Assessment of Marine Oil Spill Risk and Environmental Vulnerability for the State of Alaska

Appendix A: Incident Rate and Spill Volume Analysis

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Glossary of Key Terms

Actual spill incident: an incident (see **Incident**) in which spillage of oil occurs.

AKRID: Alaska Risk Incident Database, which includes incident data (potential spills and actual spills) from the Alaska Department of Environmental Conservation, US Coast Guard vessel and facility spill and casualty databases, and other data incorporated into ERC's spill databases.

Baseline frequency: the frequency (or incident rate) for the present time based on the analysis of historical incidents rates for the years 1995 – 2010.

Bbl: barrels. A barrel (bbl) is the equivalent of 42 gallons or 37.7 cubic meters.

Blowout: NOAA defines a well blowout as "an uncontrolled flow of gas, oil, or other fluids from a well into the atmosphere or into an underground formation". The BOEM and BSEE define a "loss of well control" as "uncontrolled flow of formation or other fluids, including flow to an exposed formation (an underground blowout) or at the surface (a surface blowout), flow through a diverter, or uncontrolled flow resulting from a failure of surface equipment or procedures".

BOEM: Bureau of Ocean Energy Management

BOEMRE: Bureau of Ocean Energy Management , Regulation, and Enforcement

BSEE: Bureau of Safety and Environmental Enforcement

Deadweight tonnage (DWT): the maximum amount of weight a ship or vessel can safely carry as expressed in metric tons (tonnes)

EPA: Environmental Protection Agency

ERC: Environmental Research Consulting

Facility: a structure or operation that stores, handles, produces, or consumes petroleum (oil), including such entities as power plants, oil terminals, offshore oil and gas exploration and production, pipelines, storage tanks, and vehicles.

Forecasted frequency: the predicted frequency (or incident rate) for the future (the year 2026).

Gross tonnage (GT): a measure of a ship's overall internal volume.

Incident: Events involving vessels or facilities (including pipelines and offshore wells) that could potentially result in the spillage of oil, such as casualties, accidents, discharges, and leakages.

Incident rate: the frequency of incidents or the number of incidents per year or other time period

Maximum Most-Probable Discharge (MMPD) for Facilities: the volume based on US Coast Guard regulations as the lesser of 1,200 bbl or 10% of the WCD (see **WCD**).

Maximum Most-Probable Discharge (MMPD) for Vessels: he volume based on US Coast Guard regulations as the 10% of the WCD for vessels of less than 25,000 deadweight tonnage (DWT), and 2,500 bbl for vessels greater than or equal to 25,000 DWT (see **DWT**).

Oil Type: one of the four major oil categories – crude, distillate, heavy, or light.

Period: one of the two-month time periods (December – January, February – March, April – May, June – July, August – September, and October – November) during which an incident occurred.

Potential spill incident: an incident (see **Incident**) in which the potential for spillage exists (or existed) but which does not result in the spillage of oil.

Region: one of the 14 marine/coastal geographic districts (Southeast Alaska, Prince William Sound, South-Central Alaska, Cook Inlet, Offshore Kenai Peninsula, Kodiak/Shelikof Strait, Aleutians, Bristol Bay, Aniakchak, Western Alaska, Norton Sound/St. Lawrence Island, Kotzebue Sound/Hope Basin, Chukchi Sea, and Beaufort Sea).[1]

Weight-Averaged Maximum Most-Probable Discharge (WA-MMPD): a volume derived by taking a weighted-average of the MMPDs (see MMPD) for all the incidents in a particular region (see Weighted-Average).

Weighted-Average: An average in which each quantity to be averaged is assigned a weight based on the relative proportion of occurrence; these weightings determine the relative importance of each quantity on the average. For example, if 75% of the incidents in a region came from sources (A) that had an MMPD of 100 bbl and 25% came from sources (B) had an MMPD of 1,500 bbl, the weighted-average would be calculated as:

$$WA - MMPD = 0.75MMPD_A + O.25MMPD_B$$
$$WA - MMPD = 0.75(100bbl) + 0.25(1,500bbl)$$
$$WA - MMPD = 450bbl$$

Worst-Case Discharge (WCD) for Facilities: The spill volume based on US Coast Guard regulations as "the largest foreseeable discharge in adverse weather conditions". The actual WCD for a specific facility depends on the capacity of storage tanks, the numbers and lengths of pipelines between control points (shut-off valves, etc.), the pressure in the pipelines, the diameters of the pipelines, the lengths of time between pipeline inspections and the time it would typically take to detect a loss of oil, and other factors. In this study the WCD for facilities are based on the types of facilities present in each region and the known capacities of the facilities. For facilities for which there was no reported capacity, a typical capacity for the facility type was applied based on a survey of thousands of facilities in the US as previously conducted for the EPA. These volumes range from 100 bbl to 200,000 bbl.

Worst-Case Discharge (WCD) for Wells: For offshore wells, the WCDs depend on the pressure in the well, the size and type of pipe or riser, the type of blowout preventer, the length of time before a discharge is detected, and the length of time to capping of the well or stemming of the flow of oil. For the

[1] The Interior district is not analyzed in this study.

purposes of these analyses, the WCDs for the Beaufort and Chukchi Sea wells are assumed to be those that are presented in BOEM's 2012-2017 OCS Oil and Gas Leasing Program Final Programmatic Environmental Impact Assessment[2] as "Catastrophic Discharge Events" (CDEs), as these represent the equivalent level of catastrophic event as a worst-case discharge tanker spill in which the entire contents of the tanker spills. The discharge volume for the Beaufort and Chukchi Seas, are 3.9 million bbl and 2.2 million bbl, respectively. For the Cook Inlet, Kodiak/Shelikof Strait, and Aniakchak regions, the discharge volumes are 39,000 bbl, due to the differences in recorded production rates from the different regions, as well as differences in the durations of flow due to factors such as type of drilling rig and rig availability to drill relief wells during open-water season.

Worst-Case Discharge (WCD) for Vessels: The spill volume based on US Coast Guard regulations as the total capacity of the cargo and/or bunker fuel tanks of the vessel. This volume varies from 10 bbl for small recreational vessels to 1.9 million bbl for fully-loaded crude tankers (also called "tank ships").

[2] BOEM 2012.

Executive Summary

An analysis of historical vessel and facility incidents for the years 1995 through 2012 that led to oil spillage or could potentially have led to spillage in Alaskan marine waters and coastal areas was conducted to determine incident rates by region, source, oil type, and two-month time period over the year. The results were to be applied to the environmental sensitivity of each region by oil type and time period for incidents resulting in maximum most-probable discharges (MMPD) and worst-case discharges (WCD). A forecast for spillage in the year 2025 and beyond was also conducted.

1. Definitions

The analyses were conducted on a regional basis for the regions shown in Figure ES-1 and Table ES-1.

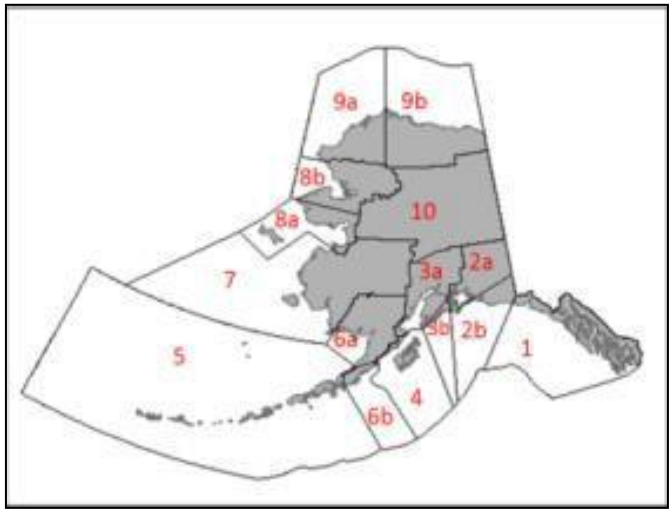

Figure ES-1: Geographic Regions

Table ES-1: Geographic Regions[3]	
Map Number	**Region**
1	Southeast Alaska
2a	Prince William Sound
2b	South-Central Alaska
3a	Cook Inlet
3b	Offshore Kenai Peninsula
4	Kodiak/Shelikof Strait
5	Aleutians
6a	Bristol Bay
6b	Aniakchak
7	Western Alaska
8a	Norton Sound/St. Lawrence Island
8b	Kotzebue Sound/Hope Basin
9a	Chukchi Sea
9b	Beaufort Sea
10[4]	Interior

[3] Based on Alaska Department of Environmental Conservation (ADEC) Regions with regions 2,3,6,8, and 9 broken into two sub-regions each to better accommodate biological risk analyses.
[4] Region 10 (Interior) was excluded from the analysis as this is outside areas of potential marine impact.

In this study, "incidents" are defined as events involving vessels or facilities (including pipelines and offshore wells) that could potentially result in the spillage of oil, such as casualties, accidents, discharges, and leakages.

This study employs the US Coast Guard (USCG) definitions of WCD depending on source type. For onshore facilities, deep-water ports, and offshore facilities, WCD is defined as "the largest foreseeable discharge in adverse weather conditions". The actual WCD for a specific facility depends on the capacity of storage tanks, the numbers and lengths of pipelines between control points (shut-off valves, etc.), the pressure in the pipelines, the diameters of the pipelines, the lengths of time between pipeline inspections and the time it would typically take to detect a loss of oil, and other factors. In this study the WCD for facilities are based on the types of facilities present in each region and the known capacities of the facilities. For facilities for which there was no reported capacity, a typical capacity for the facility type was applied based on a survey of thousands of facilities in the US as previously conducted for the Environmental Protection Agency (EPA). These volumes range from 100 bbl to 200,000 bbl.

For offshore wells, the WCDs depend on the pressure in the well, the size and type of pipe or riser, the type of blowout preventer, the length of time before a discharge is detected, and the length of time to capping of the well or stemming of the flow of oil with relief wells. For the purposes of these analyses, the WCDs for the Beaufort and Chukchi Sea wells are assumed to be those that are presented in BOEM's 2012-2017 OCS Oil and Gas Leasing Program Final Programmatic Environmental Impact Assessment[5] as "Catastrophic Discharge Events" (CDEs), as these represent the equivalent level of catastrophic event as a worst-case discharge tanker spill in which the entire contents of the tanker spills. The discharge volumes for the Beaufort and Chukchi Seas are 3.9 million bbl and 2.2 million bbl, respectively. For the Cook Inlet, Kodiak/Shelikof Strait, and Aniakchak regions daily discharge rates of 39,000 bbl are used, due to the differences in recorded production rates from the different regions, as well as differences in the durations of flow due to factors such as type of drilling rig and rig availability to drill relief wells during open-water season.

For vessels, the WCD is defined as the total capacity of the cargo and/or bunker fuel tanks of the vessel. This volume varies from 10 bbl for small recreational vessels to 1.9 million bbl for fully-loaded crude tankers (also called "tank ships").

For the MMPDs, the US Coast Guard definitions were applied. The MMPD volumes are defined by source type as follows:

- Facility MMPD = the lesser of 1,200 bbl or 10% of the WCD;
- Vessel (<25,000 deadweight tonnage) MMPD = 10% of the WCD; and
- Vessel (≥25,000 deadweight tonnage) MMPD = 2,500 bbl.

Based on these definitions, the largest possible MMPD is 2,500 bbl. Since there is no analogous equivalent for offshore wells in BOEM or BSEE regulations, the facility MMPD of 1,200 bbl was applied to offshore wells in this analysis.

[5] BOEM 2012.

2. Potential for Spillage Volumes

The greatest potential for spill volume in Alaska is from offshore oil wells. For the 40 years prior to the 2010 Macondo MC252 spill in the Gulf of Mexico, the volume of spillage from US offshore wells and platforms had totaled 277,000 bbl. Of this, 80% had spilled during 1969 and 1970. Between 1978 and 2009, average annual spillage in the US was 1,500 bbl.[6] The estimated 4.2 million bbl of spillage[7] from the Macondo MC252 incident skewed all previous data, making up about 90% of the total spillage from US wells over the course of 45 years. An analysis of international data on well blowouts indicates that since 1968, there have been 11 well blowouts involving more than 50,000 bbl. Only two incidents involved more than 250,000 bbl.

Though the term "blowout" seemingly implies a WCD, this is not the actual case.[8] Of the 18 well blowouts that have been reported in the US, only two have involved 100,000 bbl or more – the 1969 Alpha Well 21 Platform A blowout off Santa Barbara, California, and the Macondo MC252 blowout. Of the 18 blowouts that have occurred in the US over 45 years, one third have involved less 50 bbl, 22% less than 10 bbl.

As a result of offshore exploration and production activities, a catastrophic discharge volume well blowout could potentially occur in the Beaufort Sea or the Chukchi Sea. The probability of such an event is considered to be very low, but certainly needs to be considered in risk planning. The worst-case discharge (WCD) volume for well blowouts in these regions is defined in these analyses as 3.9 million bbl for the Beaufort Sea region, and 2.2 million bbl for the Chukchi Sea region.[9]

The next largest WCD spill volume would be a spill from a fully-loaded crude tanker. In US coastal waters, between the years 1969 and 2013, there has never been a true WCD from an oil tanker. Note that despite its significant environmental and socioeconomic impacts, the 1989 Exxon Valdez spill was not a WCD. The tanker only spilled about 14% of its cargo load. Had it been a WCD, the volume of spillage would have been about 1.6 million bbl rather than 262,000 bbl. Average spillage volume from tankers in the US is 435 bbl. Since 1969, there have been 13 tanker spill incidents in the US involving 100,000 bbl

[6] Etkin (2009a).

[7] The total volume of spillage from the Macondo MC252 blowout is in dispute. BP and Anadarko claim that the total volume of spillage was 3,260,000 bbl of which 810,000 bbl were captured at the wellhead, releasing 2,450,000 bbl to the environment (Fitch et al. 2013). The US government claims that the total volume was 5,000,000 bbl of which 800,000 bbl were captured at the wellhead, releasing 4,200,000 bbl to the environment l (Hauck et al. 2013).

[8] NOAA defines a well blowout as "an uncontrolled flow of gas, oil, or other fluids from a well into the atmosphere or into an underground formation". The Bureau of Ocean Energy Management, Regulation, and Enforcement defines a "loss of well control" as "uncontrolled flow of formation or other fluids, including flow to an exposed formation (an underground blowout) or at the surface (a surface blowout), flow through a diverter, or uncontrolled flow resulting from a failure of surface equipment or procedures".

[9] The 30-day time frame is in line with the WCD scenarios for response preparedness as stipulated by EPA under 40 CFR §112.20 for offshore wells at depths of less than 10,000 feet. It also meets the US Bureau of Safety and Environmental Enforcement (BSEE) regulations that stipulate that each operator calculate its own WCD for each well flowing for 30 days. However, according to BOEM's 2012-2017 OCS Oil and Gas Leasing Program Final Programmatic Environmental Impact Assessment, much larger catastrophic events can occur and need to be considered in risk planning.

or more. [10] While the likelihood of a WCD from a tanker is seemingly higher than a WCD due to a well blowout, this still represents a very low likelihood of occurrence.

3. Incident Rate Analysis Results Summary

The baseline (historically-based) and forecasted incident results are summarized in Table ES-2. In the table, the incident rates are color-coded so that dark red represents highest probability, red represent very high probability, orange represents high probability, yellow represents moderate probability, light green represents low probability, darker green represents very low probability, and blue represents lowest (unlikely) probability (as shown in the key in Figure ES-2). *Note that the probability of an incident is not the only factor related to risk. The environmental impact of the spill by location, oil type, time period, and spill volume must be coupled with the probability to determine risk.*

Figure ES-2: Color-Code Key for Table ES-2

[10] Etkin (2009a.)

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]								
Region	**Oil Type**	**Period**	**Baseline[12]**			**Forecasted (2025)**		
			Frequency	**WCD (bbl)**	**WA-MMPD (bbl)**	**Frequency**	**WCD (bbl)**	**WA-MMPD (bbl)**
Aleutians	**Crude**	**Dec-Jan**	**0.000**	n/a	n/a	**0.065**	950,000	600
		Feb-Mar	**0.000**	n/a	n/a	**0.065**	950,000	600
		Apr-May	**0.000**	n/a	n/a	**0.065**	950,000	600
		Jun-Jul	**0.000**	n/a	n/a	**0.065**	950,000	600
		Aug-Sep	**0.000**	n/a	n/a	**0.065**	950,000	600
		Oct-Nov	**0.000**	n/a	n/a	**0.065**	950,000	600
	Distillate	**Dec-Jan**	**0.120**	523,000	250	**0.248**	950,000	400
		Feb-Mar	**0.390**	523,000	560	**0.809**	950,000	400
		Apr-May	**0.280**	523,000	560	**0.579**	950,000	400
		Jun-Jul	**0.500**	523,000	560	**1.038**	950,000	400
		Aug-Sep	**0.280**	523,000	560	**0.579**	950,000	400
		Oct-Nov	**0.220**	523,000	560	**0.460**	950,000	400
	Heavy	**Dec-Jan**	**0.560**	523,000	250	**0.403**	950,000	1,500
		Feb-Mar	**0.500**	523,000	560	**0.362**	950,000	1,500
		Apr-May	**0.220**	523,000	560	**0.160**	950,000	1,500
		Jun-Jul	**0.390**	523,000	560	**0.282**	950,000	1,500
		Aug-Sep	**0.670**	523,000	560	**0.483**	950,000	1,500
		Oct-Nov	**0.440**	523,000	560	**0.317**	950,000	1,500
	Light	**Dec-Jan**	**11.280**	523,000	250	**12.998**	950,000	200
		Feb-Mar	**19.780**	523,000	560	**22.796**	950,000	200
		Apr-May	**12.440**	523,000	560	**14.335**	950,000	200
		Jun-Jul	**13.450**	523,000	560	**15.498**	950,000	200
		Aug-Sep	**16.440**	523,000	560	**18.948**	950,000	200
		Oct-Nov	**11.330**	523,000	560	**13.059**	950,000	200
Aniakchak	**Crude**	**Dec-Jan**	**0.020**	523,000	560	**0.008**	261,500	1,900
		Feb-Mar	**0.020**	523,000	150	**0.008**	261,500	1,900
		Apr-May	**0.020**	523,000	150	**0.008**	261,500	1,900
		Jun-Jul	**0.020**	523,000	150	**0.008**	261,500	1,900
		Aug-Sep	**0.020**	523,000	150	**0.008**	261,500	1,900
		Oct-Nov	**0.020**	523,000	150	**0.008**	261,500	1,900
	Distillate	**Dec-Jan**	**0.030**	523,000	560	**0.042**	261,500	400

[11] WCD = worst-case discharge; WA-MMPD = weight-averaged maximum most-probable discharge; bbl = barrels.
[12] Baseline = results based on historical data for 1995–2012.

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]

Region	Oil Type	Period	Baseline[12]			Forecasted (2025)		
			Frequency	WCD (bbl)	WA-MMPD (bbl)	Frequency	WCD (bbl)	WA-MMPD (bbl)
		Feb-Mar	0.030	523,000	150	0.042	261,500	400
		Apr-May	0.030	523,000	150	0.042	261,500	400
		Jun-Jul	0.030	523,000	150	0.042	261,500	400
		Aug-Sep	0.030	523,000	150	0.042	261,500	400
		Oct-Nov	0.030	523,000	150	0.042	261,500	400
	Heavy	Dec-Jan	0.040	523,000	560	0.018	261,500	2,300
		Feb-Mar	0.040	523,000	150	0.018	261,500	2,300
		Apr-May	0.040	523,000	150	0.018	261,500	2,300
		Jun-Jul	0.040	523,000	150	0.018	261,500	2,300
		Aug-Sep	0.040	523,000	150	0.018	261,500	2,300
		Oct-Nov	0.040	523,000	150	0.018	261,500	2,300
	Light	Dec-Jan	0.110	523,000	560	0.127	261,500	400
		Feb-Mar	0.780	523,000	150	0.897	261,500	400
		Apr-May	0.390	523,000	150	0.448	261,500	400
		Jun-Jul	0.610	523,000	150	0.703	261,500	400
		Aug-Sep	0.610	523,000	150	0.703	261,500	400
		Oct-Nov	0.280	523,000	150	0.321	261,500	400
Beaufort Sea	Crude	Dec-Jan	1.830	3,900,000	1,200	10.012	3,900,000	1,200
		Feb-Mar	3.280	1,900,000	830	17.963	3,900,000	1,200
		Apr-May	3.720	1,900,000	830	20.363	3,900,000	1,200
		Jun-Jul	4.610	1,900,000	830	25.235	3,900,000	1,200
		Aug-Sep	2.890	1,900,000	830	15.830	3,900,000	1,200
		Oct-Nov	2.390	1,900,000	830	13.090	3,900,000	1,200
	Distillate	Dec-Jan	0.000	n/a	n/a	0.366	950,000	1,100
		Feb-Mar	0.000	n/a	n/a	0.366	950,000	1,100
		Apr-May	0.060	523,000	830	0.366	950,000	1,100
		Jun-Jul	0.060	523,000	830	0.366	950,000	1,100
		Aug-Sep	0.060	523,000	830	0.366	950,000	1,100
		Oct-Nov	0.060	523,000	830	0.366	950,000	1,100
	Heavy	Dec-Jan	0.000	n/a	n/a	0.059	950,000	1,600
		Feb-Mar	0.000	n/a	n/a	0.059	950,000	1,600
		Apr-May	0.070	1,900,000	830	0.059	950,000	1,600
		Jun-Jul	0.070	1,900,000	830	0.059	950,000	1,600
		Aug-Sep	0.070	1,900,000	830	0.059	950,000	1,600

