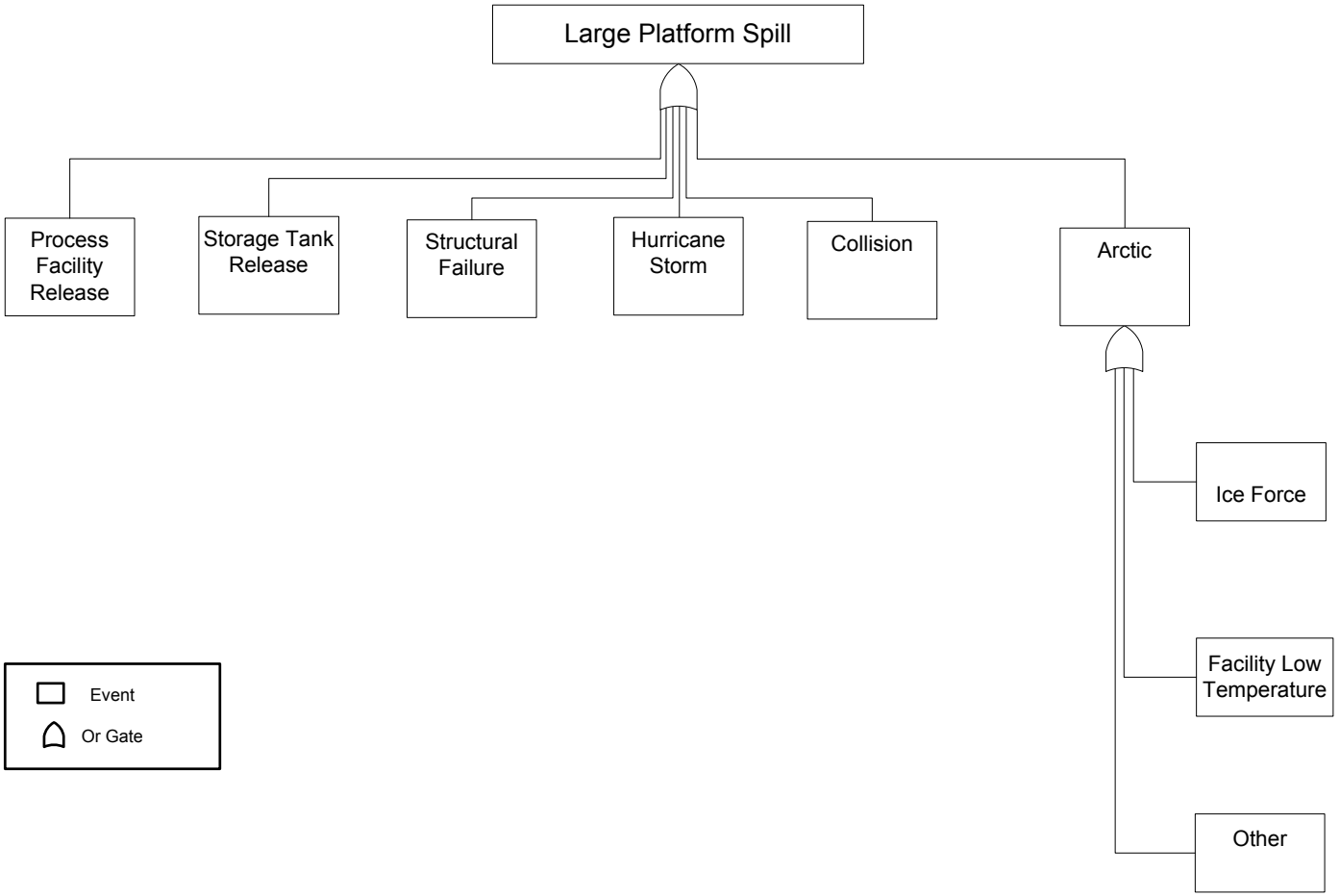


Figure C-3. Typical Fault Tree for a Platform Spill

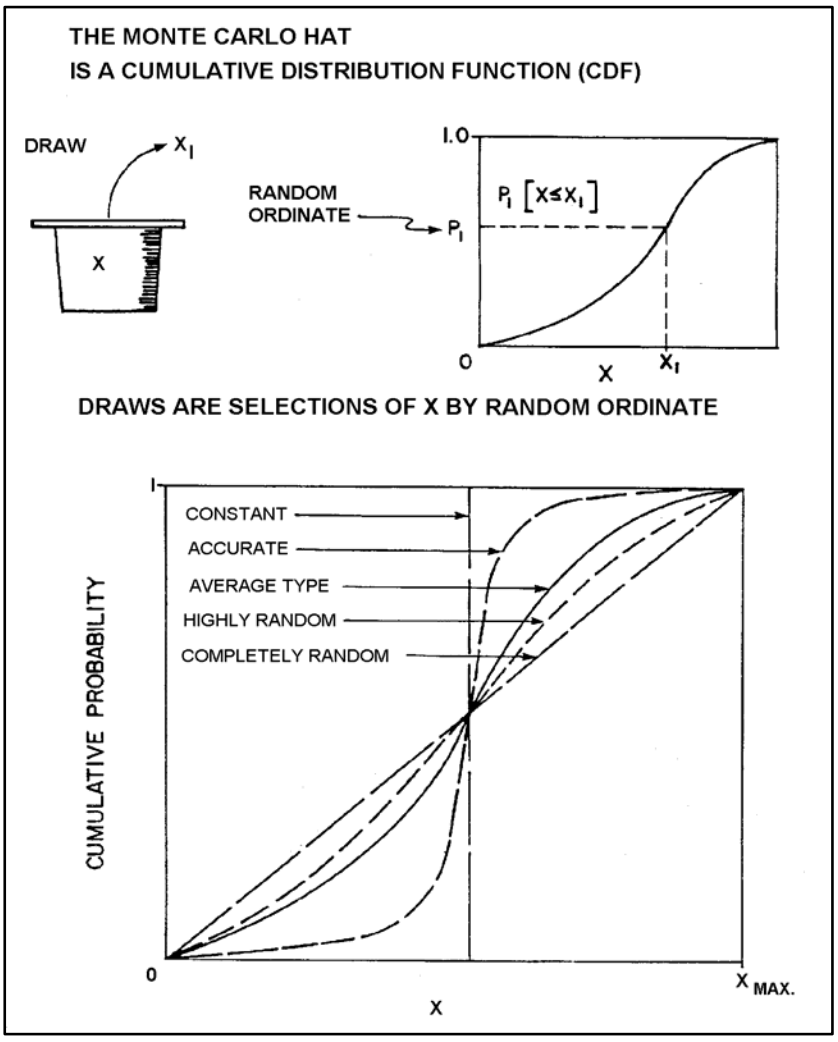
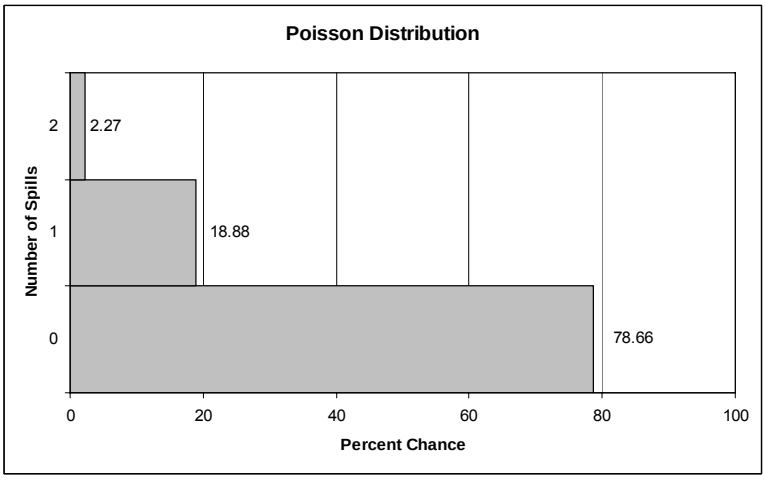


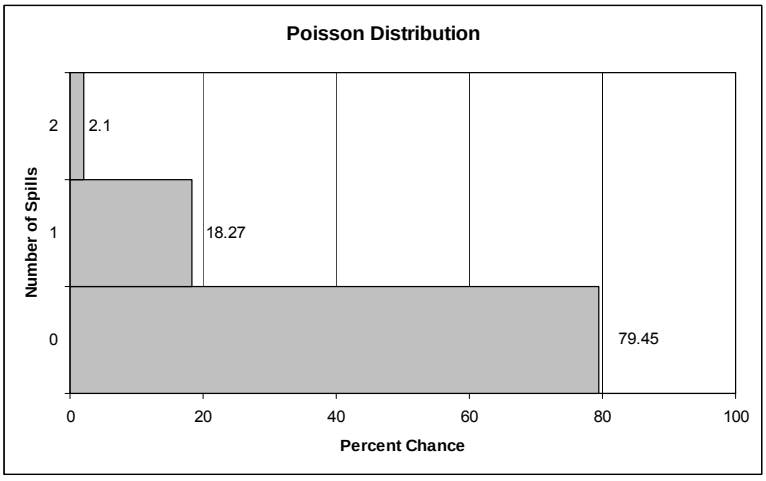
Figure C-4. Schematic of Monte Carlo Process as a Cumulative Distribution Function

Figure C-5. Poisson Distribution: Alternatives I, II, V, and VI Total (Pipeline and Platform)



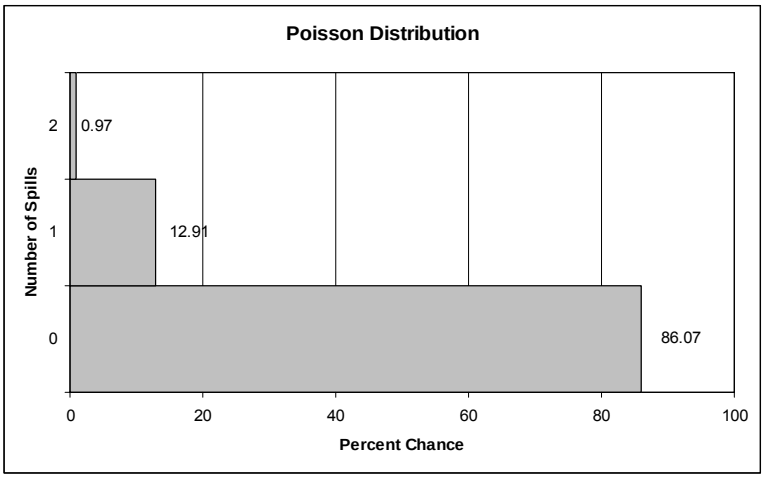
Mean Number of Spills = 0.24
Percent Chance of One or More = 21%
Percent Chance of No Spills = 79%