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]								
Region	Oil Type	Period	Baseline[12]			Forecasted (2025)		
			Frequency	WCD (bbl)	WA-MMPD (bbl)	Frequency	WCD (bbl)	WA-MMPD (bbl)
		Oct-Nov	0.070	1,900,000	830	0.059	950,000	1,600
	Light	Dec-Jan	10.670	523,000	1,200	50.904	950,000	1,200
		Feb-Mar	13.500	1,900,000	830	64.401	950,000	1,200
		Apr-May	12.000	1,900,000	830	57.241	950,000	1,200
		Jun-Jul	9.890	1,900,000	830	47.187	950,000	1,200
		Aug-Sep	9.330	1,900,000	830	44.504	950,000	1,200
		Oct-Nov	7.720	1,900,000	830	36.816	950,000	1,200
Bristol Bay	Crude	Dec-Jan	0.000	n/a	n/a	0.000	n/a	n/a
		Feb-Mar	0.000	n/a	n/a	0.000	n/a	n/a
		Apr-May	0.000	n/a	n/a	0.000	n/a	n/a
		Jun-Jul	0.000	n/a	n/a	0.000	n/a	n/a
		Aug-Sep	0.000	n/a	n/a	0.000	n/a	n/a
		Oct-Nov	0.000	n/a	n/a	0.000	n/a	n/a
	Distillate	Dec-Jan	0.000	n/a	n/a	0.092	163,000	1,000
		Feb-Mar	0.000	n/a	n/a	0.092	163,000	1,000
		Apr-May	0.440	523,000	150	0.229	163,000	1,000
		Jun-Jul	0.340	523,000	150	0.178	163,000	1,000
		Aug-Sep	0.170	523,000	150	0.088	163,000	1,000
		Oct-Nov	0.120	523,000	150	0.062	163,000	1,000
	Heavy	Dec-Jan	0.040	163,000	420	0.011	163,000	500
		Feb-Mar	0.040	1,900,000	150	0.011	163,000	500
		Apr-May	0.060	1,900,000	150	0.017	163,000	500
		Jun-Jul	0.280	1,900,000	150	0.078	163,000	500
		Aug-Sep	0.110	1,900,000	150	0.031	163,000	500
		Oct-Nov	0.040	1,900,000	150	0.011	163,000	500
	Light	Dec-Jan	0.280	163,000	420	0.327	163,000	200
		Feb-Mar	0.560	1,900,000	150	0.654	163,000	200
		Apr-May	2.060	1,900,000	150	2.412	163,000	200
		Jun-Jul	6.450	1,900,000	150	7.558	163,000	200
		Aug-Sep	1.220	1,900,000	150	1.432	163,000	200
		Oct-Nov	0.390	1,900,000	150	0.457	163,000	200
Cook Inlet	Crude	Dec-Jan	1.330	1,900,000	830	1.258	950,000	1,200
		Feb-Mar	1.720	1,900,000	670	1.627	950,000	1,200
		Apr-May	2.880	1,900,000	670	2.725	950,000	1,200

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]

Region	Oil Type	Period	Baseline[12]			Forecasted (2025)		
			Frequency	WCD (bbl)	WA-MMPD (bbl)	Frequency	WCD (bbl)	WA-MMPD (bbl)
		Jun-Jul	2.110	1,900,000	670	2.000	950,000	1,200
		Aug-Sep	2.940	1,900,000	670	2.784	950,000	1,200
		Oct-Nov	1.330	1,900,000	670	1.258	950,000	1,200
	Distillate	Dec-Jan	0.390	523,000	830	0.490	261,500	800
		Feb-Mar	0.500	523,000	670	0.630	261,500	800
		Apr-May	1.110	523,000	670	1.398	261,500	800
		Jun-Jul	0.720	523,000	670	0.908	261,500	800
		Aug-Sep	0.830	523,000	670	1.042	261,500	800
		Oct-Nov	0.390	523,000	670	0.490	261,500	800
	Heavy	Dec-Jan	0.280	1,900,000	830	0.890	950,000	1,200
		Feb-Mar	0.280	1,900,000	670	0.890	950,000	1,200
		Apr-May	0.390	1,900,000	670	1.243	950,000	1,200
		Jun-Jul	0.500	1,900,000	670	1.596	950,000	1,200
		Aug-Sep	0.670	1,900,000	670	2.133	950,000	1,200
		Oct-Nov	0.390	1,900,000	670	1.243	950,000	1,200
	Light	Dec-Jan	6.780	1,900,000	830	7.408	950,000	700
		Feb-Mar	7.610	1,900,000	670	8.318	950,000	700
		Apr-May	9.890	1,900,000	670	10.810	950,000	700
		Jun-Jul	12.780	1,900,000	670	13.965	950,000	700
		Aug-Sep	11.390	1,900,000	670	12.445	950,000	700
		Oct-Nov	7.060	1,900,000	670	7.713	950,000	700
Kotzebue Sound/ Hope Basin	Crude	Dec-Jan	0.000	n/a	n/a	0.000	n/a	n/a
		Feb-Mar	0.000	n/a	n/a	0.000	n/a	n/a
		Apr-May	0.000	n/a	n/a	0.000	n/a	n/a
		Jun-Jul	0.000	n/a	n/a	0.000	n/a	n/a
		Aug-Sep	0.000	n/a	n/a	0.000	n/a	n/a
		Oct-Nov	0.000	n/a	n/a	0.000	n/a	n/a
	Distillate	Dec-Jan	0.000	n/a	n/a	0.216	163,000	300
		Feb-Mar	0.000	n/a	n/a	0.216	163,000	300
		Apr-May	0.060	523,000	520	0.038	163,000	300
		Jun-Jul	0.120	523,000	520	0.073	163,000	300
		Aug-Sep	0.110	523,000	520	0.068	163,000	300
		Oct-Nov	0.060	523,000	520	0.038	163,000	300
	Heavy	Dec-Jan	0.000	n/a	n/a	0.019	163,000	1,400

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]

Region	Oil Type	Period	Baseline[12]			Forecasted (2025)		
			Frequency	WCD (bbl)	WA-MMPD (bbl)	Frequency	WCD (bbl)	WA-MMPD (bbl)
		Feb-Mar	0.000	n/a	n/a	0.019	163,000	1,400
		Apr-May	0.030	1,900,000	520	0.019	163,000	1,400
		Jun-Jul	0.030	1,900,000	520	0.019	163,000	1,400
		Aug-Sep	0.030	1,900,000	520	0.019	163,000	1,400
		Oct-Nov	0.030	1,900,000	520	0.019	163,000	1,400
	Light	Dec-Jan	0.110	163,000	790	0.109	163,000	800
		Feb-Mar	0.280	1,900,000	520	0.274	163,000	800
		Apr-May	0.170	1,900,000	520	0.165	163,000	800
		Jun-Jul	0.720	1,900,000	520	0.709	163,000	800
		Aug-Sep	0.330	1,900,000	520	0.326	163,000	800
		Oct-Nov	0.440	1,900,000	520	0.430	163,000	800
Kodiak/ Shelikof Strait	Crude	Dec-Jan	0.050	1,900,000	150	0.014	950,000	1,700
		Feb-Mar	0.050	1,900,000	230	0.014	950,000	1,700
		Apr-May	0.050	1,900,000	230	0.014	950,000	1,700
		Jun-Jul	0.050	1,900,000	230	0.014	950,000	1,700
		Aug-Sep	0.050	1,900,000	230	0.014	950,000	1,700
		Oct-Nov	0.050	1,900,000	230	0.014	950,000	1,700
	Distillate	Dec-Jan	0.330	523,000	150	0.609	261,500	300
		Feb-Mar	0.110	523,000	230	0.203	261,500	300
		Apr-May	0.390	523,000	230	0.715	261,500	300
		Jun-Jul	0.280	523,000	230	0.512	261,500	300
		Aug-Sep	0.110	523,000	230	0.203	261,500	300
		Oct-Nov	0.230	523,000	230	0.423	261,500	300
	Heavy	Dec-Jan	0.170	1,900,000	150	0.091	950,000	1,200
		Feb-Mar	0.110	1,900,000	230	0.060	950,000	1,200
		Apr-May	0.170	1,900,000	230	0.091	950,000	1,200
		Jun-Jul	0.060	1,900,000	230	0.034	950,000	1,200
		Aug-Sep	0.170	1,900,000	230	0.091	950,000	1,200
		Oct-Nov	0.280	1,900,000	230	0.151	950,000	1,200
	Light	Dec-Jan	7.000	1,900,000	150	7.939	950,000	100
		Feb-Mar	7.450	1,900,000	230	8.446	950,000	100
		Apr-May	7.280	1,900,000	230	8.256	950,000	100
		Jun-Jul	9.170	1,900,000	230	10.400	950,000	100
		Aug-Sep	6.890	1,900,000	230	7.814	950,000	100

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]								
Region	**Oil Type**	**Period**	**Baseline[12]**			**Forecasted (2025)**		
			Frequency	**WCD (bbl)**	**WA-MMPD (bbl)**	**Frequency**	**WCD (bbl)**	**WA-MMPD (bbl)**
		Oct-Nov	**6.000**	1,900,000	230	**6.804**	950,000	100
Chukchi Sea	**Crude**	**Dec-Jan**	**0.010**	2,200,000	560	**0.061**	2,200,000	1,200
		Feb-Mar	**0.010**	2,200,000	1,200	**0.061**	2,200,000	1,200
		Apr-May	**0.010**	2,200,000	1,200	**0.061**	2,200,000	1,200
		Jun-Jul	**0.010**	2,200,000	1,200	**0.061**	2,200,000	1,200
		Aug-Sep	**0.010**	2,200,000	1,200	**0.061**	2,200,000	1,200
		Oct-Nov	**0.010**	2,200,000	1,200	**0.061**	2,200,000	1,200
	Distillate	**Dec-Jan**	**0.070**	50,000	560	**0.026**	950,000	200
		Feb-Mar	**0.070**	523,000	1,200	**0.026**	950,000	200
		Apr-May	**0.070**	523,000	1,200	**0.026**	950,000	200
		Jun-Jul	**0.070**	523,000	1,200	**0.026**	950,000	200
		Aug-Sep	**0.070**	523,000	1,200	**0.026**	950,000	200
		Oct-Nov	**0.070**	523,000	1,200	**0.026**	950,000	200
	Heavy	**Dec-Jan**	**0.000**	n/a	n/a	**0.027**	950,000	2,000
		Feb-Mar	**0.000**	n/a	n/a	**0.027**	950,000	2,000
		Apr-May	**0.020**	523,000	1,200	**0.027**	950,000	2,000
		Jun-Jul	**0.020**	523,000	1,200	**0.027**	950,000	2,000
		Aug-Sep	**0.020**	523,000	1,200	**0.027**	950,000	2,000
		Oct-Nov	**0.020**	523,000	1,200	**0.027**	950,000	2,000
	Light	**Dec-Jan**	**0.220**	50,000	560	**0.183**	950,000	800
		Feb-Mar	**0.110**	523,000	1,200	**0.255**	950,000	800
		Apr-May	**0.110**	523,000	1,200	**0.218**	950,000	800
		Jun-Jul	**0.110**	523,000	1,200	**0.984**	950,000	800
		Aug-Sep	**0.610**	523,000	1,200	**0.693**	950,000	800
		Oct-Nov	**0.060**	523,000	1,200	**0.473**	950,000	800
Norton Sound/ St. Lawrence Island	**Crude**	**Dec-Jan**	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Feb-Mar	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Apr-May	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Jun-Jul	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Aug-Sep	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Oct-Nov	**0.000**	n/a	n/a	**0.000**	n/a	n/a
	Distillate	**Dec-Jan**	**0.120**	163,000	650	**0.132**	163,000	700
		Feb-Mar	**0.110**	50,000	560	**0.122**	163,000	700
		Apr-May	**0.060**	50,000	560	**0.069**	163,000	700

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]

Region	Oil Type	Period	Baseline[12]			Forecasted (2025)		
			Frequency	WCD (bbl)	WA-MMPD (bbl)	Frequency	WCD (bbl)	WA-MMPD (bbl)
		Jun-Jul	0.180	50,000	560	0.201	163,000	700
		Aug-Sep	0.170	50,000	560	0.186	163,000	700
		Oct-Nov	0.060	50,000	560	0.069	163,000	700
	Heavy	Dec-Jan	0.000	n/a	n/a	0.023	163,000	200
		Feb-Mar	0.000	n/a	n/a	0.023	163,000	200
		Apr-May	0.040	30,000	560	0.005	163,000	200
		Jun-Jul	0.050	30,000	560	0.007	163,000	200
		Aug-Sep	0.040	30,000	560	0.005	163,000	200
		Oct-Nov	0.040	30,000	560	0.005	163,000	200
	Light	Dec-Jan	0.280	163,000	650	0.305	163,000	500
		Feb-Mar	0.390	50,000	560	0.426	163,000	500
		Apr-May	0.330	50,000	560	0.363	163,000	500
		Jun-Jul	1.500	50,000	560	1.641	163,000	500
		Aug-Sep	1.060	50,000	560	1.157	163,000	500
		Oct-Nov	0.720	50,000	560	0.789	163,000	500
Off Kenai Peninsula	Crude	Dec-Jan	0.010	523,000	150	0.003	261,500	1,900
		Feb-Mar	0.010	523,000	150	0.003	261,500	1,900
		Apr-May	0.010	523,000	150	0.003	261,500	1,900
		Jun-Jul	0.010	523,000	150	0.003	261,500	1,900
		Aug-Sep	0.010	523,000	150	0.003	261,500	1,900
		Oct-Nov	0.010	523,000	150	0.003	261,500	1,900
	Distillate	Dec-Jan	0.110	523,000	150	0.079	261,500	300
		Feb-Mar	0.110	523,000	250	0.079	261,500	300
		Apr-May	0.170	523,000	250	0.120	261,500	300
		Jun-Jul	0.110	523,000	250	0.079	261,500	300
		Aug-Sep	0.330	523,000	250	0.238	261,500	300
		Oct-Nov	0.060	523,000	250	0.517	261,500	300
	Heavy	Dec-Jan	0.110	523,000	150	0.049	261,500	700
		Feb-Mar	0.110	523,000	250	0.049	261,500	700
		Apr-May	0.030	523,000	250	0.014	261,500	700
		Jun-Jul	0.030	523,000	250	0.014	261,500	700
		Aug-Sep	0.030	523,000	250	0.014	261,500	700
		Oct-Nov	0.030	523,000	250	0.014	261,500	700
	Light	Dec-Jan	1.280	523,000	150	1.482	261,500	100

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]

Region	Oil Type	Period	Baseline[12]			Forecasted (2025)		
			Frequency	WCD (bbl)	WA-MMPD (bbl)	Frequency	WCD (bbl)	WA-MMPD (bbl)
		Feb-Mar	2.110	523,000	250	2.446	261,500	100
		Apr-May	2.610	523,000	250	3.021	261,500	100
		Jun-Jul	3.000	523,000	250	3.477	261,500	100
		Aug-Sep	2.220	523,000	250	2.569	261,500	100
		Oct-Nov	1.670	523,000	250	1.934	261,500	100
South-Central Alaska	Crude	Dec-Jan	0.110	1,900,000	670	0.062	950,000	2,500
		Feb-Mar	0.110	1,900,000	520	0.062	950,000	2,500
		Apr-May	0.050	1,900,000	420	0.027	950,000	2,500
		Jun-Jul	0.040	1,900,000	420	0.022	950,000	2,500
		Aug-Sep	0.040	1,900,000	420	0.022	950,000	2,500
		Oct-Nov	0.050	1,900,000	420	0.027	950,000	2,500
	Distillate	Dec-Jan	0.000	n/a	n/a	0.030	950,000	300
		Feb-Mar	0.000	n/a	n/a	0.030	950,000	300
		Apr-May	0.220	163,000	420	0.074	950,000	300
		Jun-Jul	0.110	163,000	420	0.037	950,000	300
		Aug-Sep	0.110	163,000	420	0.037	950,000	300
		Oct-Nov	0.000	n/a	n/a	0.030	950,000	300
	Heavy	Dec-Jan	0.050	1,900,000	670	0.026	950,000	2,200
		Feb-Mar	0.110	163,000	420	0.059	950,000	2,200
		Apr-May	0.110	163,000	420	0.059	950,000	2,200
		Jun-Jul	0.040	163,000	420	0.021	950,000	2,200
		Aug-Sep	0.040	163,000	420	0.021	950,000	2,200
		Oct-Nov	0.050	163,000	420	0.026	950,000	2,200
	Light	Dec-Jan	0.390	1,900,000	670	0.481	950,000	400
		Feb-Mar	0.830	163,000	420	1.022	950,000	400
		Apr-May	1.110	163,000	420	1.371	950,000	400
		Jun-Jul	0.780	163,000	420	0.962	950,000	400
		Aug-Sep	0.940	163,000	420	1.158	950,000	400
		Oct-Nov	0.440	163,000	420	0.541	950,000	400
Prince William Sound	Crude	Dec-Jan	0.830	1,900,000	520	0.496	261,500	2,000
		Feb-Mar	0.610	1,900,000	520	0.366	261,500	2,000
		Apr-May	0.500	1,900,000	520	0.300	261,500	2,000
		Jun-Jul	0.670	1,900,000	520	0.400	261,500	2,000
		Aug-Sep	0.280	1,900,000	520	0.167	261,500	2,000

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]

Region	Oil Type	Period	Baseline[12]			Forecasted (2025)		
			Frequency	WCD (bbl)	WA-MMPD (bbl)	Frequency	WCD (bbl)	WA-MMPD (bbl)
		Oct-Nov	0.560	1,900,000	520	0.334	261,500	2,000
	Distillate	Dec-Jan	0.390	523,000	520	0.463	950,000	600
		Feb-Mar	0.390	163,000	790	0.463	950,000	600
		Apr-May	0.780	163,000	790	0.925	950,000	600
		Jun-Jul	0.840	163,000	790	0.999	950,000	600
		Aug-Sep	0.280	163,000	790	0.331	950,000	600
		Oct-Nov	0.730	163,000	790	0.867	950,000	600
	Heavy	Dec-Jan	0.060	1,900,000	520	0.522	950,000	1,200
		Feb-Mar	0.060	163,000	790	0.522	950,000	1,200
		Apr-May	0.060	163,000	790	0.522	950,000	1,200
		Jun-Jul	0.280	163,000	790	2.349	950,000	1,200
		Aug-Sep	0.060	163,000	790	0.522	950,000	1,200
		Oct-Nov	0.170	163,000	790	1.417	950,000	1,200
	Light	Dec-Jan	5.670	1,900,000	520	5.706	950,000	200
		Feb-Mar	6.220	163,000	790	6.263	950,000	200
		Apr-May	7.560	163,000	790	7.610	950,000	200
		Jun-Jul	12.170	163,000	790	12.250	950,000	200
		Aug-Sep	8.500	163,000	790	8.559	950,000	200
		Oct-Nov	5.000	163,000	790	5.033	950,000	200
Southeast Alaska	Crude	Dec-Jan	0.030	1,900,000	230	0.042	950,000	1,200
		Feb-Mar	0.030	1,900,000	230	0.042	950,000	1,200
		Apr-May	0.030	1,900,000	230	0.042	950,000	1,200
		Jun-Jul	0.030	1,900,000	230	0.042	950,000	1,200
		Aug-Sep	0.030	1,900,000	230	0.042	950,000	1,200
		Oct-Nov	0.030	1,900,000	230	0.042	950,000	1,200
	Distillate	Dec-Jan	2.110	523,000	230	2.677	950,000	200
		Feb-Mar	1.610	163,000	650	2.677	950,000	200
		Apr-May	1.720	163,000	650	2.677	950,000	200
		Jun-Jul	3.720	163,000	650	2.677	950,000	200
		Aug-Sep	3.610	163,000	650	2.677	950,000	200
		Oct-Nov	2.830	163,000	650	2.677	950,000	200
	Heavy	Dec-Jan	0.390	1,900,000	230	0.300	950,000	900
		Feb-Mar	0.330	163,000	650	0.256	950,000	900
		Apr-May	0.330	163,000	650	0.256	950,000	900

Table ES-2: Comparison of Baseline and Forecasted Incident Rates and Volumes[11]								
Region	**Oil Type**	**Period**	**Baseline[12]**			**Forecasted (2025)**		
			Frequency	**WCD (bbl)**	**WA-MMPD (bbl)**	**Frequency**	**WCD (bbl)**	**WA-MMPD (bbl)**
		Jun-Jul	**0.500**	163,000	650	**0.386**	950,000	900
		Aug-Sep	**0.670**	163,000	650	**0.515**	950,000	900
		Oct-Nov	**0.780**	163,000	650	**0.600**	950,000	900
	Light	**Dec-Jan**	**20.170**	1,900,000	230	**23.254**	950,000	200
		Feb-Mar	**27.560**	163,000	650	**31.774**	950,000	200
		Apr-May	**25.840**	163,000	650	**29.794**	950,000	200
		Jun-Jul	**44.280**	163,000	650	**51.052**	950,000	200
		Aug-Sep	**38.950**	163,000	650	**44.905**	950,000	200
		Oct-Nov	**26.170**	163,000	650	**30.171**	950,000	200
Western Alaska	**Crude**	**Dec-Jan**	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Feb-Mar	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Apr-May	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Jun-Jul	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Aug-Sep	**0.000**	n/a	n/a	**0.000**	n/a	n/a
		Oct-Nov	**0.000**	n/a	n/a	**0.000**	n/a	n/a
	Distillate	**Dec-Jan**	**0.220**	163,000	510	**0.184**	950,000	700
		Feb-Mar	**0.110**	163,000	510	**0.092**	950,000	700
		Apr-May	**0.230**	163,000	510	**0.191**	950,000	700
		Jun-Jul	**0.720**	163,000	510	**0.598**	950,000	700
		Aug-Sep	**0.500**	163,000	510	**0.415**	950,000	700
		Oct-Nov	**0.500**	163,000	510	**0.415**	950,000	700
	Heavy	**Dec-Jan**	**0.000**	n/a	n/a	**0.041**	950,000	800
		Feb-Mar	**0.000**	n/a	n/a	**0.041**	950,000	800
		Apr-May	**0.070**	163,000	510	**0.041**	950,000	800
		Jun-Jul	**0.070**	163,000	510	**0.041**	950,000	800
		Aug-Sep	**0.070**	163,000	510	**0.041**	950,000	800
		Oct-Nov	**0.070**	163,000	510	**0.041**	950,000	800
	Light	**Dec-Jan**	**1.280**	163,000	510	**1.475**	950,000	400
		Feb-Mar	**1.670**	163,000	510	**1.925**	950,000	400
		Apr-May	**2.890**	163,000	510	**3.333**	950,000	400
		Jun-Jul	**4.000**	163,000	510	**4.610**	950,000	400
		Aug-Sep	**4.390**	163,000	510	**5.059**	950,000	400
		Oct-Nov	**1.720**	163,000	510	**1.981**	950,000	400

Figures ES-3 through ES-6 show maps of the baseline and forecasted incident probability rates by oil type (across all seasons). Note that this only indicates the probability that there will be an incident, *not* the impact of the incident. The color key in Figure ES-2 applies to these figures. Note that for distillate and light oil (Figures ES-4 and ES-6) there is no significant change in the rates.