Figure C-6. Poisson Distribution Alternatives IV and VII Total (Pipeline and Platform)



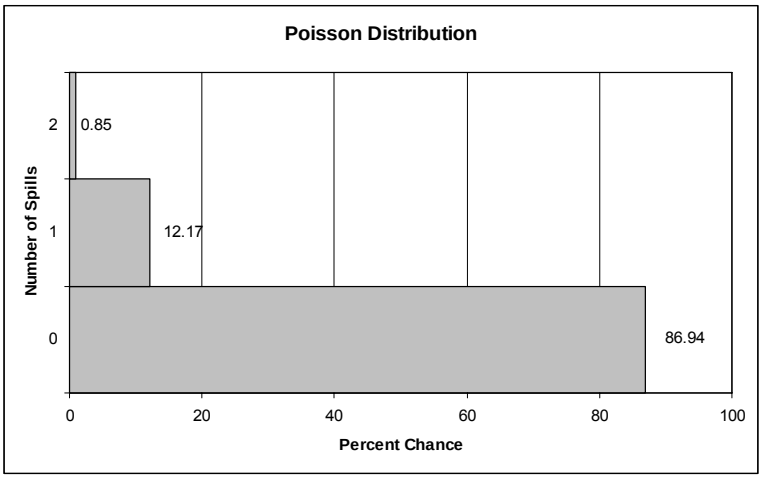
Mean Number of Spills = 0.23
Percent Chance of One or More = 21%
Percent Chance of No Spills = 79%

Figure C-7. Poisson Distribution Alternatives I, III, V, VI and VII Platform



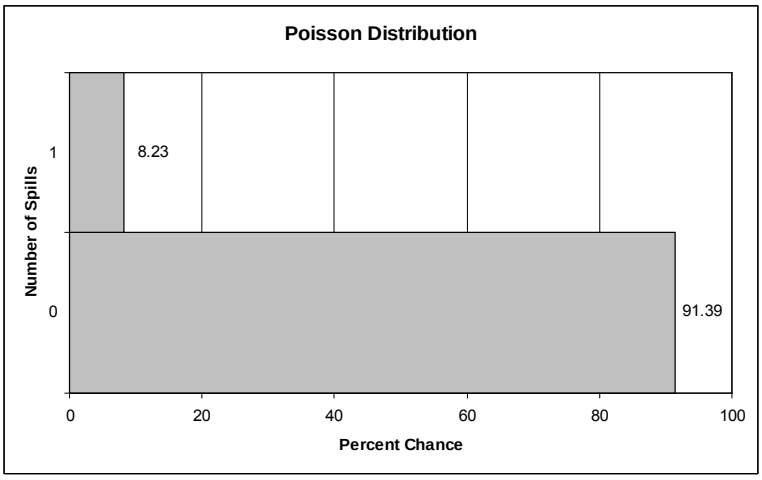
Mean Number of Spills = 0.15
Percent Chance of One or More =14%
Percent Chance of No Spills = 86%

Figure C-8. Poisson Distribution Alternative IV Platform



Mean Number of Spills = 0.14
Percent Chance of One or More =14%
Percent Chance of No Spills = 86%

Figure C-9. Poisson Distribution Alternatives I, III, IV, V, VI and VII Pipeline



Mean Number of Spills = 0.09
Percent Chance of One or More =9%
Percent Chance of No Spills = 91%

Table C-1
Pipeline Fault Tree Analysis Input Rationalization for Arctic Modified Events

Event Classification	Spill Size	Shallow	Medium	Deep	Reason
		Frequency Change %			
Arctic Modified					
Corrosion					
External	**All**	(30)	(30)	(30)	Lower temperature and biological effects. Extra smart pigging. State of art coatings
Internal	**All**	(30)	(30)	(30)	Additional inspection and smart pigging above historical levels.
Third Party Impact					
Anchor Impact	**All**	(50)	(50)	(50)	Low vessel traffic of third party shipping.
Jackup Rig or Spud Barge	**All**	(50)	(50)	(50)	Low facility density than historic data population in other OCS areas.
Trawl/Fishing Net	**All**	(50)	(60)	(70)	Low commercial fishing activity.
Operation Impact					
Rig Anchoring	**All**	(20)	(20)	(20)	No marine traffic during ice season (8 months).
Work Boat Anchoring	**All**	(20)	(20)	(20)	No work boat traffic during ice season (8 months).
Mechanical					
Connection Failure	**All**	—	—	—	No change was made to account for Arctic effects.
Material Failure	**All**	—	—	—	No change was made to account for Arctic effects.
Natural Hazard					
Mud Slide	**All**	(60)	(50)	(40)	Gradient low. Mud slide potential (gradient) increases with water depth.
Storm/ Hurricane	**All**	(50)	(50)	(50)	Fewer severe storms. Damping of ocean surface by ice cover for 8 months.