The major change is the increase in the probability of crude spill incidents in the Beaufort Sea and a slight increase in the probability of crude spills in the Aleutians.

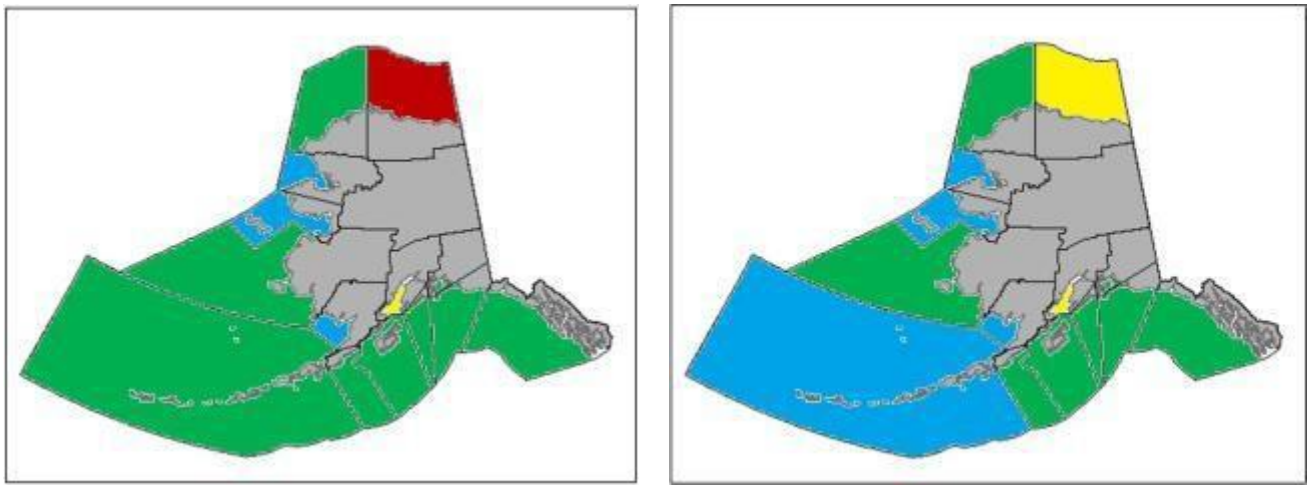

Figure ES-3: Baseline (left) and Forecasted (right) Crude Incident Rates

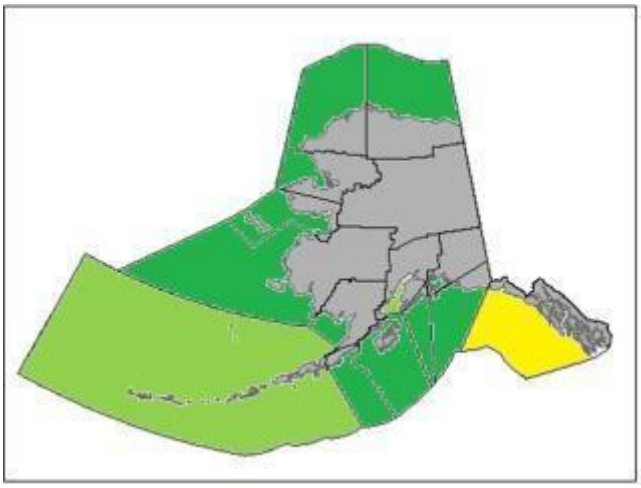

Figure ES-4: Baseline and Forecasted Distillate Incident Rates (No Change)

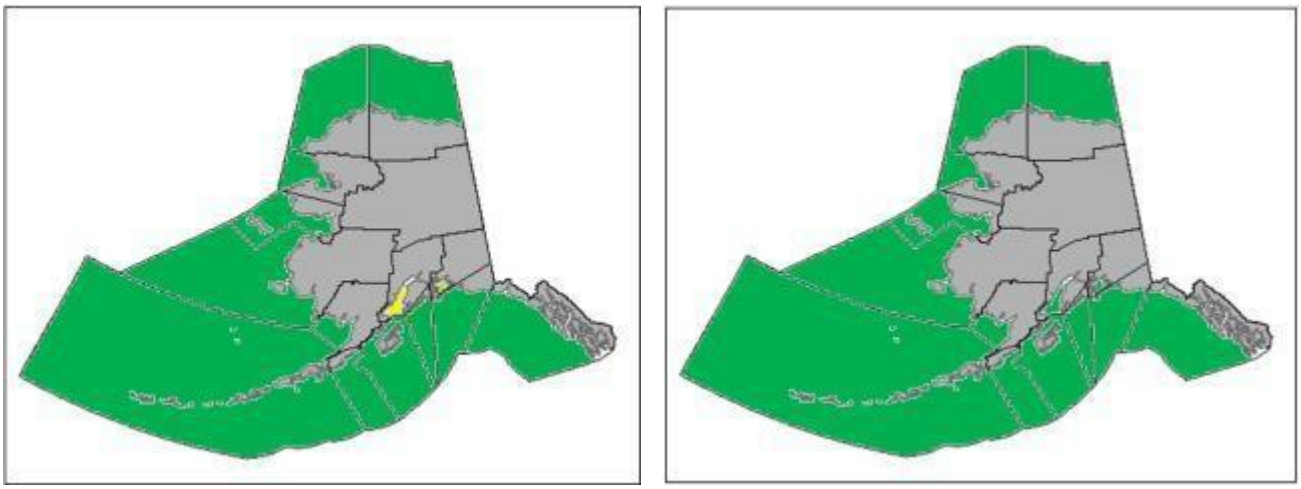

Figure ES-5: Baseline (left) and Forecasted (right) Heavy Oil Incident Rates

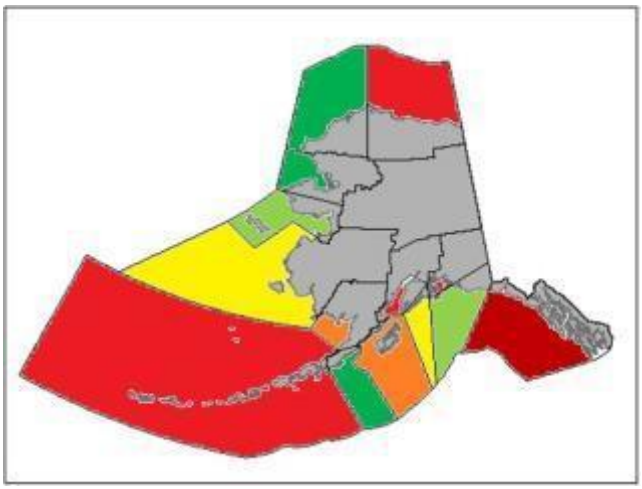

Figure ES-6: Baseline and Forecasted Light Oil Incident Rates (No Change)

Overall, on average, there are likely to be 610 incidents per year (almost two incidents per day) that could lead to oil spillage. About 67% of the incidents would come from vessels and the rest from facilities. The vast majority of these incidents will result in little if any spillage.

Since there is unavoidable uncertainty in the incident rates for the future, the resulting risk calculations derived need to be viewed with appropriate awareness and caution. The project scope and purpose leans towards identifying those spill scenarios (regional location, oil type, yearly time period, and MMPD and WCD volume) that present the highest *risk* – that is, the highest probability and environmental impact combination. Because of the extremely large volumes involved with WCD well blowouts, as well as very large tanker WCDs, the overall risk is skewed towards these types of events. It is important to bear in mind that the probabilities of these "catastrophic" spill events are extremely low. Of course, this does not mean that these events could never happen.

The spill volumes shown in ES-2 are the weight-averaged maximum most-probable discharges (WA-MMPD) and the worst-case discharge (WCD) volumes. Both represent a scenario for which there is a

very low likelihood of occurrence. For all incident types, the volume tends to be small and even the maximum most-probable discharge is an anomaly. The WCD volumes, especially for large tanker spills and well blowouts have a very low probability of occurrence, but must be taken into account for contingency planning and risk mitigation development.

Source Types with Highest WCDs and Incident Rates

Across the entire state waters (i.e., all marine regions), the AMPD, MMPD, and WCD volumes by source types along with the actual recorded spill volumes are shown in Table ES-3. Table ES-4 shows the sources with the highest incident rates across all regions. Overall, the results show that the actual spill volumes during 1995 – 2012 were usually much smaller than the MMPD and WCD volumes. It is important to note also that not all incidents resulted in actual spillage.

Table ES-3: Source Types in Descending Order of WCD Volumes (All Regions)

Source	Annual Incident Number	Actual Spillage (bbl) (All Zones)			Discharge Scenarios (bbl)		
		% No Spill[13]	Average[14]	Max.	AMPD[15]	MMPD[16]	WCD[17]
Oil Exp/Prod (Beaufort/Chukchi)[18]	81.556	1.0%	1.4	262	50	1,200	3,900,000
Tanker >90,000DWT[19]	3.278	45.8%	0.3	5	50	2,500	1,900,000
Tanker <90,000DWT	4.056	42.5%	0.4	10	50	2,500	523,000
Petroleum Terminal	5.611	34.7%	1.6	90	50	1,200	200,000
Refinery	12.779	1.3%	4.2	200	50	1,200	200,000
Tank Barge >400GT[20]	7.389	29.3%	1.7	62	50	2,500	163,000
Tank Barge <400GT	3.611	50.8%	0.8	12	50	2,500	163,000
Airport	0.944	23.5%	165	2,009	50	1,200	50,000
Power Plant	7.000	4.0%	7.9	238	50	1,200	50,000
Pipeline Facility	0.278	40.0%	0.02	0.02	50	1,200	45,000
Oil Exp/Prod Facility (Other)	28.500	17.9%	2.1	214	50	1,200	39,000
Fuel Terminal	9.000	11.1%	4.1	128	50	1,200	30,000
Bulk Carrier >400GT	1.222	72.7%	1,139	7,944[21]	50	2,500	12,000
Container Ship >400GT	1.889	88.2%	0.6	1	50	2,500	11,000
Cruise Ship >400GT	9.778	46.6%	0.3	19	50	2,500	11,000
Bulk Chemical Facility	1.167	9.5%	0.3	2	50	1,000	10,000
Military Facility	2.444	22.7%	26.4	619	50	1,000	10,000
Ship Terminal	0.500	22.2%	0.08	0.4	50	1,000	10,000

[13] Percent of incidents (across all zones) in the category that resulted in no spillage (i.e., only potential spill).
[14] Only includes incidents with actual spillage. For each category, there are incidents that involved no spillage.
[15] The "average most-probable discharge" (AMPD) is the lesser of 50 bbl or 1% WCD. This classification has been dropped from the USCG's Spill Classification Matrix as the response to such a small spill would generally be very localized. It is presented here as a comparison only.
[16] MMPD = maximum most-probable discharge
[17] WCD = worst-case discharge. The WCD in each category is determined by the typical size of the source type for the purpose of estimating WCD volumes across all regions. In some cases an actual spill event may have exceeded the WCD as estimated across all regions because the particular source (usually a vessel) was unusually large or had an unusually high volume of fuel on board.
[18] The Beaufort Sea has the highest potential catastrophic discharge.
[19] DWT = deadweight tonnage
[20] GT = gross tonnage
[21] Selendang Ayu incident.

Table ES-3: Source Types in Descending Order of WCD Volumes (All Regions)							
Source	Annual Incident Number	Actual Spillage (bbl) (All Zones)			Discharge Scenarios (bbl)		
		% No Spill[13]	Average[14]	Max.	AMPD[15]	MMPD[16]	WCD[17]
General Cargo Ship >400GT	3.000	46.3%	37.5	929	50	2,500	8,000
Vehicle Carrier Ship >400GT	0.111	100%	0	0	50	2,500	6,000
Oil Recovery Vessel >400GT	0.833	26.7%	0.7	7	50	500	5,000
Passenger Ship >400GT	0.944	41.2%	0.2	2	40	400	4,000
Freight Barge >400GT	3.333	53.3%	0.7	7	30	300	3,000
Military Vessel <400GT	0.611	27.3%	2.6	24	30	300	3,000
Military Vessel >400GT	8.000	4.9%	0.5	18	30	300	3,000
Offshore Supply Vessel >400GT	0.056	42.9%	0.04	0.1	30	300	3,000
Ferry >400GT	14.222	82.0%	1.6	71	25	250	2,500
Fishing Vessel >400GT	22.611	50.9%	11.5	833	25	250	2,500
Barge Terminal	1.000	5.6%	2.2	24	10	100	1,000
Container Terminal	0.944	11.8%	0.7	3	10	100	1,000
Cruise Terminal	2.278	12.2%	0.03	0.4	10	100	1,000
Drydock Facility	0.222	25.0%	0.5	1	10	100	1,000
Ferry Terminal	1.000	5.6%	0.3	2	10	100	1,000
Industrial Vessel >400 GT	0.778	0%	1.0	5	10	100	1,000
Logging Facility	0.889	47.1%	0.2	1	10	100	1,000
Marine Services Facility	0.813	0%	1.8	14	10	100	1,000
Municipal Fuel Storage	7.333	4.5%	5.9	119	10	100	1,000
Offshore Supply Facility	0.667	0%	0.2	1	10	100	1,000
Seafood Facility	7.500	8.9%	16.8	1,637	10	100	1,000
Small Boat Harbor	16.111	10.0%	0.4	14	10	100	1,000
Research Vessel <400GT	1.389	52.0%	0.1	0.5	8	80	800
Industrial Vessel <400 GT	6.778	13.9%	1.8	143	5	50	500
Oil Recovery Vessel <400GT	1.333	20.8%	0.1	0.6	5	50	500
Towing Vessel >400GT	2.722	8.2%	0.6	7	5	50	500
Towing Vessel <400GT	13.222	42.9%	5.3	357	5	50	500
Fishing Vessel <400GT	154.167	40.4%	3.7	731	2	20	200
Freight Barge <400GT	2.000	44.4%	1.4	16	2	20	200
Construction Site	0.889	25.0%	1.0	6	1	10	100
Mining Facility	0.389	14.3%	0.4	1	1	10	100
MODU <400GT	0.111	50.0%	0.002	0.002	1	10	100
Offshore Supply Vessel <400GT	1.889	26.5%	6.2	143	1	10	100
Other Facility	1.889	26.5%	8.3	167	1	10	100
Unknown Land Source	5.611	36.6%	6.1	238	1	10	100
Ferry <400GT	1.222	86.4%	0.2	0.5	0.5	5	50
General Cargo Ship <400GT	1.389	24.0%	7.6	71	0.5	5	50
Passenger Ship <400GT	18.222	62.5%	0.6	12	0.5	5	50
Recreational Vessel <400GT	117.89	11.1%	0.5	143	0.1	1	10
Recreational Vessel >400GT	2.222	7.5%	1.1	18	0.1	1	10
Residential Facility	1.167	71.4%	1.3	4	0.1	1	10
Vehicle	0.556	50.0%	0.1	0.2	0.02	1	2

Table ES-4: Source Types in Descending Order of Incident Numbers (All Regions)							
Source	**Annual Incident Number**	**Actual Spillage (bbl) (All Zones)**			**Discharge Scenarios (bbl)**		
		% No Spill[22]	**Average[23]**	**Max.**	**AMPD[24]**	**MMPD[25]**	**WCD[26]**
Fishing Vessel <400GT	154.167	40.40%	3.7	731	2	20	200
Recreational Vessel <400GT	117.890	11.10%	0.5	143	0.1	1	10
Oil Exp/Prod (Beaufort)	81.556	1.00%	1.4	262	50	1,200	3,900,000
Oil Exp/Prod Facility (Other)	28.500	17.90%	2.1	214	50	1,200	39,000
Fishing Vessel >400GT	22.611	50.90%	11.5	833	25	250	2,500
Passenger Ship <400GT	18.222	62.50%	0.6	12	0.5	5	50
Small Boat Harbor	16.111	10.00%	0.4	14	10	100	1,000
Ferry >400GT	14.222	82.00%	1.6	71	25	250	2,500
Towing Vessel <400GT	13.222	42.90%	5.3	357	5	50	500
Refinery	12.779	1.30%	4.2	200	50	1,200	200,000
Cruise Ship >400GT	9.778	46.60%	0.3	19	50	2,500	11,000
Fuel Terminal	9.000	11.10%	4.1	128	50	1,200	30,000
Military Vessel >400GT	8.000	4.90%	0.5	18	30	300	3,000
Seafood Facility	7.500	8.90%	16.8	1,637	10	100	1,000
Tank Barge >400GT[27]	7.389	29.30%	1.7	62	50	2,500	163,000
Municipal Fuel Storage	7.333	4.50%	5.9	119	10	100	1,000
Power Plant	7.000	4.00%	7.9	238	50	1,200	50,000
Industrial Vessel <400 GT	6.778	13.90%	1.8	143	5	50	500
Petroleum Terminal	5.611	34.70%	1.6	90	50	1,200	200,000
Unknown Land Source	5.611	36.60%	6.1	238	1	10	100
Tanker <90,000DWT	4.056	42.50%	0.4	10	50	2,500	523,000
Tank Barge <400GT	3.611	50.80%	0.8	12	50	2,500	163,000
Freight Barge >400GT	3.333	53.30%	0.7	7	30	300	3,000
Tanker >90,000DWT[28]	3.278	45.80%	0.3	5	50	2,500	1,900,000
General Cargo Ship >400GT	3.000	46.30%	37.5	929	50	2,500	8,000
Towing Vessel >400GT	2.722	8.20%	0.6	7	5	50	500
Military Facility	2.444	22.70%	26.4	619	50	1,000	10,000
Cruise Terminal	2.278	12.20%	0.03	0.4	10	100	1,000
Recreational Vessel >400GT	2.222	7.50%	1.1	18	0.1	1	10
Freight Barge <400GT	2.000	44.40%	1.4	16	2	20	200
Container Ship >400GT	1.889	88.20%	0.6	1	50	2,500	11,000
Offshore Supply Vessel <400GT	1.889	26.50%	6.2	143	1	10	100
Other Facility	1.889	26.50%	8.3	167	1	10	100
Research Vessel <400GT	1.389	52.00%	0.1	0.5	8	80	800

[22] Percent of incidents (across all zones) in the category that resulted in no spillage (i.e., only potential spill).
[23] Only includes incidents with actual spillage. For each category, there are incidents that involved no spillage.
[24] The "average most-probable discharge" (AMPD) is the lesser of 50 bbl or 1% WCD. This classification has been dropped from the USCG's Spill Classification Matrix as the response to such a small spill would generally be very localized. It is presented here as a comparison only.
[25] MMPD = maximum most-probable discharge
[26] WCD = worst-case discharge. The WCD in each category is determined by the typical size of the source type for the purpose of estimating WCD volumes across all regions. In some cases an actual spill event may have exceeded the WCD as estimated across all regions because the particular source (usually a vessel) was unusually large or had an unusually high volume of fuel on board.
[27] GT = gross tonnage
[28] DWT = deadweight tonnage

Table ES-4: Source Types in Descending Order of Incident Numbers (All Regions)							
Source	Annual Incident Number	Actual Spillage (bbl) (All Zones)			Discharge Scenarios (bbl)		
		% No Spill[22]	Average[23]	Max.	AMPD[24]	MMPD[25]	WCD[26]
General Cargo Ship <400GT	1.389	24.00%	7.6	71	0.5	5	50
Oil Recovery Vessel <400GT	1.333	20.80%	0.1	0.6	5	50	500
Bulk Carrier >400GT	1.222	72.70%	1,139	7,944[29]	50	2,500	12,000
Ferry <400GT	1.222	86.40%	0.2	0.5	0.5	5	50
Bulk Chemical Facility	1.167	9.50%	0.3	2	50	1,000	10,000
Residential Facility	1.167	71.40%	1.3	4	0.1	1	10
Barge Terminal	1.000	5.60%	2.2	24	10	100	1,000
Ferry Terminal	1.000	5.60%	0.3	2	10	100	1,000
Airport	0.944	23.50%	165	2,009	50	1,200	50,000
Passenger Ship >400GT	0.944	41.20%	0.2	2	40	400	4,000
Container Terminal	0.944	11.80%	0.7	3	10	100	1,000
Logging Facility	0.889	47.10%	0.2	1	10	100	1,000
Construction Site	0.889	25.00%	1	6	1	10	100
Oil Recovery Vessel >400GT	0.833	26.70%	0.7	7	50	500	5,000
Marine Services Facility	0.813	0%	1.8	14	10	100	1,000
Industrial Vessel >400 GT	0.778	0%	1	5	10	100	1,000
Offshore Supply Facility	0.667	0%	0.2	1	10	100	1,000
Military Vessel <400GT	0.611	27.30%	2.6	24	30	300	3,000
Vehicle	0.556	50.00%	0.1	0.2	0.02	1	2
Oil Exp/Prod (Chukchi)	0.556	40%	9.2	39	50	1,200	2,200,000
Ship Terminal	0.500	22.20%	0.08	0.4	50	1,000	10,000
Mining Facility	0.389	14.30%	0.4	1	1	10	100
Pipeline Facility	0.278	40.00%	0.02	0.02	50	1,200	45,000
Drydock Facility	0.222	25.00%	0.5	1	10	100	1,000
Vehicle Carrier Ship >400GT	0.111	100%	0	0	50	2,500	6,000
MODU <400GT	0.111	50.00%	0.002	0.002	1	10	100
Offshore Supply Vessel >400GT	0.056	42.90%	0.04	0.1	30	300	3,000

Tables ES-5 and ES-6 show the source types with the highest incident numbers and WCD volumes by region.

Table ES-5: Source Types with Highest Incident Numbers by Region								
Region	Source Type	Annual Incident Number	Actual Spillage (bbl) (All Zones)			USCG Discharge Scenarios (bbl)		
			% No Spill	Average	Max.	AMPD	MMPD	WCD
Aleutians	**Fishing Vessel <400GT**	42.389	64.6%	6.7	476	2	20	200
	Fishing Vessel >400GT	14.611	43.8%	6.7	731	25	250	2,500
	Recreational Vessel <400GT	10.778	5.3%	0.7	14	0.1	1	10
	Seafood Facility	5.056	5.5%	20.9	1,637	10	100	1,000
	Fuel Terminal	2.111	2.6%	1.6	14	50	1,200	30,000
Aniak-	**Fishing Vessel <400GT**	1.222	86.4%	12.2	48	2	20	200

[29] Selendang Ayu incident.

Table ES-5: Source Types with Highest Incident Numbers by Region								
Region	Source Type	Annual Incident Number	Actual Spillage (bbl) (All Zones)			USCG Discharge Scenarios (bbl)		
			% No Spill	Average	Max.	AMPD	MMPD	WCD
chak	Seafood Facility	0.611	9.1%	12.6	100	10	100	1,000
	Fishing Vessel >400GT	0.278	100%	0	0	25	250	2,500
	Tank Barge >400GT	0.167	25%	0.3	1	50	2,500	163,000
	Bulk Carrier >400GT	0.111	100%	0	0	50	2,500	12,000
Beaufort Sea	Oil Exp/Prod Facility	81.000	0.3%	1.4	262	50	1,200	3,900,000
	Fishing Vessel <400GT	0.167	0%	0.4	1	2	20	200
	Industrial Vessel <400 GT	0.167	66.7%	0.4	0.4	5	50	500
	Passenger Ship <400GT	0.167	100%	0	0	0.5	5	50
	Freight Barge >400GT	0.111	50.0%	0.02	0.02	30	300	3,000
Bristol Bay	Fishing Vessel <400GT	5.667	60.8%	0.8	6	2	20	200
	Recreational Vessel <400GT	1.056	15.5%	0.7	6	0.1	1	10
	Fuel Terminal	0.667	16.7%	3.9	24	50	1,200	30,000
	Seafood Facility	0.667	16.7%	9.2	67	10	100	1,000
	Fishing Vessel >400GT	0.556	60.0%	18.5	67	25	250	2,500
Chukchi Sea	Oil Exp/Prod Facility	0.556	40%	9.2	39	50	1,200	2,200,000
	Towing Vessel >400GT	0.444	0%	1.4	7	5	50	500
	Municipal Fuel Storage	0.389	14.3%	1.4	6	10	100	1,000
	Power Plant	0.167	0%	1.2	2	50	1,200	50,000
	Industrial Vessel <400 GT	0.056	100%	0	0	5	50	500
Cook Inlet	Oil Exp/Prod Facility	28.389	18.0%	2.1	214	50	1,200	39,000
	Fishing Vessel <400GT	11.056	24.6%	0.4	7	2	20	200
	Refinery	10.056	1.1%	3.4	124	50	1,200	200,000
	Recreational Vessel <400GT	5.944	10.8%	0.4	10	0.1	1	10
	Passenger Ship <400GT	2.111	52.6%	1.0	7	0.5	5	50
Kodiak/ Shelikof	Fishing Vessel <400GT	24.333	45.2%	6.1	192	2	20	200
	Recreational Vessel <400GT	9.611	11.5%	0.3	10	0.1	1	10
	Military Vessel <400GT	3.611	1.4%	0.9	24	30	300	3,000
	Towing Vessel <400GT	0.944	42.1%	6.4	36	5	50	500
	Small Boat Harbor	0.722	0%	0.7	5	10	100	1,000
Kotzebue/ Hope	Power Plant	0.556	0%	2.9	14	50	1,200	50,000
	Mining Facility	0.333	0%	0.4	1	1	10	100
	Fuel Terminal	0.222	0%	33.2	128	50	1,200	30,000
	Municipal Fuel Storage	0.222	0%	13.2	48	10	100	1,000
	Tank Barge >400GT	0.222	25.0%	0.02	0.02	50	2,500	163,000
Norton S/ St. Lawrence	Municipal Fuel Storage	1.278	0%	2.9	12	10	100	1,000
	Tank Barge >400GT	0.667	46.2%	3.8	11	50	2,500	163,000
	Fuel Terminal	0.444	25.0%	27.1	119	50	1,200	30,000
	Power Plant	0.389	0%	38.4	238	50	1,200	50,000
	Fishing Vessel <400GT	0.278	80.0%	0.02	0.02	2	20	200
Off Kenai Peninsula	Fishing Vessel <400GT	4.333	43.6%	1.5	19	2	20	200
	Recreational Vessel <400GT	3.722	20.6%	0.2	4	0.1	1	10
	Passenger Ship <400GT	1.833	67.6%	0.1	0.2	0.5	5	50
	Towing Vessel <400GT	0.611	45.5%	0.3	1	5	50	500
	Industrial Vessel <400 GT	0.389	28.6%	0.3	1	5	50	500

Table ES-5: Source Types with Highest Incident Numbers by Region								
Region	Source Type	Annual Incident Number	Actual Spillage (bbl) (All Zones)			USCG Discharge Scenarios (bbl)		
			% No Spill	Average	Max.	AMPD	MMPD	WCD
Prince William Sound	Recreational Vessel <400GT	11.278	10.0%	1.1	143	0.1	1	10
	Fishing Vessel <400GT	9.167	33.9%	3.2	83	2	20	200
	Petroleum Terminal	4.389	38.0%	0.2	3	50	1,200	200,000
	Refinery	2.611	2.1%	7.3	200	50	1,200	200,000
	Towing Vessel <400GT	2.611	31.7%	4.5	153	5	50	500
South-Central	Fishing Vessel <400GT	2.222	52.5%	6.0	49	2	20	200
	Recreational Vessel <400GT	0.444	37.5%	1.3	4	0.1	1	10
	Tanker >90,000DWT	0.444	50.0%	0.2	1	50	2,500	1,900,000
	Power Plant	0.389	0%	8.6	36	50	1,200	50,000
	Tanker <90,000DWT	0.278	100%	0	0	50	2,500	523,000
Southeast Alaska	Recreational Vessel <400GT	71.389	6.0%	0.3	24	0.1	1	10
	Fishing Vessel <400GT	49.944	34.7%	1.8	119	2	20	200
	Ferry >400GT	10.722	80.3%	2.1	71	25	250	2,500
	Small Boat Harbor	10.722	8.3%	0.3	12	10	100	1,000
	Passenger Ship <400GT	10.667	66.5%	0.4	7	0.5	5	50
Western Alaska	Fishing Vessel <400GT	3.333	55.0%	1.6	12	2	20	200
	Municipal Fuel Storage	3.333	3.3%	3.4	36	10	100	1,000
	Fishing Vessel >400GT	3.167	87.7%	0.4	1	25	250	2,500
	Power Plant	1.667	6.7%	12.2	190	50	1,200	50,000
	Fuel Terminal	1.222	0%	5.1	76	50	1,200	30,000

Table ES-6: Source with Largest WCD Volume by Region								
Region	Source Type	Annual Incident Number	Actual Spillage (bbl) (All Zones)			USCG Discharge Scenarios (bbl)		
			% No Spill	Average	Maximum	AMPD	MMPD	WCD
Aleutians	Tanker <90,000DWT	0.222	75.0%	0.1	0.1	50	2,500	523,000
Aniakchak	Tanker <90,000DWT	0.111	50.0%	0.02	0.02	50	2,500	523,000
Beaufort Sea	Oil Exp/Prod Facility	81.000	0.3%	1.4	262	50	1,200	3,900,000
Bristol Bay	Tank Barge >400GT	1.056	21.1%	1.5	12	50	2,500	163,000
Chukchi Sea	Oil Exp/Prod Facility	0.556	40.0%	9.2	39	50	1,200	2,200,000
Cook Inlet	Tanker >90,000DWT	0.111	50.0%	0.6	1	50	2,500	1,900,000
Kodiak/Shelikof	Tanker >90,000DWT	0.056	100%	0	0	50	2,500	1,900,000
Kotzebue/Hope	Tank Barge >400GT	0.222	25.0%	0.02	0.02	50	2,500	163,000
Norton S	Tank Barge >400GT	0.722	46.2%	3.8	11	50	2,500	163,000
Off Kenai	Tanker <90,000DWT	0.056	100%	0	0	50	2,500	523,000
Prince William	Tanker >90,000DWT	2.500	42.2%	0.3	5	50	2,500	1,900,000
South-Central	Tanker >90,000DWT	0.444	50.0%	0.2	1	50	2,500	1,900,000
Southeast	Tanker >90,000DWT	0.167	66.7%	0.01	0.01	50	2,500	1,900,000
Western	Tank Barge >400GT	1.556	25.0%	0.6	3	50	2,500	163,000

Conclusions

The most significant conclusions from the incident analysis of historical incidents in Alaskan marine waters are:

- For each potential spill incident involving a vessel that occurs, there is a 61% probability that there will be spillage of oil;
- For each potential spill incident involving a facility (or pipeline) that occurs there is an 85% probability that there will be spillage of oil;
- The difference in rates between facilities and vessels most probably reflects the greater likelihood of a potential spill incident to be reported to or detected by US Coast Guard or state officials as part of vessel casualty reporting;
- Facility incident rates have remained fairly steady over the last 18 years, while vessel incident rates have declined dramatically;
- About one-third of all incidents occur in the Southeast Alaska region, followed by the Aleutians with 15% and Beaufort Sea with 14%;
- Nearly 87% of all incidents involve light oils, mostly diesel;
- Incidents are somewhat more likely in the summer months than during other time periods, probably due to more fishing and recreational boating activities;
- Annually, there are, on average, 610 incidents, the most common of which are light oil spills in Southeast Alaska and the Aleutians;
- The highest potential spill volume is a WCD due to a well blowout in the Beaufort or Chukchi Seas, though the likelihood of this occurring is extremely small;
- The theoretical volume of a WCD from a well blowout is 3.9 million bbl (in the Beaufort Sea); and
- While there are, on average, 81 incidents per year involving Beaufort Sea oil exploration and production facilities, none of these incidents have involved a blowout; 85% of the incidents have involved less than one bbl or no spillage, and the total volume of spillage has been 2,020 bbl.

Future spillage rates are expected to change in the following ways:

- Potential reduction in overall tanker spillage rates by 34% attributable to additional changes in risk mitigation measures for causes other than impact accidents;
- Reduction in spill probability due to impact accidents based on full implementation of double hulls for tank vessels (tankers and tank barges), which make up 2% of tanker incidents and 16% of barge incidents in Alaska, as follows:
    - Crude tankers – 67% reduction;
    - Product tankers – 63% reduction;
    - Tank barges - 58% reduction;
- Increase of vessel traffic in Cook Inlet and other regions (except Aleutians, Beaufort Sea, and Chukchi Sea) by 25%;
- Decrease in probability of spillage from non-tank vessels by 23% due to the presence of double-hulls on bunker tanks on 45% of vessels;
- Increase in vessel traffic in the Aleutians, Beaufort Sea, and Chukchi Sea regions as follows:

    - Container ships: 34%
    - Bulk carriers: 6%
    - General cargo vessels: 82%
    - Product tankers: 133%
- Increase in Beaufort Sea oil exploration and production-related spillage rates by 400% and Chukchi Sea activities by 150%;
- Overall increases spills from facility and vessel activities (if not otherwise addressed in another category in this list) of 14%;
- Increase of 20% in Cook Inlet spillage rates from oil exploration and production;
- 50% reduction in WCD volumes for crude and product tankers; and
- Shift of 50% from heavy bunker fuel to diesel fuel on larger ships due to regulatory changes related to air emissions in in-port areas.

In the future projections, for any time periods for which the incident rate is zero for shipping, oil production, and other activities, incident rates were distributed evenly across these time periods due to the presumed lower rate of ice coverage. It was assumed that recreational boating and cruise ship transits would still follow typical seasonal patterns despite the changes in ice coverage.

1 Introduction

As part of the risk analysis of oil spillage to Alaskan marine coastlines and waters[30], a thorough analysis of the characterization and likelihood of spill events was conducted.

1.1 Included Analyses

The steps included as part of the analysis of incident rates and probabilities are:

- Development of a database of historical incidents for the years 1995 through 2012 (18 years), including vessel[31]- and facility[32]-related incidents that caused oil spillage and those that could potentially have resulted in spillage;
- Incident characterization by geographic region, oil category, and period for the risk matrix;
- Analyses of sources and incident causes to develop probability density functions for spill volume;
- Analyses of sources, incident causes, locations, and oil categories for inclusion in the future projections analysis; and
- Analyses of season, geographic, source type, cause, and temporal components of incident rates.

The time period 1995 through 2012 was selected for the historical incident analysis for two reasons:

- The most complete data on incidents (including potential spill incidents) was available for this time period. Prior to 1995, Alaska Department of Environmental Conservation (ADEC) did not keep complete spill and potential spill incident data and US Coast Guard and another data sources were not as complete as ideally required for this analysis; and
- The time period corresponds with the post-OPA 90 decrease seen in spill rates, which would be much more reflective of current spill and incident frequencies for future projections (Figures 1 and 2 and Table 1.)

Table 1: Changes in Annual US Oil Spillage Rates between Decades[33]

Source Type	% Changes in Annual Spillage between Decades			
	1969-1977 to 1978-1987	1978-1987 to 1988-1997	1988-1997 to 1998-2007	1969-1977 to 1998-2007
Production	**-72.3%**	**74.5%**	**-34.5%**	**-68.4%**
Offshore Platform Spills	-94.8%	34.9%	-29.7%	-95.1%
Offshore Pipelines	-22.7%	134.5%	-67.9%	-41.7%
Offshore Supply Vessels	150.0%	-80.0%	-85.7%	-92.9%
Inland Production Wells	264.3%	42.4%	16.3%	503.5%
Refining	**17.0%**	**327.3%**	**-19.2%**	**304.2%**
Refinery Spills	17.0%	327.3%	-19.2%	304.2%
Transport	**-38.3%**	**-36.8%**	**-49.5%**	**-80.3%**
Inland Pipelines	-30.1%	-34.7%	-35.1%	-70.4%

[30] Incidents from vessels or facilities that impacted or could potentially have impacted Alaskan/US coastlines and waters in areas of USCG jurisdiction as per the USCG/EPA Memorandum of Understanding were included. Also included were incidents that occurred in Canadian waters that could impact Alaskan/US waters and coastlines.
[31] The term "vessel" is used generically to include any boat, ship, or vessel of any size or function that uses oil for fuel and/or cargo from small recreational boats to large tank ships.
[32] The term "facility" is used generically to include any fixed (non-mobile) facility, pipeline, drilling platform, storage facility, etc., that stores, handles, produces, or consumes oil.
[33] Etkin 2010.

Table 1: Changes in Annual US Oil Spillage Rates between Decades[33]				
Source Type	**% Changes in Annual Spillage between Decades**			
	1969-1977 to 1978-1987	**1978-1987 to 1988-1997**	**1988-1997 to 1998-2007**	**1969-1977 to 1998-2007**
Tanker Trucks	62.7%	6.7%	76.1%	205.8%
Railroads	16.1%	-6.9%	-34.0%	-28.7%
Tank Ships	-68.7%	-30.0%	-91.5%	-98.1%
Tank Barges	66.5%	-56.8%	-76.3%	-82.9%
Storage and Consumption	**-18.0%**	**186.5%**	**-72.1%**	**-34.5%**
Non-Tank Vessels	35.7%	-58.5%	-43.0%	-67.9%
Other Vessels	-55.8%	-4.2%	-33.9%	-72.0%
Gas Stations and Truck Stops	0.0%	30.4%	-48.0%	-32.2%
Residential	23.8%	184.6%	-4.1%	238.1%
Inland EPA-Regulated Facilities[34]	15.8%	605.3%	-75.6%	98.9%
Aircraft[35]	0.4%	4.0%	4.7%	9.3%
Coastal Facilities (Non-Refining)	-31.2%	-64.8%	-71.9%	-93.2%
Inland Unknown	7.0%	127.5%	-76.4%	-42.6%
Motor Vehicles	-45.1%	335.9%	73.5%	315.5%
Total	**-35.9%**	**21.5%**	**-60.7%**	**-69.4%**

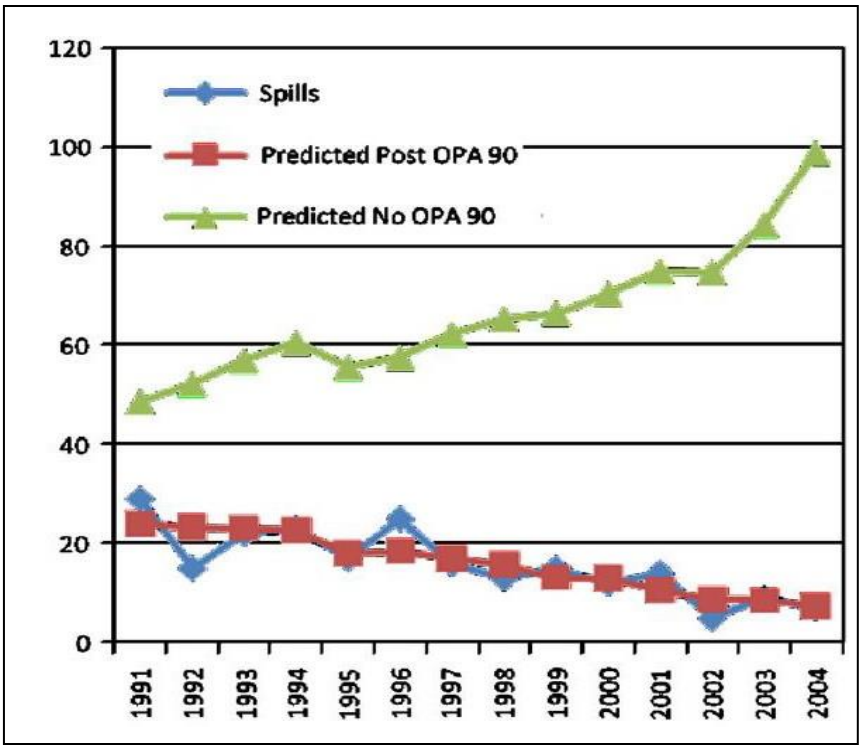

Figure 1: Oil Spill Rate Reduction post-OPA 90[36]

[34] Excluding refineries, gas stations, and production wells.
[35] Includes aircraft in inland areas plus estimates of marine inputs (based on NRC, 2003).
[36] Homan and Steiner 2008.

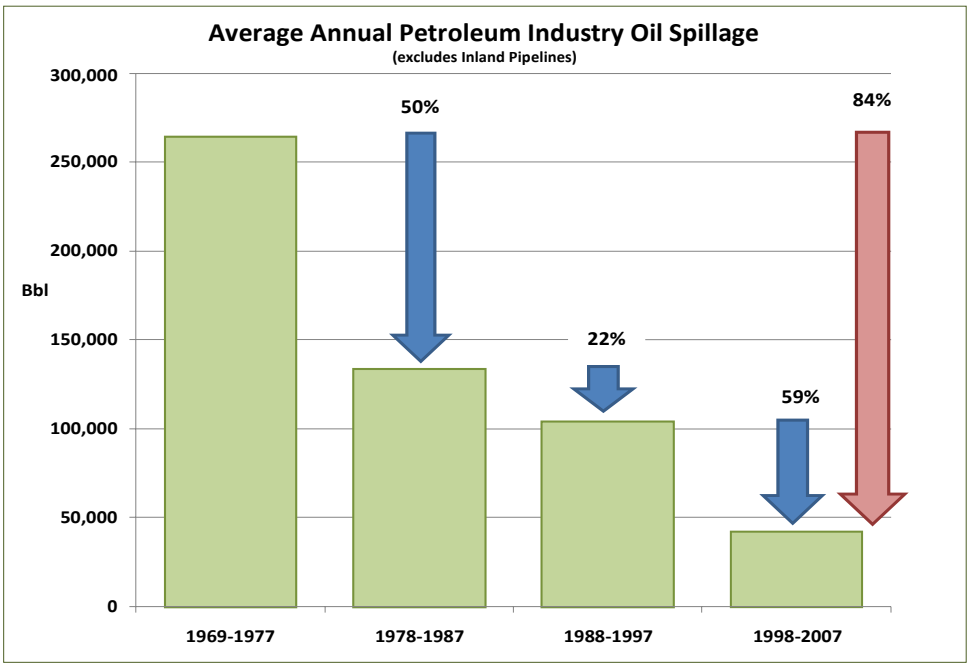

Figure 2: Oil Industry Spillage Changes by Decade[37]

1.2 Definitions

The analyses were conducted on a regional basis for the regions shown in Figure 3 and Table 2.

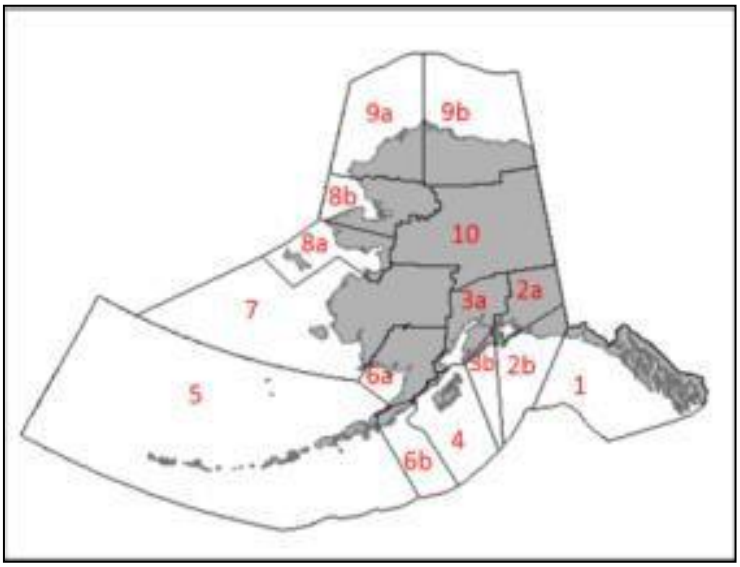

Figure 3: Geographic Regions

[37] Etkin 2009a.