Note:
All = All spill sizes combined

Table C-2
Platform Fault Tree Input Rationalization

Event Classification	Spill Size	Frequency Change %			Reason
		Shallow	Medium	Deep	
Arctic Modified					
Process Facility RIs.	All	(30)	(30)	(30)	State of the art now, High QC, High Inspection and Maintenance Requirements
Storage Tank RIs.	All	(30)	(30)	(30)	State of the art now, High QC, High Inspection and Maintenance Requirements
Structural Failure	All	(20)	(20)	(20)	High safety factor, Monitoring Programs
Hurricane/Storm	All	(50)	(40)	(30)	Less severe storms.
Collision	All	(50)	(50)	(50)	Very low traffic density.
—		**Freq. Increment per 10^4 well-year**			—
		Median Expected	**Median Expected**	***Median* Expected**	
Arctic Unique					
Ice Force	SM	0.1447	0.2170	0.3256	Assumed 10,000 year return period ice force causes spill 4% of occu. 85% of the spills are SM.
		0.0340	0.0510	0.0765	
	HL	0.0255	0.0383	0.0575	
		0.0060	0.0090	0.0135	
Facility Low Temperature	SM	0.1000	0.1000	0.1000	Assumed 10% of Historical Process Facilities release frequency and corresponding spill size distribution.
		0.1000	0.1000	0.1000	
	HL	0.0080	0.0080	0.0080	
		0.0080	0.0080	0.0080	
—	SM	0.0244	0.0316	0.0424	10% of above
		0.0134	0.0151	0.0177	
	HL	0.0033	0.0046	0.0065	
		0.0014	0.0017	0.0022	

Note:
All = All spill sizes combined
SM = Small (≥50and < 100 bbl) and M = Medium (≥100and < 1000 bbl)
LH= Large (≥1000and < 10,000 bbl) and H = Huge (≥10,000)

Table C-3
Pipeline Fault Tree Analysis Input Rationalization for Arctic Unique Events

Arctic Unique Event Classification		Freq. Inc. per 10^5 km-yr			Reason
		Median	Median	Median	
Ice Gouging	**S**	0.3495	0.2796		Ice gouge failure rate calculated using exponential failure distribution Hnatiuk & Brown, 1983; Weeks et al, 1983) for 2.5-m cover, 0.2-m average gouge depth, 2 gouges per km-yr flux. Frequency is distributed among different spill sizes.
	M	0.0680	0.0544		
	L	0.6178	0.4943		
	H	0.1210	0.0968		
Strudel Scour	**S**	1.3438	1.0750		Only in shallow water. Average frequency of 4 scours/mile^2 and 100 ft of bridge length with 10% conditional pipeline failure probability. The same spill size distribution as above.
	M	0.2610	0.2088		
	L	0.3762	0.3010		
	H	0.0730	0.0584		
Upheaval Buckling	**S**	0.0021			All water depth. The failure frequency is 20% of that of Strudel Scour (Paulin et al., 2001).
	M	0.0012			
	L	0.0038			
	H	0.0020			
Thaw Settlement	**S**	0.0082			All water depth. The failure frequency is 10% of that of Strudel Scour (Paulin et al., 2001).
	M	0.0045			
	L	0.0023			
	H	0.0012			
Other	**S**	0.0004	0.0004	0.0004	To be assessed as 25% of the sum of above.
	M	0.0002	0.0002	0.0002	
	L	0.0008	0.0008	0.0008	
	H	0.0004	0.0004	0.0004	

Note:
S = Small (≥50and < 100 bbl)
M = Medium (≥100and < 1000 bbl)
L = Large (≥1000and < 10,000 bbl)
H = Huge (≥10,000)

Table C-4
Arctic Pipeline Effects Uncertainty Variations

Event Classification	Spill Size	Water Depth								
		Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
Arctic Modified										
Corrosion										
External	**All**	(90)	(30)	(10)	(90)	(30)	(10)	(90)	(30)	(10)
Internal	**All**	(90)	(30)	(10)	(90)	(30)	(10)	(90)	(30)	(10)
Third Party Impact										
Anchor Impact	**All**	(90)	(50)	(10)	(90)	(50)	(10)	(90)	(50)	(10)
Jackup Rig Or Spud Barge	**All**	(90)	(50)	(10)	(90)	(50)	(10)	(90)	(50)	(10)
Trawl/Fishing Net	**All**	(90)	(50)	(10)	(90)	(60)	(10)	(90)	(70)	(10)
Operation Impact										
Rig Anchoring	**All**	(50)	(20)	(10)	(50)	(20)	(10)	(50)	(20)	(10)
Work Boat Anchoring	**All**	(50)	(20)	(10)	(50)	(20)	(10)	(50)	(20)	(10)
Mechanical										
Connection Failure	**All**									
Material Failure	**All**									
Natural Hazard										
Mud Slide	**All**	(90)	(60)	(10)	(90)	(50)	(10)	(90)	(40)	(10)
Storm/ Hurricane	**All**	(90)	(50)	(10)	(90)	(50)	(10)	(90)	(50)	(10)
Ice Gouging	**S**	0.0060	0.0680	0.8290	0.0048	0.0544	0.6632			
	M	0.0090	0.1210	1.4670	0.0072	0.0968	1.1736			
	L	0.0210	0.2610	3.1900	0.0168	0.2088	2.5520			
	H	0.0060	0.0730	0.8930	0.0048	0.0584	0.7144			
Strudel Scour	**S**	0.0004	0.0012	0.0044						
	M	0.0006	0.0020	0.0078						
	L	0.0014	0.0045	0.0170						
	H	0.0004	0.0012	0.0048						
Upheaval Buckling	**S**	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088
	M	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156
	L	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340
	H	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095
Thaw Settlement	**S**	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044
	M	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078
	L	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170
	H	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048
Other	**S**	0.00162	0.01738	0.20869	0.00123	0.01369	0.16613	0.00003	0.00009	0.00033
	M	0.00246	0.03092	0.36929	0.00185	0.02435	0.29399	0.00005	0.00015	0.00059
	L	0.00571	0.06670	0.80303	0.00431	0.05253	0.63928	0.00011	0.00033	0.00128
	H	0.00163	0.01865	0.22480	0.00123	0.01469	0.17896	0.00003	0.00009	0.00036