Table 2: Geographic Regions[38]	
Map Number	**Region**
1	Southeast Alaska
2a	Prince William Sound
2b	South-Central Alaska
3a	Cook Inlet
3b	Offshore Kenai Peninsula
4	Kodiak/Shelikof Strait
5	Aleutians
6a	Bristol Bay
6b	Aniakchak
7	Western Alaska
8a	Norton Sound/St. Lawrence Island
8b	Kotzebue Sound/Hope Basin
9a	Chukchi Sea
9b	Beaufort Sea
10[39]	Interior

In this study, "incidents" are defined as events involving sources that contain oil that could potentially result in the spillage of oil or actually result in spillage, such as casualties, accidents, discharges, and leakages involving vessels or facilities (including pipelines and offshore wells).

This study employs the US Coast Guard (USCG) definitions of WCD for vessels and onshore facilities (i.e., not for offshore exploration and production wells). For onshore facilities, deep-water ports, and other offshore facilities, WCD is defined as "the largest foreseeable discharge in adverse weather conditions". The actual WCD for a specific facility depends on the capacity of storage tanks, the numbers and lengths of pipelines between control points (shut-off valves, etc.), the pressure in the pipelines, the diameters of the pipelines, the lengths of time between pipeline inspections and the time it would typically take to detect a loss of oil, and other factors. In this study, the WCDs for facilities are based on the types of facilities present in each region and the known capacities of the facilities. For facilities for which there was no reported capacity, a typical capacity for the facility type was applied based on a survey of thousands of facilities in the US as previously conducted for the Environmental Protection Agency (EPA).[40] These volumes range from 100 bbl to 200,000 bbl.

For vessels, the WCD is defined as the total capacity of the cargo and/or bunker fuel tanks of the vessel. This volume varies from 10 bbl for small recreational vessels to 1.9 million bbl for fully-loaded crude tankers (also called "tank ships").

For offshore wells, the WCDs depend on the type of well (e.g., exploratory, production, completion, wildcat, appraisal), the pressure in the well reservoir and the flow rate, the size and type of pipe or riser, the type of blowout preventer, the length of time before a discharge is detected, and the length of time to

[38] Based on Alaska Department of Environmental Conservation (ADEC) Regions with regions 2,3,6,8, and 9 broken into two sub-regions each to better accommodate biological risk analyses.
[39] Region 10 (Interior) was excluded from the analysis as this is outside areas of potential marine impact.
[40] Etkin 2004b.

natural bridging,[41] capping of the well or stemming of the flow of oil through relief wells. The EPA's regulations for response preparedness stipulate that the WCD for a well be defined as 30 days of flow at the maximum daily production rate for wells that are 10,000 feet or less, and 45 days of flow at the daily production rate for wells that are 10,000 feet or more. But, for this risk analysis study, BOEM's catastrophic discharge event assumptions[42] were applied (as per communication with BOEM) due to the greater likelihood of a longer duration of flow due to the inherent logistical challenges in responding to a blowout. BOEM applies the assumptions shown in Table 3 in determining volumes and durations of flow.

Table 3: BOEM OCS Catastrophic Discharge Event[43]

Program Area	Total Volume (bbl)	Duration (days)	Factors Affecting Duration
Chukchi Sea	1,400,000 – 2,200,000	40 – 75	Type of drill rig used and rig availability to drill relief well during open water season
Beaufort Sea	1,700,000 – 3,900,000	60 – 300	Type of drill rig, timing of drilling relative to ice conditions, and rig availability to drill relief well

Potential flow rates (bbl/day) vary considerably between wells. The estimated flow rate for the Macondo MC252 well was estimated to be between 35,900 bbl/day to 70,000 bbl/day.[44] Maximum flow rates may, however, by considerably higher. For example, the Shell Appomattox MC-391 well has a maximum flow rate of 405,000 bbl/day.[45] For the Chukchi Sea, the highest potential flow rate, based on available information, is 25,000 bbl/day.[46] For the Beaufort Sea, the highest potential flow rate, based on available information, is 69,000 bbl/day.[47]

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[41] Natural bridging occurs when sediment naturally fills the well pipe or riser to such an extent that flow ceases. International analyses indicate that this occurs in 84% of well blowouts within 0.5 to 5 days (Holand 2013).

[42] BOEM 2012.

[43] The GOM OCS Region has estimated the discharge rate and duration for a catastrophic spill event for both shallow and deep water (in part) based on information gathered from shallow water and deepwater well tests and flow rates validated by the Ixtoc (1979) and the DWH (2010) oil spills. The Alaska OCS Region has estimated a very large oil-spill scenario based on a reasonable, maximum flow rate for each OCS planning area, taking into consideration geologic conditions and well log data. The Alaska OCS Region modeled the flow of fluids from a representative reservoir into the well and flow up through the borehole based on formation thickness, porosity, and permeability; oil saturation, viscosity, and gas content; and reservoir pressure and temperature. The number of days until a hypothetical blowout and discharge from a well could be contained was also estimated. Different assumptions about the type of drilling rig, timing of drilling, nature of ice conditions, and relief well operations underlie the CDE scenarios in the Chukchi Sea and Beaufort Sea; therefore, the scenarios are not directly comparable. The time period required to drill a relief well and kill the well in the Chukchi Sea is explained in detail in BOEMRE (2011). The relief well is drilled and killed within the open water season. Over half of the 75-day estimate includes transport of relief well rig to the site and drilling of the actual relief well. The greater range in spill duration in the Beaufort reflects different assumptions about the drilling rig and timing of drilling relative to seasonal ice conditions. The scenario range incorporates both open- and late open-water season and winter blowout scenarios (the late open-water season may delay the relief well drilling until the following open-water season). These are discharge volumes and do not account for decreases in volume from bridging, containment, or response operations. Note that under BOEM and BSEE regulations, exploration and development plans and oil spill response plans must incorporate a separate worst-case discharge calculation derived from individual well parameters and characteristics.

[44] Oldenburg et al. 2012; McNutt et al. 2012a; McNutt et al. 2012b.

[45] Shell 2010.

[46] Shell 2011.

[47] Memorandum from Bureau of Ocean Energy Management to NOAA regarding "Estimate of Very Large Oil Spill from an Exploration Well in the Beaufort Sea OCS Planning Area, Alaska," 28 March 2014. 12 p.

Based on the application of these assumptions, the worst-case discharge (WCD) assigned to OCS offshore wells for Chukchi Sea is 2.2 million bbl and for Beaufort Sea is 3.9 million bbl. For all other regions with offshore wells (Cook Inlet, Kodiak/Shelikof Strait, and Aniakchak), the WCD is assumed to be 39,000 bbl based on information on the production rates of wells in state waters.

For the MMPDs, the US Coast Guard definitions were applied. The MMPD volumes are defined by source type as follows:

- Facility MMPD = the lesser of 1,200 bbl or 10% of the WCD;
- Vessel (<25,000 deadweight tonnage) MMPD = 10% of the WCD; and
- Vessel (≥25,000 deadweight tonnage) MMPD = 2,500 bbl.

Based on these definitions, the largest possible MMPD is 2,500 bbl. Since there is no analogous equivalent for offshore wells in BOEM or BSEE regulations, the facility MMPD of 1,200 bbl was applied to offshore wells in this analysis.

1.3 Overall Approach to Incident Analysis and Characterization

As stated above, the analyses included incidents in which oil spilled or in which oil could conceivably have spilled. This approach allowed a broader spectrum of incidents to be evaluated with respect to characterizing probabilities of incidents and spillage as the baseline case and for the future projections. This allowed for the various types of incidents with spill potential to be analyzed with respect to location, source type, oil type, and season. It is important to note that not all incidents in the past will have resulted in actual spillage. This is also true for future incidents.

The incident rates derived represent the relative probabilities that an incident involving a particular type of oil and potential volume might occur in each particular region and seasonal time period. For each incident (e.g., a vessel grounding) there is a certain probability that a spill that ensue. The probability is related to the cause of the incident, the characteristics of the source, and various other factors. A complete analysis of the causes of incidents, outflow probabilities, and factors that influence spillage was outside the scope of this current project.

In this analysis, incidents (with or without actual spillage) were used to determine the relative frequencies of spills for the historical baseline and future projections. Using incidents with the potential for spillage rather than just actual reported spills allowed for greater precision in determining the locations and types of incidents likely to occur in future. All the incidents used in the analytical data were ones in which there was sufficient concern about the likelihood of a spill that US Coast Guard and/or state officials were prompted to respond.

2 Incident Characterization

A total of 10,985 incidents that occurred during 1995 and 2012 were included in the Alaska Risk Incident Database (AKRID)[48] developed specifically for this study. A total of 3,581 facility-related incidents, and

[48] AKRID includes incident data (potential spills and actual spills) from the Alaska Department of Environmental Conservation, US Coast Guard vessel and facility spill and casualty databases, and other data incorporated into ERC's spill databases.

7,404 incidents (67%) related to vessels. The annual incident numbers averaged 610, though there was some variation from year to year, as in Figure 4.

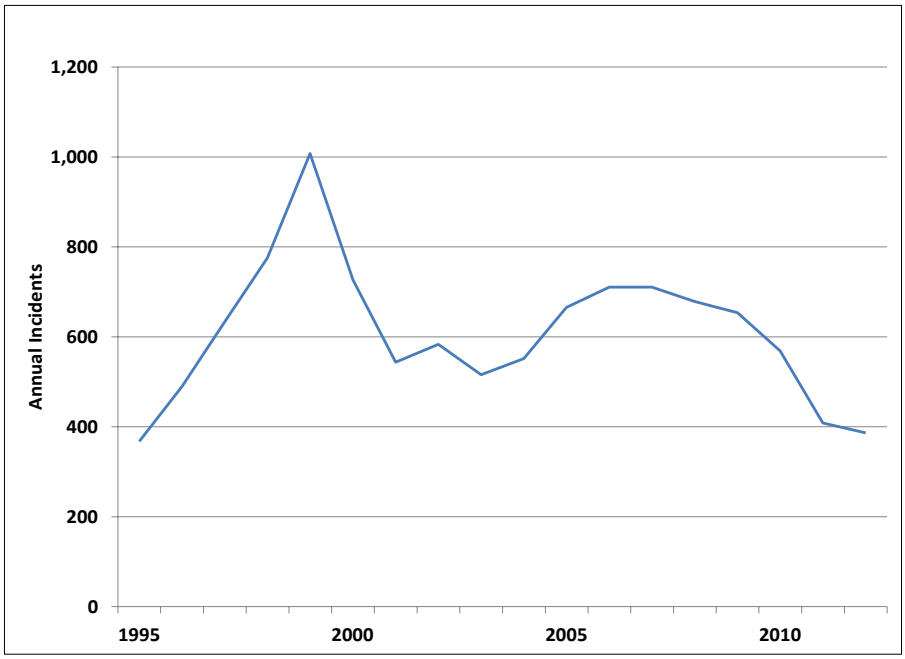

Figure 4: Annual Incidents (Facilities and Vessels) in Alaskan Marine Waters (AKRID)

2.1 Breakdown of Facility and Vessel Incidents

Figure 5 shows the incidents for facilities and vessels.

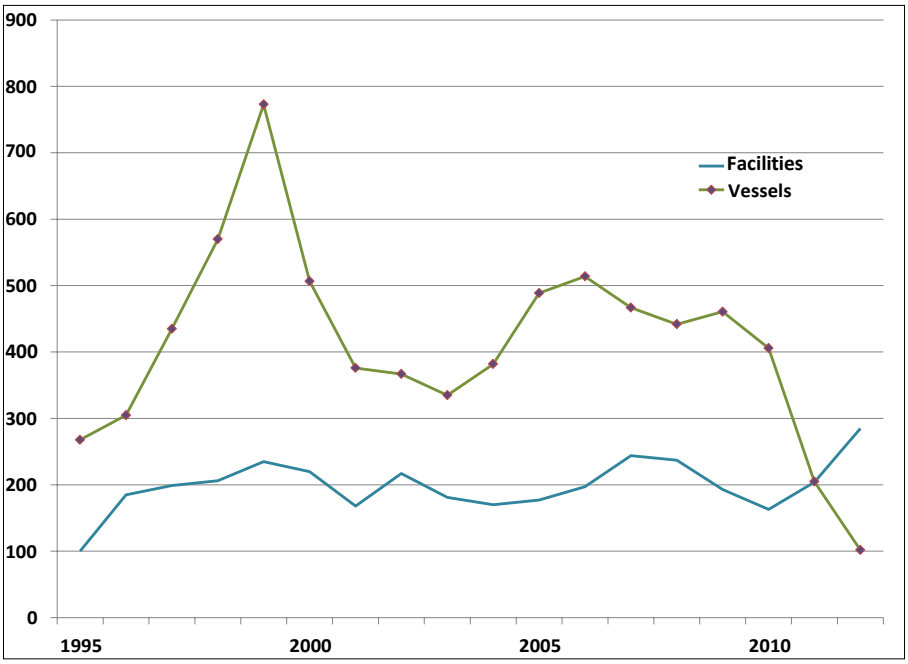

Figure 5: Annual Incidents (Facilities and Vessels) in Alaskan Marine Waters (AKRID)

Of the 10, 985 incidents, there were 3,281 facility spills and 5,386 vessel spills. In other words, 92% of facility incidents result in spillage and 73% of vessel incidents result in spillage (Figure 6 and Table 4). The difference in rates between facilities and vessels most probably reflects the greater likelihood of a potential spill incident to be reported to or detected by US Coast Guard or state officials as part of vessel casualty reporting. An incident with a vessel (e.g., sinking, collision, grounding) is more likely to be reported or detected because of safety considerations beyond spillage likelihood than a facility incident.

Table 4: Vessel and Facility Incidents in Alaskan Waters 1995 – 2012 in AKRID

Year	Facility Incidents			Vessel Incidents		
	No Spill	Spill	Spillage %	No Spill	Spill	Spillage %
1995	23	77	77.0%	9	259	96.6%
1996	24	161	87.0%	7	298	97.7%
1997	29	170	85.4%	28	407	93.6%
1998	46	160	77.7%	32	538	94.4%
1999	51	184	78.3%	64	709	91.7%
2000	22	198	90.0%	45	462	91.1%
2001	15	153	91.1%	51	325	86.4%
2002	12	205	94.5%	134	233	63.5%
2003	6	175	96.7%	152	183	54.6%
2004	1	169	99.4%	150	232	60.7%
2005	12	165	93.2%	214	275	56.2%
2006	15	182	92.4%	230	284	55.3%
2007	2	242	99.2%	186	281	60.2%
2008	8	229	96.6%	182	260	58.8%
2009	7	186	96.4%	207	254	55.1%
2010	2	161	98.8%	219	187	46.1%
2011	12	192	94.1%	82	123	60.0%
2012	13	272	95.4%	26	76	74.5%
Total	**300**	**3,281**	**91.6%**	**2,018**	**5,386**	**72.7%**

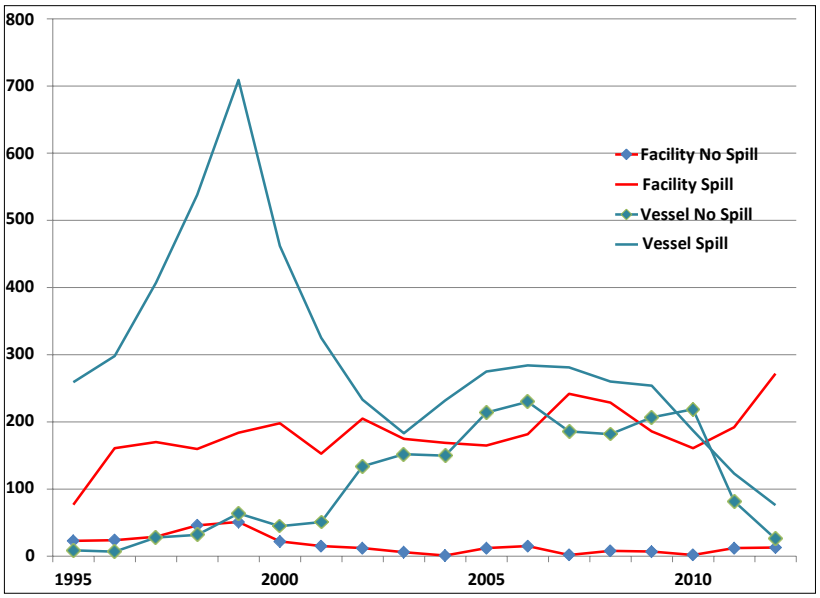

Figure 6: Potential/Actual Spill Incidents from Facilities and Vessels in Alaskan Waters (AKRID)

2.2 Geographic Distribution of Incidents

Figure 7 shows the general geographic distribution of incidents in AKRID. [Note that the individual red dots may represent multiple incidents occurring in approximately the same location.] The numbers of incidents by geographic region are summarized in Table 4. Incident numbers on an annualized basis are shown in Table 6. Figure 8 shows the percentages of incidents by region.

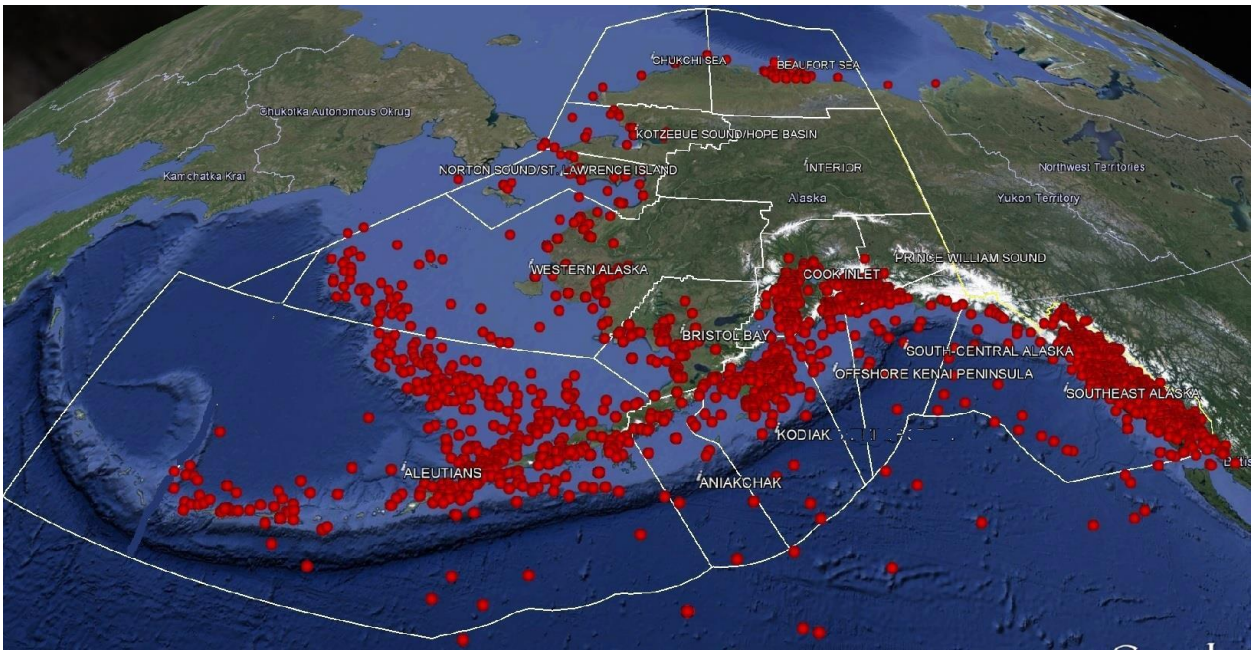

Figure 7: Geographic Distribution of Incident Locations 1995 – 2012 (AKRID)

Table 5: Incidents by Geographic Region 1995 – 2012[49] (AKRID)

Region	Facility Incidents		Vessel Incidents		Total Incidents		Total
	Potential	Spills	Potential	Spills	Potential	Spills	
Aleutians	11	177	409	1,011	420	1,188	**1,608**
Aniakchak	2	17	29	11	31	28	**59**
Beaufort Sea	8	1,454	7	13	15	1,467	**1,482**
Bristol Bay	4	42	77	102	81	144	**225**
Cook Inlet	96	741	106	394	202	1,135	**1,337**
Kotzebue S/Hope Basin	1	30	3	11	4	41	**45**
Kodiak/Shelikof Str.	8	51	218	558	226	609	**835**
Chukchi Sea	4	18	1	9	5	27	**32**
Norton S/ St. Lawrence I.	5	55	7	25	12	80	**92**
Off Kenai Peninsula	5	29	70	151	75	180	**255**
South-Central Alaska	2	13	42	46	44	59	**103**
Prince William Sound	43	151	177	576	220	727	**947**
Southeast Alaska	104	377	769	2,381	873	2,758	**3,631**
Western Alaska	7	126	103	98	110	224	**334**
Total	**300**	**3,281**	**2,018**	**5,386**	**2,318**	**8,667**	**10,985**

[49] Incidents are divided into ones for which there was only the potential for spillage and no spillage occurred, and those in which spillage actually occurred.