Note:

All = All spill sizes combined
S = Small (≥50and < 100 bbl)
M = Medium (≥100and < 1000 bbl)
L = Large (≥1000and < 10,000 bbl)
H = Huge (≥10,000)

Table C-5
Arctic Platform Effects Uncertainty Variations

Cause Classification	Spill Size	Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
Arctic Modified										
Process Facility Rls.	**All**	(60)	(30)	(10)	(60)	(30)	(10)	(60)	(30)	(10)
Storage Tank Rls.	**All**	(60)	(30)	(10)	(60)	(30)	(10)	(60)	(30)	(10)
Structural Failure	**All**	(60)	(20)	(10)	(60)	(20)	(10)	(60)	(20)	(10)
Hurricane/Storm	**All**	(90)	(50)	(10)	(90)	(40)	(10)	(90)	(30)	(10)
Collision	**All**	(90)	(50)	(10)	(90)	(50)	(10)	(90)	(50)	(10)
Ice Force	**SM**	0.003	0.034	0.340	0.005	0.051	0.510	0.008	0.077	0.765
	HL	0.001	0.006	0.060	0.001	0.009	0.090	0.001	0.014	0.135
Facility Low Temperature	**SM**	0.050	0.100	0.150	0.050	0.100	0.150	0.050	0.100	0.150
	HL	0.004	0.008	0.012	0.004	0.008	0.012	0.004	0.008	0.012
Other	**SM**	0.005	0.013	0.049	0.006	0.015	0.066	0.006	0.018	0.092
	HL	0.000	0.001	0.007	0.000	0.002	0.010	0.001	0.002	0.015

Note:

All = All spill sizes combined
SM = Small (≥50and < 100 bbl) and M = Medium (≥100and < 1000 bbl)
LH= Large (≥1000and < 10,000 bbl) and H = Huge (≥10,000)

Table C-6

Estimated Mean Number of Large Platform, Pipeline and Total Spills for Alternative VII, the Proposed Action (Sale 202) and its Alternatives

Alternative		Mean Number of Platform Spills	Mean Number of Pipeline Spills	Mean Number of Spills Total
I	Area of the Call	0.15	0.09	0.24
II	No Sale	0	0	0
III	Barrow Subsistence Whale Deferral	0.15	0.09	0.24
IV	Nuiqsut Subsistence Whale Deferral	0.14	0.09	0.23
V	Kaktovik Subsistence Whale Deferral	0.15	0.09	0.24
VI	Eastern Deferral	0.15	0.09	0.24
VII	Proposed Action	0.15	0.09	0.24

Note:

Mean number of spills is rounded to two decimal places after multiplying the spill rate times the oil resource volume.

Table C-7

Estimated Number of Total Spills for Alternative VII, the Proposed Action (Sale 202) and its Alternatives Using Spill Rates at the 95% Confidence Interval

Alternative		Number of Spills Total
I	Alternative I	0.16-0.34
II	No Sale	0
III	Barrow Subsistence Whale Deferral	0.16-0.33
IV	Nuiqsut Subsistence Whale Deferral	0.15-0.32
V	Kaktovik Subsistence Whale Deferral	0.16-0.33
VI	Eastern Deferral	0.16-0.33
VII	Proposed Action	0.16-0.32

Note:

Mean Number is rounded to the two decimal places after multiplying the spill rate times the resource volume.

Table C-8

Estimated Percent Chance of One or More Large Platform, Pipeline and Total Spills for Alternative I, the Proposed Action (Sale 202) and it's Alternatives over the Life of the Project

Alternative		Percent Chance of One or More Pipeline Spills	Percent Chance of One or More Platform Spills	Percent Chance of One or More Spills Total
I	Alternative I	9	14	21
II	No Sale	0	0	0
III	Barrow Subsistence Whale Deferral	9	14	21
IV	Nuiqsut Subsistence Whale Deferral	9	13	21
V	Kaktovik Subsistence Whale Deferral	9	14	21
VI	Eastern Deferral	9	14	21
VII	Proposed Action	9	14	21

Table C-9

Estimated Percent Chance of One or More Total Spills for Alternative VII, the Proposed Action (Sale 202) and its Alternatives Using the Spill Rates at the 95% Confidence Interval