Table 6: Annualized Incidents by Geographic Region (AKRID)							
Region	**Facility Incidents**		**Vessel Incidents**		**Total Incidents**		**Total**
	Potential	**Spills**	**Potential**	**Spills**	**Potential**	**Spills**	
Aleutians	0.6	9.8	22.7	56.2	23.3	66.0	**89.3**
Aniakchak	0.1	0.9	1.6	0.6	1.7	1.6	**3.3**
Beaufort Sea	0.4	80.8	0.4	0.7	0.8	81.5	**82.3**
Bristol Bay	0.2	2.3	4.3	5.7	4.5	8.0	**12.5**
Cook Inlet	5.3	41.2	5.9	21.9	11.2	63.1	**74.3**
Kotzebue S/Hope Basin	0.1	1.7	0.2	0.6	0.2	2.3	**2.5**
Kodiak/Shelikof Str.	0.4	2.8	12.1	31.0	12.6	33.8	**46.4**
Chukchi Sea	0.2	1.0	0.1	0.5	0.3	1.5	**1.8**
Norton S/ St. Lawrence I.	0.3	3.1	0.4	1.4	0.7	4.4	**5.1**
Off Kenai Peninsula	0.3	1.6	3.9	8.4	4.2	10.0	**14.2**
South-Central Alaska	0.1	0.7	2.3	2.6	2.4	3.3	**5.7**
Prince William Sound	2.4	8.4	9.8	32.0	12.2	40.4	**52.6**
Southeast Alaska	5.8	20.9	42.7	132.3	48.5	153.2	**201.7**
Western Alaska	0.4	7.0	5.7	5.4	6.1	12.4	**18.6**
Total	**16.7**	**182.3**	**112.1**	**299.2**	**128.8**	**481.5**	**610.3**

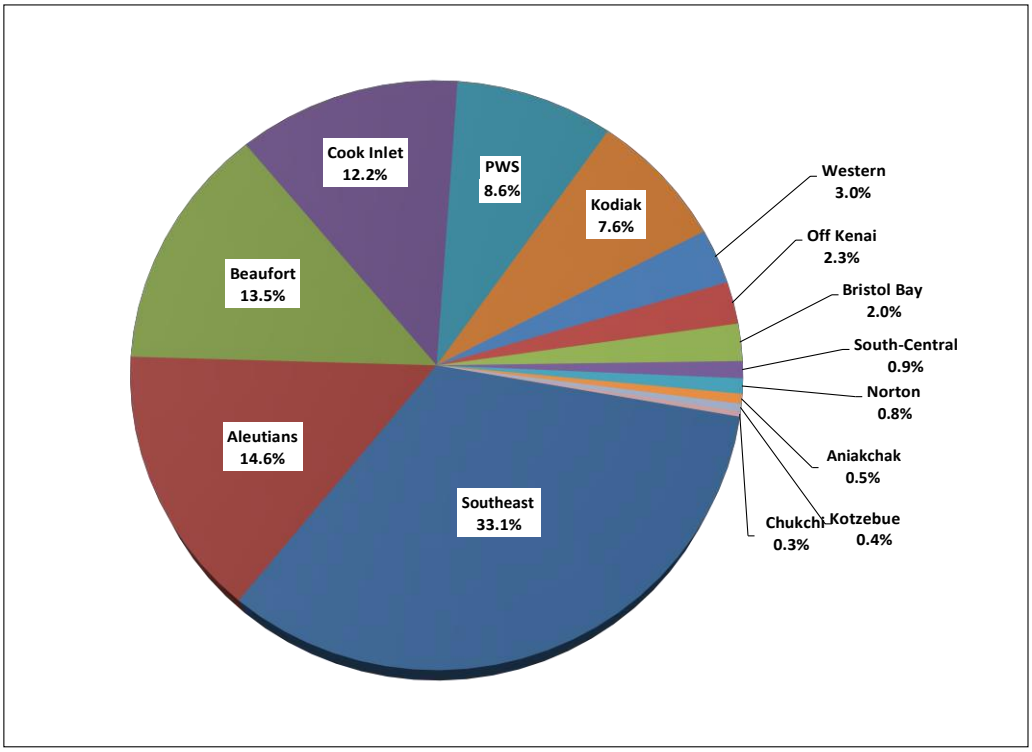

Figure 8: Percentages of Incidents by Region (AKRID)

2.3 Distribution of Oil Types by Region

The incidents were characterized by oil type actually spilled or oil type that would have potentially spilled as summarized in Table 7. Annualized incidents by oil type and region are shown in Table 8. Across all regions, the vast majority of incidents (nearly 87%) involved light oils, particularly diesel fuel (Figure 9 and Table 9). The regions differed somewhat with respect to percentages of incident oil types.

Table 7: Incident Oil Types by Region 1995 – 2012 (AKRID)					
Region	**Crude**	**Distillate[50]**	**Heavy**	**Light**	**Total**
Aleutians	1	32	50	1,525	**1,608**
Aniakchak	2	3	4	50	**59**
Beaufort Sea	337	4	5	1,136	**1,482**
Bristol Bay	0	19	9	197	**225**
Cook Inlet	222	71	45	999	**1,337**
Kotzebue S/Hope Basin	0	6	2	37	**45**
Kodiak/Shelikof Str.	4	26	17	788	**835**
Chukchi Sea	1	8	1	22	**32**
Norton S/ St. Lawrence I.	0	12	3	77	**92**
Off Kenai Peninsula	1	16	6	232	**255**
South-Central Alaska	7	8	7	81	**103**
Prince William Sound	62	61	12	812	**947**
Southeast Alaska	3	281	54	3,293	**3,631**
Western Alaska	0	42	5	287	**334**
Total	**640**	**589**	**220**	**9,536**	**10,985**

Table 8: Annualized Incidents by Oil Type and Region (AKRID)					
Region	**Crude**	**Distillate**	**Heavy**	**Light**	**Total**
Aleutians	0.06	1.78	2.78	84.72	**89.33**
Aniakchak	0.11	0.17	0.22	2.78	**3.28**
Beaufort Sea	18.72	0.22	0.28	63.11	**82.33**
Bristol Bay	0.00	1.06	0.50	10.94	**12.50**
Cook Inlet	12.33	3.94	2.50	55.50	**74.28**
Kotzebue S/Hope Basin	0.00	0.33	0.11	2.06	**2.50**
Kodiak/Shelikof Str.	0.22	1.44	0.94	43.78	**46.39**
Chukchi Sea	0.06	0.44	0.06	1.22	**1.78**
Norton S/ St. Lawrence I.	0.00	0.67	0.17	4.28	**5.11**
Off Kenai Peninsula	0.06	0.89	0.33	12.89	**14.17**
South-Central Alaska	0.39	0.44	0.39	4.50	**5.72**
Prince William Sound	3.44	3.39	0.67	45.11	**52.61**
Southeast Alaska	0.17	15.61	3.00	182.94	**201.72**
Western Alaska	0.00	2.33	0.28	15.94	**18.56**
Total	**35.56**	**32.72**	**12.22**	**529.78**	**610.28**

Table 9: Percentage of Incidents by Oil Type and Region (Within Region)(AKRID)					
Region	**Crude**	**Distillate**	**Heavy**	**Light**	**Total**
Aleutians	0.1%	2.0%	3.1%	94.8%	**100.0%**
Aniakchak	3.4%	5.1%	6.8%	84.7%	**100.0%**
Beaufort Sea	22.7%	0.3%	0.3%	76.7%	**100.0%**
Bristol Bay	0.0%	8.4%	4.0%	87.6%	**100.0%**
Cook Inlet	16.6%	5.3%	3.4%	74.7%	**100.0%**
Kotzebue S/Hope Basin	0.0%	13.3%	4.4%	82.2%	**100.0%**
Kodiak/Shelikof Str.	0.5%	3.1%	2.0%	94.4%	**100.0%**
Chukchi Sea	3.1%	25.0%	3.1%	68.8%	**100.0%**
Norton S/ St. Lawrence I.	0.0%	13.0%	3.3%	83.7%	**100.0%**
Off Kenai Peninsula	0.4%	6.3%	2.4%	91.0%	**100.0%**
South-Central Alaska	6.8%	7.8%	6.8%	78.6%	**100.0%**
Prince William Sound	6.5%	6.4%	1.3%	85.7%	**100.0%**

[50] Distillate includes distillates, kerosene, and jet fuel.

Table 9: Percentage of Incidents by Oil Type and Region (Within Region)(AKRID)					
Region	**Crude**	**Distillate**	**Heavy**	**Light**	**Total**
Southeast Alaska	0.1%	7.7%	1.5%	90.7%	**100.0%**
Western Alaska	0.0%	12.6%	1.5%	85.9%	**100.0%**
Total	**5.8%**	**5.4%**	**2.0%**	**86.8%**	**100.0%**

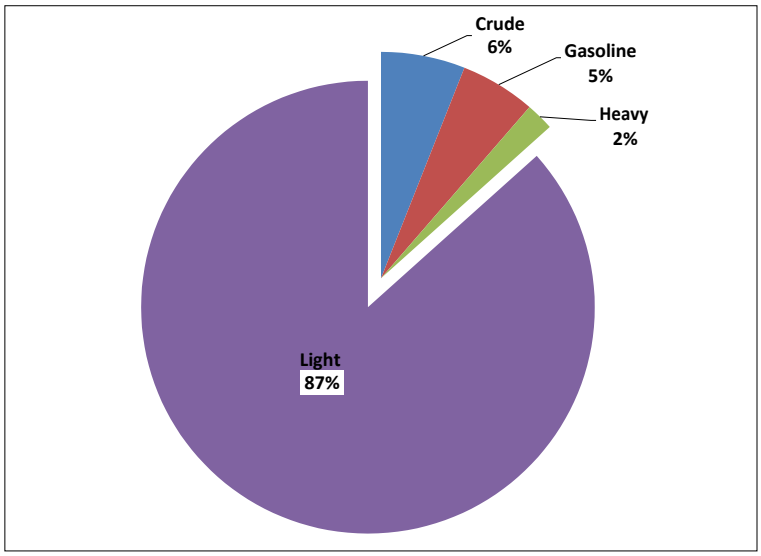

Figure 9: Incident Oil Types across Regions 1995 – 2012 (AKRID)

2.4 Distribution of Incidents by Period

The incidents in the AKRID were categorized by "period" using the following two-month designations, which best matched the biological data:

- December – January
- February – March
- April – May
- June – July
- August – September
- October – November

Total numbers of incidents by period across all regions are presented in Tables 10 and 11 and Figures 10 and 11. There was a general increase in incidents in the summer months with fewer incidents during late fall and early winter.

Table 10: Distribution of Incidents by Period across Regions (1995 – 2012) (AKRID)							
Region	**Dec-Jan**	**Feb-Mar**	**Apr-May**	**Jun-Jul**	**Aug-Sep**	**Oct-Nov**	**Total**
Aleutians	215	372	233	258	313	217	**1,608**
Aniakchak	4	14	10	13	11	7	**59**
Beaufort Sea	225	302	283	263	226	183	**1,482**
Bristol Bay	5	11	45	128	27	9	**225**
Cook Inlet	158	182	257	290	285	165	**1,337**
Kotzebue S/Hope Basin	2	5	4	15	9	10	**45**
Kodiak/Shelikof Str.	135	140	143	172	127	118	**835**

Table 10: Distribution of Incidents by Period across Regions (1995 – 2012) (AKRID)							
Region	**Dec-Jan**	**Feb-Mar**	**Apr-May**	**Jun-Jul**	**Aug-Sep**	**Oct-Nov**	**Total**
Chukchi Sea	4	4	1	5	17	1	**32**
Norton S/ St. Lawrence I.	7	9	7	31	24	14	**92**
Off Kenai Peninsula	25	45	51	56	47	31	**255**
South-Central Alaska	10	19	27	18	20	9	**103**
Prince William Sound	125	131	160	251	164	116	**947**
Southeast Alaska	409	532	502	873	779	536	**3,631**
Western Alaska	27	32	57	85	100	33	**334**
Total	**1,351**	**1,798**	**1,780**	**2,458**	**2,149**	**1,449**	**10,985**

Table 11: Percentage Distribution of Incidents by Period across Regions (AKRID)							
Region	**Dec-Jan**	**Feb-Mar**	**Apr-May**	**Jun-Jul**	**Aug-Sep**	**Oct-Nov**	**Total**
Aleutians	13.4%	23.1%	14.5%	16.0%	19.5%	13.5%	**100%**
Aniakchak	6.80%	23.70%	16.90%	22.00%	18.60%	11.90%	**100%**
Beaufort Sea	15.20%	20.40%	19.10%	17.70%	15.20%	12.30%	**100%**
Bristol Bay	2.20%	4.90%	20.40%	56.40%	12.00%	4.00%	**100%**
Cook Inlet	12%	14%	19%	22%	21%	12%	**100%**
Kotzebue S/Hope Basin	4%	11%	9%	33%	20%	22%	**100%**
Kodiak/Shelikof Str.	16%	17%	17%	21%	15%	14%	**100%**
Chukchi Sea	13%	13%	3%	16%	53%	3%	**100%**
Norton S/ St. Lawrence I.	7.60%	9.80%	7.60%	33.70%	26.10%	15.20%	**100%**
Off Kenai Peninsula	9.80%	17.60%	20.00%	22.00%	18.40%	12.20%	**100%**
South-Central Alaska	9.70%	18.40%	26.20%	17.50%	19.40%	8.70%	**100%**
Prince William Sound	13.20%	13.80%	16.90%	26.50%	17.30%	12.20%	**100%**
Southeast Alaska	11.30%	14.70%	13.80%	24.00%	21.50%	14.80%	**100%**
Western Alaska	8.10%	9.60%	17.10%	25.40%	29.90%	9.90%	**100%**
Total	**12.3%**	**16.4%**	**16.2%**	**22.4%**	**19.6%**	**13.2%**	**100%**

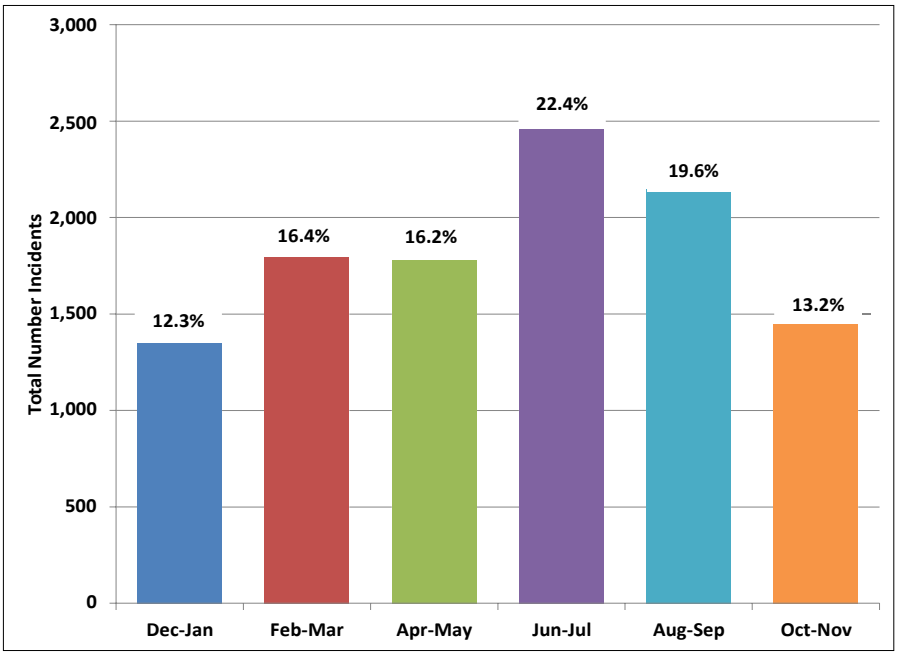

Figure 10: Distribution of Incidents in Alaska by Periods (AKRID)

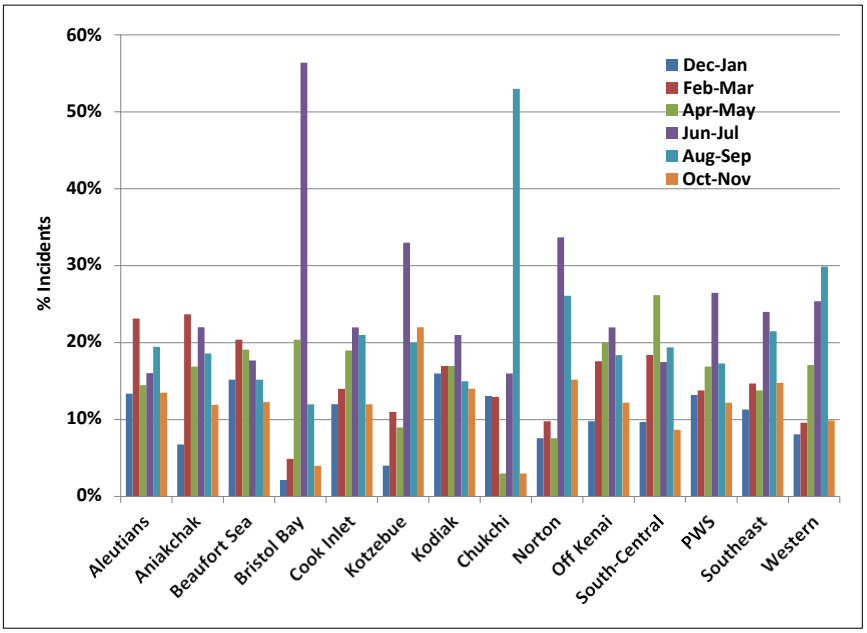

Figure 11: Distribution of Incident Periods by Region (AKRID)

3 Incident Frequency by Geographic Region

The incident frequencies in each region were characterized by time period and oil type. These results form the basis of inputs to the risk matrix with regard to incident frequency for the current time period.

3.1 Incident Density

In comparing incident rates between regions, it is important to note that the regions differ significantly with regard to geographic area, which means that the incident rates (numbers of annual incidents) need to be taken into perspective with regard to areal coverage of each region (Table 12 and Figure 12).

Table 12: Approximate Density of Incidents by Region (1995 – 2012) (AKRID)

Region	Approx. Marine Area (square miles)	Number of Incidents	Total Incidents per sq. mi.	Annual Incidents per sq. mi.
Aleutians	3,450	**1,608**	0.5	0.026
Aniakchak	970	**59**	0.1	0.003
Beaufort Sea	1,300	**1,482**	1.1	0.063
Bristol Bay	530	**225**	0.4	0.024
Cook Inlet	540	**1,337**	2.5	0.138
Kotzebue S/Hope Basin	650	**45**	0.1	0.004
Kodiak/Shelikof Str.	1,000	**835**	0.8	0.046
Chukchi Sea	1,200	**32**	0.0	0.001
Norton S/ St. Lawrence I.	1,000	**92**	0.1	0.005
Off Kenai Peninsula	880	**255**	0.3	0.016
South-Central Alaska	1,000	**103**	0.1	0.006
Prince William Sound	300	**947**	3.2	0.175
Southeast Alaska	1,500	**3,631**	2.4	0.134
Western Alaska	2,200	**334**	0.2	0.008
Total	**16,250**	**10,985**	**0.7**	**0.037**

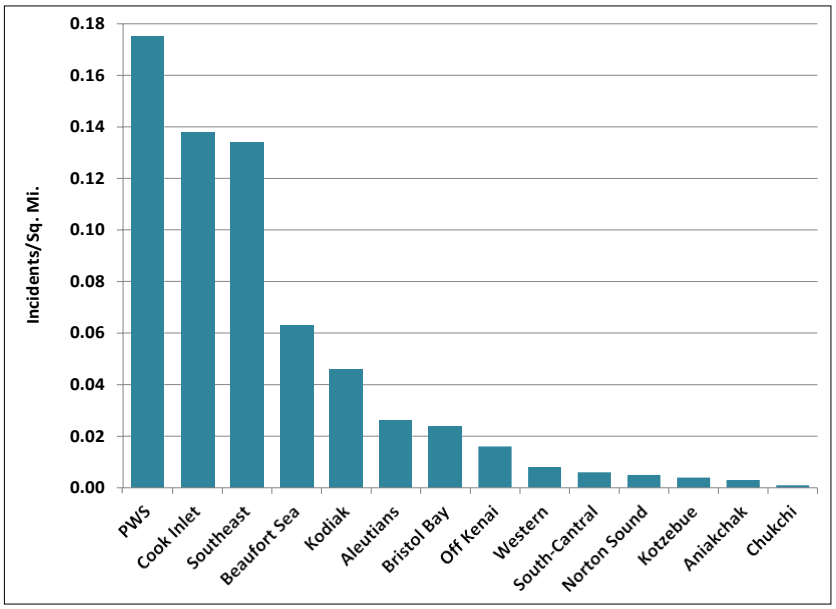

Figure 12: Incidents per Square Mile Marine Area 1995 – 2012 (AKRID)

The overall average for all regions for 1995 – 2012 was 0.7 incidents per square mile over 18 years, or 0.04 incidents per square mile per year. The regions with the greatest number of incidents per square mile are Prince William Sound, Cook Inlet, and Southeast Alaska.

3.2 Aleutians

The Aleutians region covers the largest area of all the regions, encompassing approximately 3,500 square miles. During 1995 – 2012, there were 1,608 incidents (Figure 13). There were on average 89 incidents per year. Nearly 95% of these incidents involved light oils (e.g., diesel) (Table 13). The return-year value[51] for incidents in the Aleutians is 0.01, or one incident about every four days (Table 14).

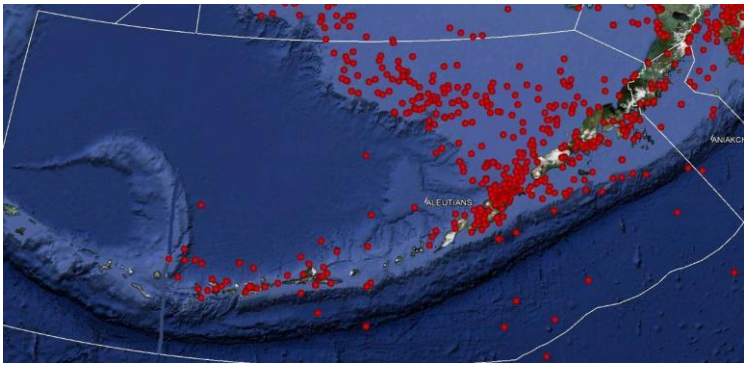

Figure 13: Distribution of Incidents in Aleutians Region 1995 – 2012 (AKRID)

[51] "Return years" refers to the length of time (in years) it would take on average to expect an incident to occur. An example is the so-called "100-year flood", which would have a return-year of 100 years. On average, one flood would occur every 100 years, or one flood could be expected within a 100-year time period. Of course, this does not mean that there cannot be two 100-year floods in consecutive decades or even consecutive years.

Table 13: Annual Incident Rates by Period and Oil Type – Aleutians (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**Total**
Dec-Jan	-	0.12	0.56	11.28	**11.94**
Feb-Mar	-	0.39	0.50	19.78	**20.67**
Apr-May	-	0.28	0.22	12.44	**12.94**
Jun-Jul	-	0.5	0.39	13.45	**14.33**
Aug-Sep	-	0.28	0.67	16.44	**17.39**
Oct-Nov	-	0.22	0.44	11.33	**12.06**
Total	-	**1.78**	**2.78**	**84.72**	**89.33**

Table 14: Incident Return Years by Period and Oil Type – Aleutians (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**Total**
Dec-Jan	-	8.33	1.80	0.09	**0.08**
Feb-Mar	-	2.56	2.00	0.05	**0.05**
Apr-May	-	3.57	4.50	0.08	**0.08**
Jun-Jul	-	2.00	2.57	0.07	**0.07**
Aug-Sep	-	3.57	1.50	0.06	**0.06**
Oct-Nov	-	4.55	2.25	0.09	**0.08**
Total	-	**0.56**	**0.36**	**0.01**	**0.01**

3.3 Aniakchak

The Aniakchak region covers approximately 970 square miles. During 1995 – 2012, there were 59 incidents (Figure 14). There were on average 3 incidents per year. Nearly 85% of these incidents involved light oils (e.g., diesel) (Table 15). The return-year value for incidents in Aniakchak is 0.31, or one incident about every 113 days (nearly four months) (Table 16).

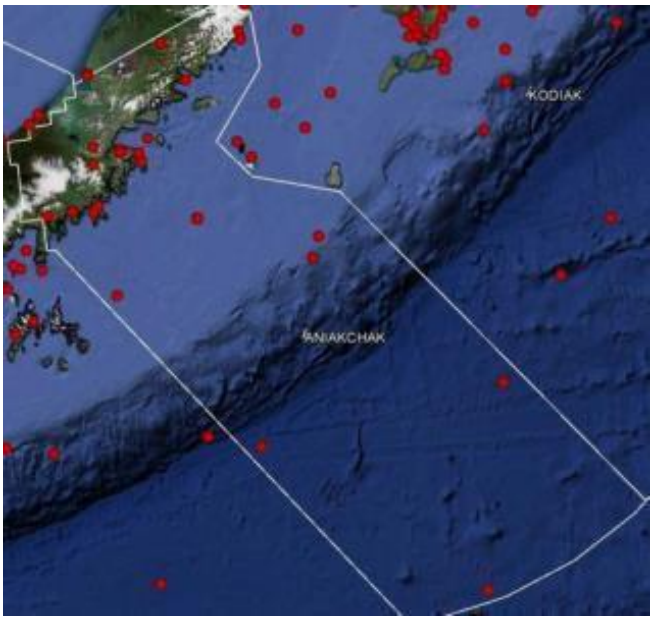

Figure 14: Distribution of Incidents in Aniakchak Region 1995 – 2012 (AKRID)

Table 15: Annual Incident Rates by Period and Oil Type – Aniakchak (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	-	0.11	0.11	**0.22**
Feb-Mar	-	-	-	0.78	**0.78**
Apr-May	0.11	0.06	-	0.39	**0.56**
Jun-Jul	-	0.06	0.06	0.61	**0.72**
Aug-Sep	-	-	-	0.61	**0.61**
Oct-Nov	-	0.06	0.06	0.28	**0.39**
All Periods	**0.11**	**0.17**	**0.22**	**2.78**	**3.28**

Table 16: Incident Return Years by Period and Oil Type – Aniakchak (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	-	9.00	9.00	**4.50**
Feb-Mar	-	-	-	1.29	**1.29**
Apr-May	9.00	16.67	-	2.57	**1.80**
Jun-Jul	-	16.67	18.00	1.64	**1.38**
Aug-Sep	-	-	-	1.64	**1.64**
Oct-Nov	-	16.67	18.00	3.60	**2.57**
All Periods	**9.00**	**5.88**	**4.50**	**0.36**	**0.31**

3.4 Beaufort Sea

The Beaufort Sea region covers approximately 1,300 square miles. During 1995 – 2012, there were 1,482 incidents (Figure 15). There were on average 82 incidents per year. Nearly 77% of these incidents involved light oils (e.g., diesel). Almost 23% involved crude oil (Table 17). The return-year value for incidents in Beaufort Sea is 0.01, or one incident about every four days (Table 18).

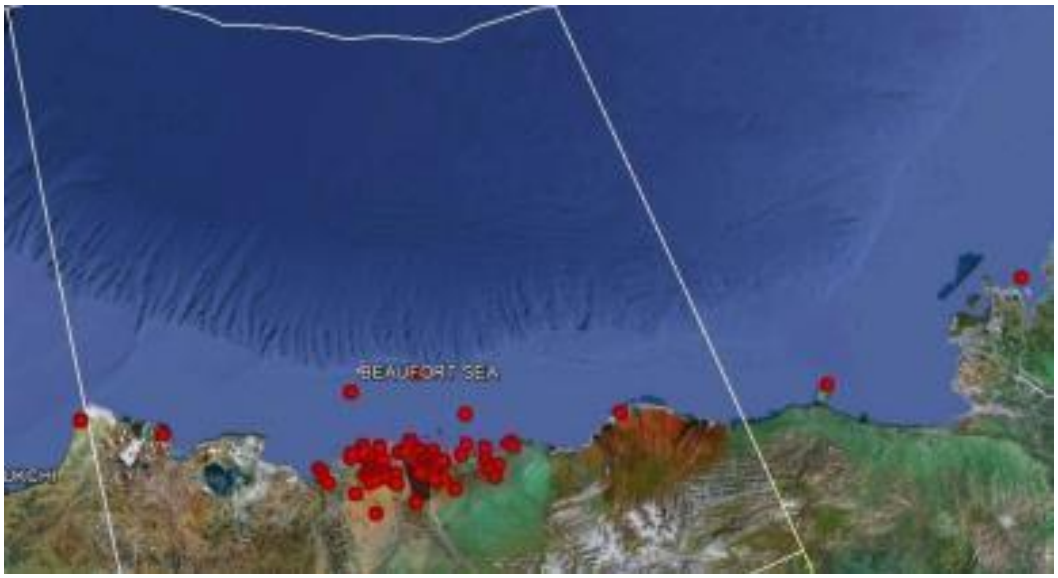

Figure 15: Distribution of Incidents in Beaufort Sea Region 1995 – 2012[52] (AKRID)

[52] Note that incidents occurring in Canadian waters that could conceivably impact Alaskan/US waters and shorelines were included in the analysis.

Table 17: Annual Incident Rates by Period and Oil Type – Beaufort Sea (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	1.83	-	-	10.67	**12.50**
Feb-Mar	3.28	-	-	13.50	**16.78**
Apr-May	3.72	-	-	12.00	**15.72**
Jun-Jul	4.61	0.11	-	9.89	**14.61**
Aug-Sep	2.89	0.11	0.22	9.33	**12.56**
Oct-Nov	2.39	-	0.06	7.72	**10.17**
All Periods	**18.72**	**0.22**	**0.28**	**63.11**	**82.33**

Table 18: Incident Return Years by Period and Oil Type – Beaufort Sea (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	0.55	-	-	0.09	**0.08**
Feb-Mar	0.31	-	-	0.07	**0.06**
Apr-May	0.27	-	-	0.08	**0.06**
Jun-Jul	0.22	9.00	-	0.10	**0.07**
Aug-Sep	0.35	9.00	4.50	0.11	**0.08**
Oct-Nov	0.42	-	18.00	0.13	**0.10**
All Periods	**0.05**	**4.50**	**3.60**	**0.02**	**0.01**

3.5 Bristol Bay

The Bristol Bay region covers approximately 530 square miles. During 1995 – 2012, there were 225 incidents (Figure 16). There were on average 13 incidents per year. Nearly 87% of these incidents involved light oils (e.g., diesel) (Table 19). The return-year value for incidents in Bristol Bay is 0.08, or one incident about every month (Table 20).

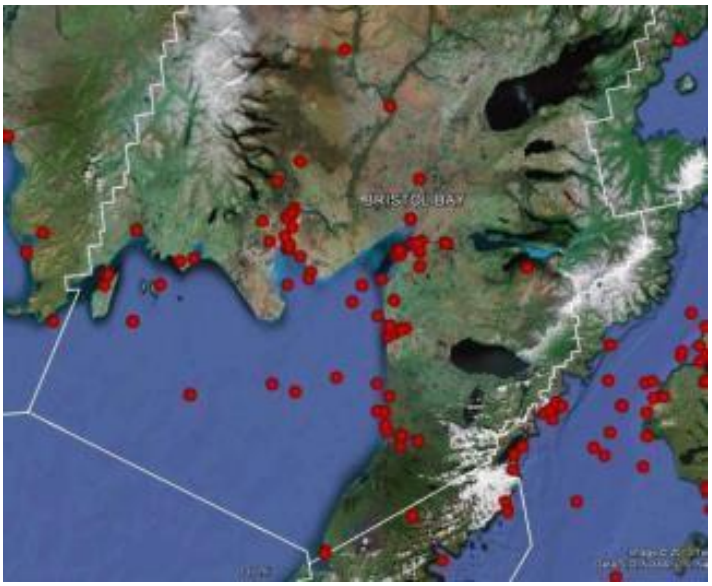

Figure 16: Distribution of Incidents in Bristol Bay Region 1995 – 2012[53] (AKRID)

[53] Note that incidents occurring in rivers within US Coast Guard jurisdiction as per the USCG/EPA MOU are included.

Table 19: Annual Incident Rates by Period and Oil Type – Bristol Bay (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	-	-	0.28	**0.28**
Feb-Mar	-	-	0.06	0.56	**0.61**
Apr-May	-	0.44	0.06	2.06	**2.56**
Jun-Jul	-	0.34	0.28	6.45	**7.06**
Aug-Sep	-	0.17	0.11	1.22	**1.50**
Oct-Nov	-	0.12	-	0.39	**0.50**
All Periods	-	**1.05**	**0.50**	**10.95**	**12.50**

Table 20: Incident Return Years by Period and Oil Type – Bristol Bay (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	-	-	3.57	**3.60**
Feb-Mar	-	-	18.00	1.79	**1.64**
Apr-May	-	2.27	18.00	0.49	**0.39**
Jun-Jul	-	2.94	3.60	0.16	**0.14**
Aug-Sep	-	5.88	9.00	0.82	**0.67**
Oct-Nov	-	8.33	-	2.56	**2.00**
All Periods	-	**0.95**	**2.00**	**0.09**	**0.08**

3.6 Cook Inlet

The Cook Inlet region covers approximately 540 square miles. During 1995 – 2012, there were 1,337 incidents (Figure 17). There were on average 74 incidents per year. About 74% of these incidents involved light oils (e.g., diesel). Nearly 17% involved crude oil (Table 21). The return-year value for incidents in Cook Inlet is 0.01, or one incident about every 5 days (Table 22).

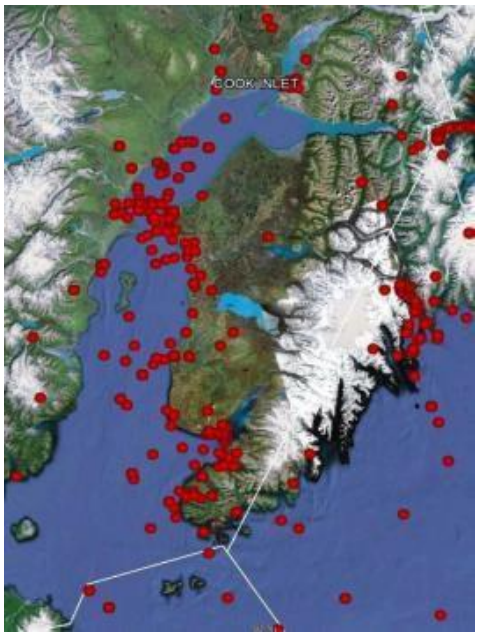

Figure 17: Distribution of Incidents in Cook Inlet Region 1995 – 2012 (AKRID)

Table 21: Annual Incident Rates by Period and Oil Type – Cook Inlet (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	1.33	0.39	0.28	6.78	**8.78**
Feb-Mar	1.72	0.50	0.28	7.61	**10.11**
Apr-May	2.88	1.11	0.39	9.89	**14.28**
Jun-Jul	2.11	0.72	0.50	12.78	**16.11**
Aug-Sep	2.94	0.83	0.67	11.39	**15.83**
Oct-Nov	1.33	0.39	0.39	7.06	**9.17**
All Periods	**12.32**	**3.95**	**2.50**	**55.51**	**74.28**

Table 22: Incident Return Years by Period and Oil Type – Cook Inlet (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	0.75	2.56	3.57	0.15	**0.11**
Feb-Mar	0.58	2.00	3.57	0.13	**0.10**
Apr-May	0.35	0.90	2.56	0.10	**0.07**
Jun-Jul	0.47	1.39	2.00	0.08	**0.06**
Aug-Sep	0.34	1.20	1.49	0.09	**0.06**
Oct-Nov	0.75	2.56	2.56	0.14	**0.11**
All Periods	**0.08**	**0.25**	**0.40**	**0.02**	**0.01**

3.7 Kotzebue Sound/Hope Basin

The Kotzebue Sound/Hope Basin region covers approximately 650 square miles. During 1995 – 2012, there were 45 incidents (Figure 18). There were on average 3 incidents per year. About 82% of these incidents involved light oils (e.g., diesel) (Table 23). The return-year value for incidents in Kotzebue Sound/Hope Basin is 0.4, or one incident about every 5 months (Table 24).

Figure 18: Distribution of Incidents in Kotzebue Sound/Hope Basin Region 1995 – 2012 (AKRID)

Table 23: Annual Incident Rates by Period and Oil Type – Kotzebue Sound/Hope Basin (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	-	-	0.11	**0.11**
Feb-Mar	-	-	-	0.28	**0.28**
Apr-May	-	0.06	-	0.17	**0.22**
Jun-Jul	-	0.12	-	0.72	**0.83**
Aug-Sep	-	0.11	0.06	0.33	**0.50**
Oct-Nov	-	0.06	0.06	0.44	**0.56**
All Periods	**-**	**0.35**	**0.11**	**2.06**	**2.50**

Table 24: Incident Return Years by Period and Oil Type – Kotzebue Sound/Hope Basin (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	-	-	9.00	**9.00**
Feb-Mar	-	-	-	3.60	**3.60**
Apr-May	-	16.67	-	6.00	**4.50**
Jun-Jul	-	8.33	-	1.38	**1.20**
Aug-Sep	-	9.09	18.00	3.00	**2.00**
Oct-Nov	-	16.67	18.00	2.25	**1.80**
All Periods	**-**	**2.86**	**9.00**	**0.49**	**0.40**

3.8 Kodiak/Shelikof Strait

The Kodiak region covers approximately 1,000 square miles. During 1995 – 2012, there were 835 incidents (Figure 19). There were on average 46 incidents per year. Nearly 94% of these incidents involved light oils (e.g., diesel) (Table 25). The return-year value for incidents in Kodiak/Shelikof Strait is 0.02, or one incident about every 8 days (Table 26).

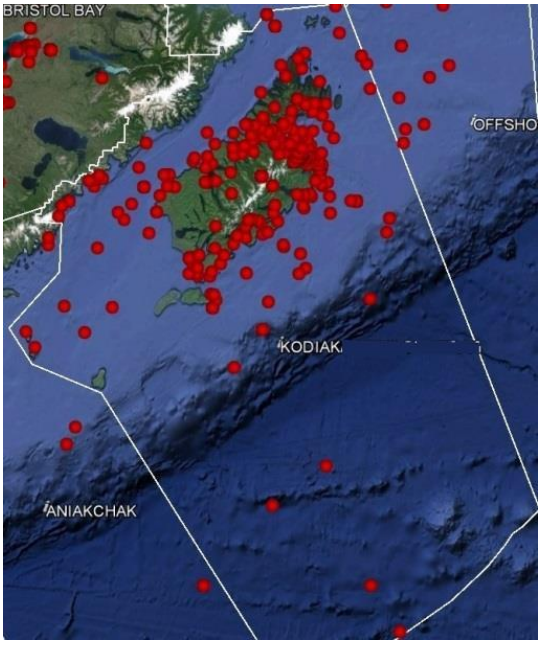

Figure 19: Distribution of Incidents in Kodiak/Shelikof Strait Region 1995 – 2012 (AKRID)

Table 25: Annual Incident Rates by Period and Oil Type – Kodiak/Shelikof Strait (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All OIls**
Dec-Jan	-	0.33	0.17	7.00	**7.50**
Feb-Mar	0.11	0.11	0.11	7.45	**7.78**
Apr-May	0.11	0.39	0.17	7.28	**7.94**
Jun-Jul	-	0.28	0.06	9.17	**9.56**
Aug-Sep	-	0.11	0.17	6.89	**7.06**
Oct-Nov	0.06	0.23	0.28	6.00	**6.56**
All Periods	**0.28**	**3.95**	**0.94**	**43.80**	**46.39**

Table 26: Incident Return Years by Period and Oil Type – Kodiak/Shelikof Strait (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	3.03	5.88	0.14	**0.13**
Feb-Mar	9.09	9.09	9.09	0.13	**0.13**
Apr-May	9.09	2.56	5.88	0.14	**0.13**
Jun-Jul	-	3.57	16.67	0.11	**0.10**
Aug-Sep	-	9.09	5.88	0.15	**0.14**
Oct-Nov	16.67	4.35	3.57	0.17	**0.15**
All Periods	**0.08**	**0.25**	**0.40**	**0.02**	**0.02**

3.9 Chukchi Sea

The Chukchi Sea region covers approximately 1,200 square miles. During 1995 – 2012, there were only 32 incidents (Figure 20). There were on average less than two incidents per year. Nearly 69% of these incidents involved light oils (e.g., diesel) (Table 27). The return-year value for incidents in Chukchi Sea is 0.56, or one incident about every seven months (Table 28).

Figure 20: Distribution of Incidents in Chukchi Sea Region 1995 – 2012 (AKRID)

Table 27: Annual Incident Rates by Period and Oil Type – Chukchi Sea (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	-	-	0.22	**0.22**
Feb-Mar	-	0.06	-	0.17	**0.22**
Apr-May	-	0.06	-	-	**0.06**
Jun-Jul	0.06	0.06	-	0.17	**0.28**
Aug-Sep	-	0.28	0.06	0.61	**0.94**
Oct-Nov	-	-	-	0.06	**0.06**
All Periods	**0.06**	**0.44**	**0.06**	**1.22**	**1.78**

Table 28: Incident Return Years by Period and Oil Type – Chukchi Sea (AKRID)						
Period	**Return Year Value**					
	Crude	**Distillate**	**Heavy**	**Jet Fuel**	**Light**	**All Oils**
Dec-Jan	-	-	-	-	4.50	**4.50**
Feb-Mar	-	18.00	-	-	6.00	**4.50**
Apr-May	-	-	-	18.00	-	**18.00**
Jun-Jul	18.00	-	-	18.00	6.00	**3.60**
Aug-Sep	-	6.00	18.00	9.00	1.64	**1.06**
Oct-Nov	-	-	-	-	18.00	**18.00**
All Periods	**18.00**	**4.50**	**18.00**	**4.50**	**0.82**	**0.56**

3.10 Norton Sound/St. Lawrence Island

The Norton Sound/St. Lawrence Island region covers approximately 1,000 square miles. During 1995 – 2012, there were 92 incidents (Figure 21). There were on average five incidents per year. Nearly 84% of these incidents involved light oils (e.g., diesel) (Table 29). The return-year value for incidents in the Norton Sound/St. Lawrence Island region is 0.2, or one incident about every 2.5 months (Table 30).

Figure 21: Distribution of Incidents in Norton Sound/St. Lawrence Island 1995 – 2012 (AKRID)

Table 29: Annual Incident Rates by Period and Oil Type – Norton Sound/St. Lawrence I. (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	0.12	-	0.28	**0.39**
Feb-Mar	-	0.11	-	0.39	**0.50**
Apr-May	-	0.06	-	0.33	**0.39**
Jun-Jul	-	0.18	0.06	1.50	**1.72**
Aug-Sep	-	0.17	0.11	1.06	**1.33**
Oct-Nov	-	0.06	-	0.72	**0.78**
All Periods	**-**	**0.78**	**0.17**	**4.28**	**5.11**

Table 30: Incident Return Years by Period and Oil Type – Norton Sound/St. Lawrence I. (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	8.33	-	3.60	**2.57**
Feb-Mar	-	9.09	-	2.57	**2.00**
Apr-May	-	16.67	-	3.00	**2.57**
Jun-Jul	-	5.56	18.00	0.67	**0.58**
Aug-Sep	-	5.88	9.00	0.95	**0.75**
Oct-Nov	-	16.67	-	1.38	**1.29**
All Periods	**-**	**1.28**	**6.00**	**0.23**	**0.20**

3.11 Offshore Kenai Peninsula

The Offshore Kenai Peninsula region covers approximately 880 square miles. During 1995 – 2012, there were 255 incidents (Figure 22). There were on average 14 incidents per year. Nearly 91% of these incidents involved light oils (e.g., diesel) (Table 31). The return-year value for incidents in Offshore Kenai Peninsula is 0.07, or one incident about every 26 days (Table 32).

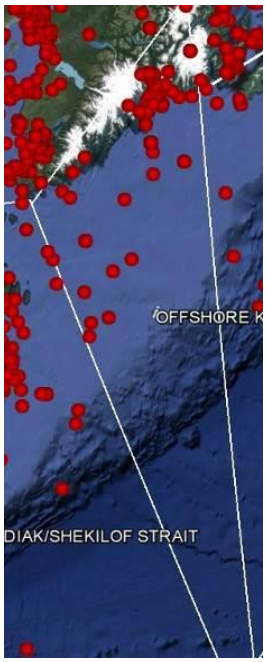

Figure 22: Distribution of Incidents in Offshore Kenai Peninsula Region 1995 – 2012 (AKRID)

Table 31: Annual Incident Rates by Period and Oil Type – Offshore Kenai Peninsula (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	-	0.11	1.28	**1.39**
Feb-Mar	0.06	0.22	0.11	2.11	**2.50**
Apr-May	-	0.17	0.06	2.61	**2.83**
Jun-Jul	-	0.11	-	3.00	**3.11**
Aug-Sep	-	0.33	0.06	2.22	**2.61**
Oct-Nov	-	0.06	-	1.67	**1.72**
All Periods	**0.06**	**0.89**	**0.33**	**12.89**	**14.17**

Table 32: Incident Return Years by Period and Oil Type – Offshore Kenai Peninsula (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	-	9.00	0.78	**0.72**
Feb-Mar	18.00	4.55	9.00	0.47	**0.40**
Apr-May	-	5.88	18.00	0.38	**0.35**
Jun-Jul	-	9.09	-	0.33	**0.32**
Aug-Sep	-	3.03	18.00	0.45	**0.38**
Oct-Nov	-	16.67	-	0.60	**0.58**
All Periods	**18.00**	**1.12**	**3.00**	**0.08**	**0.07**

3.12 South-Central Alaska

The South-Central Alaska region covers approximately 1,000 square miles. During 1995 – 2012, there were 103 incidents (Figure 23). There were on average nearly six incidents per year. Nearly 79% of these incidents involved light oils (e.g., diesel) (Table 33). The return-year value for incidents in South-Central Alaska is 0.17, or one incident about every 64 days, just over two months (Table 34).