Alternative		Percent Chance of One or More Spills Total
I	Alternative I	15 - 29
II	No Sale	0
III	Barrow Subsistence Whale Deferral	15 - 28
IV	Nuiqsut Subsistence Whale Deferral	14 - 27
V	Kaktovik Subsistence Whale Deferral	15 - 28
VI	Eastern Deferral	15 - 28
VII	Proposed Action	15 - 27

Table C-10 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 3 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
	Land	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
3	Thetis and Jones Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
27	Beaufort Spring Lead 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
28	Beaufort Spring Lead 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
31	Ice/Sea Segment 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
32	Ice/Sea Segment 4	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0	1	0.0
33	Ice/Sea Segment 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
34	Ice/Sea Segment 6	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
35	Ice/Sea Segment 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Are	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
43	Nuiqsut Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
44	Kaktovik Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table C-10 (continued) Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 3 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
54	Ice/Sea Segment 16a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
55	Ice/Sea Segment 17	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	2	0.0
56	Ice/Sea Segment 18a	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	2	0.0
57	Ice/Sea Segment 19	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
58	Ice/Sea Segment 20a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
59	Ice/Sea Segment 21	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
60	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
61	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
66	ERA 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
67	Ice/Sea Segment 16b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
68	Harrison Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
69	Harrison Bay/Colville Delta	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
70	ERA 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
71	Simpson Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0	1	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0	1	0.0
80	Ice/Sea Segment 18b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
83	Kaktovik ERA	1	0.0	1	0.0	1	0.0	:	0.0	1	0.0	:	0.0
84	Ice/Sea Segment 20b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent;: = less than 0.5 percent

Table C-11 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 10 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
	Land	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
3	Thetis and Jones Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
27	Beaufort Spring Lead 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
28	Beaufort Spring Lead 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
31	Ice/Sea Segment 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
32	Ice/Sea Segment 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
33	Ice/Sea Segment 5	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0	1	0.0
34	Ice/Sea Segment 6	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
35	Ice/Sea Segment 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Are	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
43	Nuiqsut Subsistence Area	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0	1	0.0
44	Kaktovik Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table C-11 (continued) Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 10 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
54	Ice/Sea Segment 16a	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
55	Ice/Sea Segment 17	3	0.0	3	0.0	2	0.0	3	0.0	3	0.0	3	0.0
56	Ice/Sea Segment 18a	3	0.0	3	0.0	2	0.0	3	0.0	3	0.0	3	0.0
57	Ice/Sea Segment 19	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
58	Ice/Sea Segment 20a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
59	Ice/Sea Segment 21	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
60	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
61	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
66	ERA 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
67	Ice/Sea Segment 16b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
68	Harrison Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
69	Harrison Bay/Colville Delta	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
70	ERA 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
71	Simpson Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
80	Ice/Sea Segment 18b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
83	Kaktovik ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
84	Ice/Sea Segment 20b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent;: = less than 0.5 percent

Table C-12 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 30 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
	Land	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
3	Thetis and Jones Islands	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
27	Beaufort Spring Lead 9	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
28	Beaufort Spring Lead 10	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
31	Ice/Sea Segment 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
32	Ice/Sea Segment 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
33	Ice/Sea Segment 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
34	Ice/Sea Segment 6	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
35	Ice/Sea Segment 7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Are	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
43	Nuiqsut Subsistence Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
44	Kaktovik Subsistence Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent+

Table C-12 (continued) Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 30 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	3	0.0	2	0.0	2	0.0	3	0.0	3	0.0	2	0.0
54	Ice/Sea Segment 16a	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
55	Ice/Sea Segment 17	4	0.0	4	0.0	3	0.0	4	0.0	4	0.0	4	0.0
56	Ice/Sea Segment 18a	3	0.0	3	0.0	2	0.0	3	0.0	3	0.0	3	0.0
57	Ice/Sea Segment 19	5	0.0	5	0.0	5	0.0	4	0.0	4	0.0	4	0.0
58	Ice/Sea Segment 20a	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
59	Ice/Sea Segment 21	1	0.0	1	0.0	1	0.0	:	0.0	:	0.0	:	0.0
60	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
61	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
66	ERA 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
67	Ice/Sea Segment 16b	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
68	Harrison Bay	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
69	Harrison Bay/Colville Delta	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
70	ERA 3	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
71	Simpson Lagoon	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
80	Ice/Sea Segment 18b	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	2	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
83	Kaktovik ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
84	Ice/Sea Segment 20b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent;: = less than 0.5 percent

Table C-13 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 60 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
	Land	6	0.1	6	0.1	6	0.1	6	0.1	6	0.1	6	0.1
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
3	Thetis and Jones Islands	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
4	Cottle & Return Islands, West Dock	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
16	Jago and Tapkaurak Spits	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
25	Beaufort Spring Lead 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
26	Beaufort Spring Lead 8	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
27	Beaufort Spring Lead 9	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
28	Beaufort Spring Lead 10	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
31	Ice/Sea Segment 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
32	Ice/Sea Segment 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
33	Ice/Sea Segment 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
34	Ice/Sea Segment 6	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
35	Ice/Sea Segment 7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Are	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
43	Nuiqsut Subsistence Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
44	Kaktovik Subsistence Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table C-13 (continued) Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 60 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
53	Ice/Sea Segment 15	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
54	Ice/Sea Segment 16a	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
55	Ice/Sea Segment 17	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
56	Ice/Sea Segment 18a	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
57	Ice/Sea Segment 19	5	0.0	5	0.0	5	0.0	5	0.0	5	0.0	5	0.0
58	Ice/Sea Segment 20a	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
59	Ice/Sea Segment 21	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
60	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
61	Ice/Sea Segment 22	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
66	ERA 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
67	Ice/Sea Segment 16b	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
68	Harrison Bay	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
69	Harrison Bay/Colville Delta	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
70	ERA 3	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
71	Simpson Lagoon	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
75	Water over Boulder Patch 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
76	Water over Boulder Patch 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
80	Ice/Sea Segment 18b	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	2	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
83	Kaktovik ERA	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
84	Ice/Sea Segment 20b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
85	ERA 6	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent;: = less than 0.5 percent

Table C-14 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 180 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
	Land	10	0.1	10	0.1	10	0.1	10	0.1	10	0.1	10	0.1
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
3	Thetis and Jones Islands	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	2	0.0
4	Cottle & Return Islands, West Dock	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
16	Jago and Tapkaurak Spits	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
25	Beaufort Spring Lead 7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
26	Beaufort Spring Lead 8	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
27	Beaufort Spring Lead 9	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
28	Beaufort Spring Lead 10	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
31	Ice/Sea Segment 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
32	Ice/Sea Segment 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
33	Ice/Sea Segment 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
34	Ice/Sea Segment 6	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
35	Ice/Sea Segment 7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Are	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
43	Nuiqsut Subsistence Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
44	Kaktovik Subsistence Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table C-14 (continued) Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 180 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
53	Ice/Sea Segment 15	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
54	Ice/Sea Segment 16a	5	0.1	5	0.1	5	0.0	5	0.1	5	0.1	5	0.1
55	Ice/Sea Segment 17	5	0.0	5	0.0	4	0.0	5	0.0	5	0.0	5	0.0
56	Ice/Sea Segment 18a	4	0.0	4	0.0	3	0.0	4	0.0	4	0.0	4	0.0
57	Ice/Sea Segment 19	5	0.1	5	0.1	5	0.1	5	0.1	5	0.1	5	0.1
58	Ice/Sea Segment 20a	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
59	Ice/Sea Segment 21	2	0.0	2	0.0	1	0.0	1	0.0	1	0.0	1	0.0
60	Ice/Sea Segment 22	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
61	Ice/Sea Segment 22	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
62	Ice/Sea Segment 24a	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
66	ERA 2	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
67	Ice/Sea Segment 16b	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
68	Harrison Bay	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
69	Harrison Bay/Colville Delta	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
70	ERA 3	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
71	Simpson Lagoon	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	2	0.0
75	Water over Boulder Patch 1	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0	1	0.0
76	Water over Boulder Patch 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
77	Foggy Island Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
80	Ice/Sea Segment 18b	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
83	Kaktovik ERA	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
84	Ice/Sea Segment 20b	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
85	ERA 6	1	0.0	1	0.0	1	0.0	1	0.0	:	0.0	1	0.0
86	ERA 7	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
87	ERA 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
88	Ice Sea Segment 24b	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0

Notes: ** = Greater than 99.5 percent;: = less than 0.5 percent

Table C-15 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the assumed Production Life of the Lease Area Within 360 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
	Land	14	0.2	14	0.2	14	0.1	14	0.1	14	0.1	14	0.1
1	Kasegaluk Lagoon	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
2	Point Barrow, Plover Islands	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
3	Thetis and Jones Islands	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
4	Cottle & Return Islands, West Dock	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
5	Midway Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
6	Cross and No Name Islands	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0	1	0.0
7	Endicott Causeway	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
8	McClure Islands	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0	1	0.0
9	Stockton Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
10	Tigvariak Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
11	Maguire Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
12	Flaxman Island	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
13	Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
14	Anderson Point Barrier Islands	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
15	Arey and Barter Islands, Bernard Spit	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
16	Jago and Tapkaurak Spits	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
17	Angun and Beaufort Lagoons	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
18	Icy Reef	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
19	Chukchi Spring Lead 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
20	Chukchi Spring Lead 2	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
21	Chukchi Spring Lead 3	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
22	Chukchi Spring Lead 4	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
23	Chukchi Spring Lead 5	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
24	Beaufort Spring Lead 6	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
25	Beaufort Spring Lead 7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
26	Beaufort Spring Lead 8	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
27	Beaufort Spring Lead 9	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
28	Beaufort Spring Lead 10	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
29	Ice/Sea Segment 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
30	Ice/Sea Segment 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
31	Ice/Sea Segment 3	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
32	Ice/Sea Segment 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
33	Ice/Sea Segment 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
34	Ice/Sea Segment 6	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
35	Ice/Sea Segment 7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
36	Ice/Sea Segment 8	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
37	Ice/Sea Segment 9	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
38	Point Hope Subsistence Are	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
39	Point Lay Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
40	Wainwright Subsistence Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
41	Barrow Subsistence Area 1	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
42	Barrow Subsistence Area 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
43	Nuiqsut Subsistence Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
44	Kaktovik Subsistence Area	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent

Table C-15 (continued) Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Environmental Resource over the Assumed Production Life of the Lease Area Within 360 Days, Beaufort Sea Sale 202

ID	Environmental Resource Area Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
		% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean	% Chance	Mean
45	Whale Concentration Area	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
46	Herald Shoal Polynya	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
47	Ice/Sea Segment 10	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
48	Ice/Sea Segment 11	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
49	Hanna's Shoal Polynya	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
50	Ice/Sea Segment 12	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
51	Ice/Sea Segment 13	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
52	Ice/Sea Segment 14	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
53	Ice/Sea Segment 15	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
54	Ice/Sea Segment 16a	5	0.1	5	0.1	5	0.1	5	0.1	5	0.1	5	0.1
55	Ice/Sea Segment 17	5	0.1	5	0.1	5	0.0	5	0.1	5	0.1	5	0.1
56	Ice/Sea Segment 18a	4	0.0	4	0.0	3	0.0	4	0.0	4	0.0	4	0.0
57	Ice/Sea Segment 19	5	0.1	5	0.1	5	0.1	5	0.1	5	0.1	5	0.1
58	Ice/Sea Segment 20a	4	0.0	4	0.0	4	0.0	3	0.0	3	0.0	3	0.0
59	Ice/Sea Segment 21	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
60	Ice/Sea Segment 22	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
61	Ice/Sea Segment 22	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
62	Ice/Sea Segment 24a	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
63	Ledyard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
64	Peard Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
65	ERA 1	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
66	ERA 2	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0	3	0.0
67	Ice/Sea Segment 16b	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0	4	0.0
68	Harrison Bay	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
69	Harrison Bay/Colville Delta	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
70	ERA 3	4	0.0	4	0.0	3	0.0	4	0.0	4	0.0	4	0.0
71	Simpson Lagoon	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
72	Gwyder Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
73	Prudhoe Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
74	Cross Island ERA	2	0.0	2	0.0	1	0.0	2	0.0	2	0.0	2	0.0
75	Water over Boulder Patch 1	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
76	Water over Boulder Patch 2	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
77	Foggy Island Bay	1	0.0	1	0.0	:	0.0	1	0.0	1	0.0	1	0.0
78	Mikkelsen Bay	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
79	ERA 4	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
80	Ice/Sea Segment 18b	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
81	Simpson Cove	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0	:	0.0
82	ERA 5	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
83	Kaktovik ERA	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
84	Ice/Sea Segment 20b	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0	2	0.0
85	ERA 6	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
86	ERA 7	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
87	ERA 8	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
88	Ice Sea Segment 24b	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0

Notes: ** = Greater than 99.5 percent;: = less than 0.5 percent

Table C-16 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 3 Days, Beaufort Sea Sale 202

ID	Land Segment Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	

Notes: All land segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table C-17 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 10 Days, Beaufort Sea Sale 202

ID	Land Segment Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	

Notes: All land segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table C-18 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 30 Days, Beaufort Sea Sale 202

ID	Land Segment Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	

Notes: All land segments have all values less than 0.5%; therefore the data are not shown and the tables are left blank.

Table C-19 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 60 Days, Beaufort Sea Sale 202

ID	Land Segment Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
32	Cape Halkett, Esook Trading Post, Garry Creek	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table C-20 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 180 Days, Beaufort Sea Sale 202

ID	Land Segment Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
25	Barrow, Browerville, Elson Lagoon	1	0.0	n	0.0	n	0.0	1	0.0	1	0.0	n	0.0
28	Cape Simpson, Piasuk River, Sinclair River, Tulimanik Island	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
31	Lonely, Pitt Point, Pogik Bay, Smith River	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
32	Cape Halkett, Esook Trading Post, Garry Creek	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
36	Kalubik Creek, Oliktok Point, Thetis Mound	1	0.0	1	0.0	n	0.0	1	0.0	1	0.0	1	0.0
47	Bernard Harbor, Jago Lagoon, Kaktovik, Kaktovik Lagoon	1	0.0	1	0.0	1	0.0	n	0.0	1	0.0	n	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.

Table C-21 Combined Probabilities (Expressed as Percent Chance) of One or More Spills Greater than or Equal to 1,000 Barrels, and the Estimated Number of Spills (Mean), Occurring and Contacting a Certain Land Segment over the Assumed Production Life of the Lease Area Within 360 Days, Beaufort Sea Sale 202

ID	Land Segment Name	Full Sale Area		Barrow Subsistence Whale Deferral		Nuiqsut Subsistence Whale Deferral		Kaktovik Subsistence Whale Deferral		Eastern Deferral		Proposed Action	
25	Barrow, Browerville, Elson Lagoon	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
28	Cape Simpson, Piasuk River, Sinclair River, Tulimanik Island	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
30	Drew Point, Kolovik, McLeod Point	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
31	Lonely, Pitt Point, Pogik Bay, Smith River	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
32	Cape Halkett, Esook Trading Post, Garry Creek	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
35	Anachlik Island, Colville River, Colville River Delta	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
36	Kalubik Creek, Oliktok Point, Thetis Mound	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
37	Beechey Point, Bertoncini Island, Bodfish Island, Cottle Island, Jones Islands, Milne Point, Simpson Lagoon	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
47	Bernard Harbor, Jago Lagoon, Kaktovik, Kaktovik Lagoon	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0

Notes: ** = Greater than 99.5 percent; : = less than 0.5 percent. Rows with all values less than 0.5 percent are not shown.