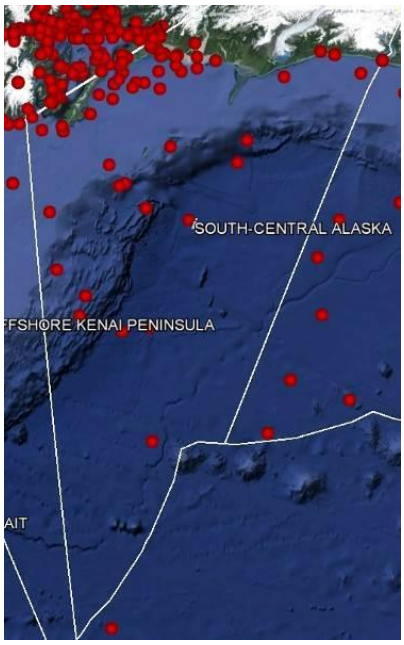

Figure 23: Distribution of Incidents in South-Central Alaska Region 1995 – 2012 (AKRID)

Table 33: Annual Incident Rates by Period and Oil Type – South-Central Alaska (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	0.11	-	0.06	0.39	**0.56**
Feb-Mar	0.11	-	0.11	0.83	**1.06**
Apr-May	0.06	0.22	0.11	1.11	**1.50**
Jun-Jul	0.06	0.11	0.06	0.78	**1.00**
Aug-Sep	-	0.11	0.06	0.94	**1.11**
Oct-Nov	0.06	-	-	0.44	**0.50**
All Periods	**0.39**	**0.44**	**0.39**	**4.50**	**5.72**

Table 34: Incident Return Years by Period and Oil Type – South-Central Alaska (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	9.00	-	18.00	2.57	**1.80**
Feb-Mar	9.00	-	9.00	1.20	**0.95**
Apr-May	18.00	4.50	9.00	0.90	**0.67**
Jun-Jul	18.00	9.00	18.00	1.29	**1.00**
Aug-Sep	-	9.00	18.00	1.06	**0.90**
Oct-Nov	18.00	-	-	2.25	**2.00**
All Periods	**2.57**	**2.25**	**2.57**	**0.22**	**0.17**

3.13 Prince William Sound

The Prince William Sound region covers approximately 300 square miles. During 1995 – 2012, there were 947 incidents (Figure 24). This region had the highest number of incidents per square mile of all the regions. There were on average nearly 53 incidents per year. Nearly 86% of these incidents involvde light oils (e.g., diesel) (Table 35). Nearly 7% of incidents involved crude oil. The return-year value for incidents in Prince William Sound is 0.02, or one incident about every week (Table 36).

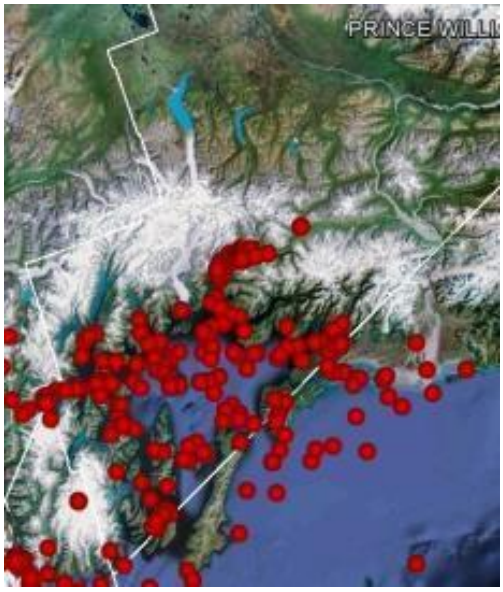

Figure 24: Distribution of Incidents in Prince William Sound Region 1995 – 2012 (AKRID)

Table 35: Annual Incident Rates by Period and Oil Type – Prince William Sound (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	0.83	0.39	0.06	5.67	**6.94**
Feb-Mar	0.61	0.39	0.06	6.22	**7.28**
Apr-May	0.50	0.78	0.06	7.56	**8.89**
Jun-Jul	0.67	0.84	0.28	12.17	**13.94**
Aug-Sep	0.28	0.28	0.06	8.50	**9.11**
Oct-Nov	0.56	0.73	0.17	5.00	**6.44**
All Periods	**3.44**	**3.39**	**0.67**	**45.12**	**52.61**

Table 36: Incident Return Years by Period and Oil Type – Prince William Sound (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	1.20	2.56	16.67	0.18	**0.14**
Feb-Mar	1.64	2.56	16.67	0.16	**0.14**
Apr-May	2.00	1.28	16.67	0.13	**0.11**
Jun-Jul	1.49	1.19	3.57	0.08	**0.07**
Aug-Sep	3.57	3.57	16.67	0.12	**0.11**
Oct-Nov	1.79	1.37	5.88	0.20	**0.16**
All Periods	**0.08**	**0.25**	**0.40**	**0.02**	**0.02**

3.14 Southeast Alaska

The Southeast Alaska region covers approximately 1,500 square miles. During 1995 – 2012, there were 3,631 incidents of spills and potential spills (Figure 25). This was the largest number of incidents in any region. There were on average 202 incidents per year. Nearly 91% of these incidents involved light oils (e.g., diesel) (Table 37). About 7% involved distillate. The return-year value for incidents in the Southeast region is 0.005, or one incident about every two days (Table 38).

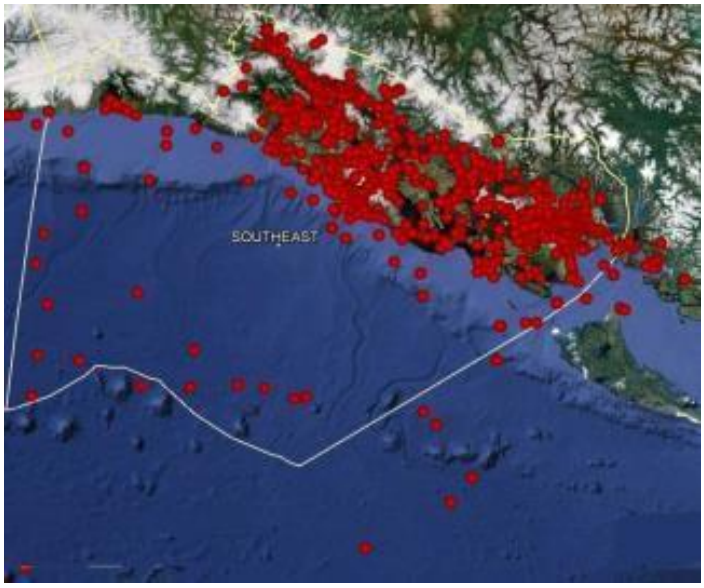

Figure 25: Distribution of Incidents in Southeast Alaska Region 1995 – 2012 (AKRID)

Table 37: Annual Incident Rates by Period and Oil Type – Southeast Alaska (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	0.06	2.11	0.39	20.17	**22.72**
Feb-Mar	0.06	1.61	0.33	27.56	**29.56**
Apr-May	-	1.72	0.33	25.84	**27.89**
Jun-Jul	-	3.72	0.50	44.28	**48.50**
Aug-Sep	0.06	3.61	0.67	38.95	**43.28**
Oct-Nov	-	2.83	0.78	26.17	**29.78**
All Periods	**0.18**	**15.62**	**3.00**	**182.97**	**201.72**

Table 38: Incident Return Years by Period and Oil Type – Southeast Alaska (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	16.67	0.47	2.56	0.05	**0.044**
Feb-Mar	16.67	0.62	3.03	0.04	**0.034**
Apr-May	-	0.58	3.03	0.04	**0.036**
Jun-Jul	-	0.27	2.00	0.02	**0.021**
Aug-Sep	16.67	0.28	1.49	0.03	**0.023**
Oct-Nov	-	0.35	1.28	0.04	**0.034**
All Periods	**2.27**	**0.06**	**0.33**	**0.01**	**0.005**

3.15 Western Alaska

The Western Alaska region covers approximately 2,200 square miles. During 1995 – 2012, there were 334 incidents (Figure 26). There were on average nearly 19 incidents per year. Nearly 86% of these incidents involved light oils (e.g., diesel) (Table 39). The return-year value for incidents in the Western Alaska region is 0.05, or one incident about every 20 days (Table 40).

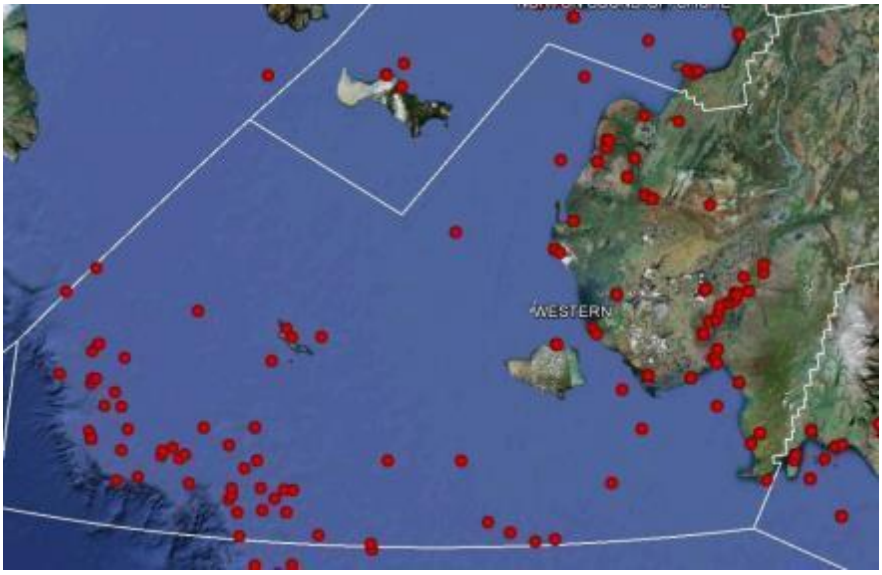

Figure 26: Distribution of Incidents in Western Alaska Region 1995 – 2012[54] (AKRID)

Table 39: Annual Incident Rates by Period and Oil Type – Western Alaska (AKRID)					
Period	**Incidents/Year**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	0.22	-	1.28	**1.50**
Feb-Mar	-	0.11	-	1.67	**1.78**
Apr-May	-	0.23	0.06	2.89	**3.17**
Jun-Jul	-	0.72	-	4.00	**4.72**
Aug-Sep	-	1.06	0.11	4.39	**5.56**
Oct-Nov	-	-	0.11	1.72	**1.83**
All Periods	**-**	**2.34**	**0.28**	**15.94**	**18.56**

[54] Note that incidents occurring in rivers within US Coast Guard jurisdiction are included.

Table 40: Incident Return Years by Period and Oil Type – Western Alaska (AKRID)					
Period	**Return Year Value**				
	Crude	**Distillate**	**Heavy**	**Light**	**All Oils**
Dec-Jan	-	4.50	-	0.78	**0.67**
Feb-Mar	-	9.00	-	0.60	**0.56**
Apr-May	-	4.35	18.00	0.35	**0.32**
Jun-Jul	-	1.39	-	0.25	**0.21**
Aug-Sep	-	0.94	9.00	0.23	**0.18**
Oct-Nov	-	-	9.00	0.58	**0.55**
All Periods	**-**	**0.43**	**3.60**	**0.06**	**0.05**

3.16 Ordered Frequency of Incident Types (Region, Oil Type, Period)

The incident frequencies by region, oil type, and period, F_{rop}, were calculated based on the historical data for the years 1995 through 2012. The incident frequencies over the years 1995 through 2012 reflect the probability that an incident might occur in the present time. This is known as the "baseline frequency".

The incident frequencies were calculated as follows for the 18-year time period of 1995 through 2012:

$$F_{rop} = \frac{\sum_{y=0}^{y=t} (n_{rop\,y})}{t}$$

Where F_{rop} = the annual frequency of incidents of region *r*, oil type *o*, and time period *p;*

n_{rop} = the number of incidents of region *r*, oil type *o*, and time period *p* in year *y*;

t = the total number of years included in the analysis

The F_{rop} values were then ordered from highest (most frequent or most-probable incident event) to the lowest. F_{rop} values are the expected number of incidents that may potentially lead to spillage that occur in a given year based on the region, oil type, and period. The F_{rop} values were categorized by general frequency as shown in Table 41.

Table 41: Incident Frequency Ratings		
Category	**Incidents/Year**	**Number of Incident Types (Region/Oil Type/Period)**
Highest	21 – 45	5
Very High	10 – 20	13
High	5 – 9	19
Moderate	2 – 4	20
Low	1	17
Very Low	< 1	163
Lowest	None	99

The F_{rop} values were also scaled relative to the highest value to derive a relative frequency R_{rop} as per:

$$R_{rop_i} = \frac{F_{rop_i}}{F_{rop_{\max}}}$$

The F_{rop} varies from 1.0 for the highest frequency to 0.0 for lowest frequency. The R_{rop} value provides a measure of the likelihood of a given incident to be of a certain type (region, oil type, period*). Note that while the* F_{rop} *and* R_{rop} *address the issue of the expected incident number and probability of a given incident to be of a particular type, respectively, neither of these measures addresses the magnitude of the impact, which will be determined by both the volume of the spillage, if any, as well as the sensitivity of the receiving environment to that oil type in that region and in that time period. This is addressed later.*

The frequency values and ratings are shown in Table 42. Table 42 and all tables to follow employ the color-code key shown in Figure 27.

Figure 27: Color-Code Key for Tables and Figures

In a given year, one can expect that there will be 183 incidents involving light oil in the Southeast Alaska region, with the highest numbers (45%) occurring during the combined period of June through September. This is reflective of the high level of recreational boating and fishing that occurs in this region during this time. Even during the other months, incidents involving light oil in the Southeast Alaska region are more frequent than any other type of incident in all of Alaska. The next most frequent incident type is a light oil incident in the Aleutians during February – March.

Table 42: Incident Frequencies by Region, Oil Type, and Period (1995 – 2012 Data)

Region	Oil Type	Period	F_{rop}	R_{rop}	Frequency Category
Southeast Alaska	**Light**	**Jun-Jul**	44.28	1.000	**HIGHEST (>20 Incidents/Year)**
Southeast Alaska	**Light**	**Aug-Sep**	38.95	0.880	
Southeast Alaska	**Light**	**Feb-Mar**	27.56	0.622	
Southeast Alaska	**Light**	**Oct-Nov**	26.17	0.591	
Southeast Alaska	**Light**	**Apr-May**	25.84	0.584	
Southeast Alaska	**Light**	**Dec-Jan**	20.17	0.456	**VERY HIGH (10 – 20 Incidents/Year)**
Aleutians	**Light**	**Feb-Mar**	19.78	0.447	
Aleutians	**Light**	**Aug-Sep**	16.44	0.371	
Beaufort Sea	**Light**	**Feb-Mar**	13.50	0.305	
Aleutians	**Light**	**Jun-Jul**	13.45	0.304	
Cook Inlet	**Light**	**Jun-Jul**	12.72	0.287	
Aleutians	**Light**	**Apr-May**	12.44	0.281	
Prince William Sound	**Light**	**Jun-Jul**	12.17	0.275	
Beaufort Sea	**Light**	**Apr-May**	12.00	0.271	
Aleutians	**Light**	**Oct-Nov**	11.33	0.256	
Cook Inlet	**Light**	**Aug-Sep**	11.33	0.256	
Aleutians	**Light**	**Dec-Jan**	11.28	0.255	
Beaufort Sea	**Light**	**Dec-Jan**	10.67	0.241	
Beaufort Sea	**Light**	**Jun-Jul**	9.89	0.223	**HIGH (5 – 9 Incidents/Year)**
Cook Inlet	**Light**	**Apr-May**	9.83	0.222	
Beaufort Sea	**Light**	**Aug-Sep**	9.33	0.211	
Kodiak/Shelikof	**Light**	**Jun-Jul**	9.17	0.207	
Prince William Sound	**Light**	**Aug-Sep**	8.50	0.192	
Beaufort Sea	**Light**	**Oct-Nov**	7.72	0.174	
Cook Inlet	**Light**	**Feb-Mar**	7.61	0.172	

Table 42: Incident Frequencies by Region, Oil Type, and Period (1995 – 2012 Data)					
Region	**Oil Type**	**Period**	F_{rop}	R_{rop}	**Frequency Category**
Prince William Sound	**Light**	**Apr-May**	7.56	0.171	
Kodiak/Shelikof	**Light**	**Feb-Mar**	7.45	0.168	
Kodiak/Shelikof	**Light**	**Apr-May**	7.28	0.164	
Cook Inlet	**Light**	**Oct-Nov**	7.06	0.159	
Kodiak/Shelikof	**Light**	**Dec-Jan**	7.00	0.158	
Kodiak/Shelikof	**Light**	**Aug-Sep**	6.89	0.156	
Cook Inlet	**Light**	**Dec-Jan**	6.78	0.153	
Bristol Bay	**Light**	**Jun-Jul**	6.45	0.146	
Prince William Sound	**Light**	**Feb-Mar**	6.22	0.140	
Kodiak/Shelikof	**Light**	**Oct-Nov**	6.00	0.136	
Prince William Sound	**Light**	**Dec-Jan**	5.67	0.128	
Prince William Sound	**Light**	**Oct-Nov**	5.00	0.113	
Beaufort Sea	**Crude**	**Jun-Jul**	4.61	0.104	
Western Alaska	**Light**	**Aug-Sep**	4.39	0.099	
Western Alaska	**Light**	**Jun-Jul**	4.00	0.090	
Beaufort Sea	**Crude**	**Apr-May**	3.72	0.084	
Southeast Alaska	**Distillate**	**Jun-Jul**	3.72	0.084	
Southeast Alaska	**Distillate**	**Aug-Sep**	3.61	0.082	
Beaufort Sea	**Crude**	**Feb-Mar**	3.28	0.074	
Cook Inlet	**Crude**	**Aug-Sep**	3.00	0.068	
Off Kenai Peninsula	**Light**	**Jun-Jul**	3.00	0.068	
Cook Inlet	**Crude**	**Apr-May**	2.94	0.066	**MODERATE (2 – 4 Incidents/Year)**
Beaufort Sea	**Crude**	**Aug-Sep**	2.89	0.065	
Western Alaska	**Light**	**Apr-May**	2.89	0.065	
Southeast Alaska	**Distillate**	**Oct-Nov**	2.83	0.064	
Off Kenai Peninsula	**Light**	**Apr-May**	2.61	0.059	
Beaufort Sea	**Crude**	**Oct-Nov**	2.39	0.054	
Off Kenai Peninsula	**Light**	**Aug-Sep**	2.22	0.050	
Cook Inlet	**Crude**	**Jun-Jul**	2.17	0.049	
Off Kenai Peninsula	**Light**	**Feb-Mar**	2.11	0.048	
Southeast Alaska	**Distillate**	**Dec-Jan**	2.11	0.048	
Bristol Bay	**Light**	**Apr-May**	2.06	0.047	
Beaufort Sea	**Crude**	**Dec-Jan**	1.83	0.041	
Cook Inlet	**Crude**	**Feb-Mar**	1.72	0.039	
Southeast Alaska	**Distillate**	**Apr-May**	1.72	0.039	
Western Alaska	**Light**	**Oct-Nov**	1.72	0.039	
Off Kenai Peninsula	**Light**	**Oct-Nov**	1.67	0.038	
Western Alaska	**Light**	**Feb-Mar**	1.67	0.038	
Southeast Alaska	**Distillate**	**Feb-Mar**	1.61	0.036	
Norton/St. Lawrence	**Light**	**Jun-Jul**	1.50	0.034	
Cook Inlet	**Crude**	**Dec-Jan**	1.33	0.030	**LOW (1 Incident/Year)**
Cook Inlet	**Crude**	**Oct-Nov**	1.33	0.030	
Off Kenai Peninsula	**Light**	**Dec-Jan**	1.28	0.029	
Western Alaska	**Light**	**Dec-Jan**	1.28	0.029	
Bristol Bay	**Light**	**Aug-Sep**	1.22	0.028	
Cook Inlet	**Distillate**	**Apr-May**	1.11	0.025	
Off Prince William Sound	**Light**	**Apr-May**	1.11	0.025	
Norton/St. Lawrence	**Light**	**Aug-Sep**	1.06	0.024	
Western Alaska	**Distillate**	**Aug-Sep**	1.06	0.024	
Off Prince William Sound	**Light**	**Aug-Sep**	0.94	0.021	**VERY LOW**

Table 42: Incident Frequencies by Region, Oil Type, and Period (1995 – 2012 Data)					
Region	**Oil Type**	**Period**	F_{rop}	R_{rop}	**Frequency Category**
Prince William Sound	**Distillate**	**Jun-Jul**	0.84	0.019	**(< 1 Incident/Year)**
Cook Inlet	**Distillate**	**Aug-Sep**	0.83	0.019	
Off Prince William Sound	**Light**	**Feb-Mar**	0.83	0.019	
Prince William Sound	**Crude**	**Dec-Jan**	0.83	0.019	
Aniakchak	**Light**	**Feb-Mar**	0.78	0.018	
Off Prince William Sound	**Light**	**Jun-Jul**	0.78	0.018	
Prince William Sound	**Distillate**	**Apr-May**	0.78	0.018	
Southeast Alaska	**Heavy**	**Oct-Nov**	0.78	0.018	
Prince William Sound	**Distillate**	**Oct-Nov**	0.73	0.016	
Cook Inlet	**Distillate**	**Jun-Jul**	0.72	0.016	
Hope Basin	**Light**	**Jun-Jul**	0.72	0.016	
Norton/St. Lawrence	**Light**	**Oct-Nov**	0.72	0.016	
Western Alaska	**Distillate**	**Jun-Jul**	0.72	0.016	
Aleutians	**Heavy**	**Aug-Sep**	0.67	0.015	
Cook Inlet	**Heavy**	**Aug-Sep**	0.67	0.015	
Prince William Sound	**Crude**	**Jun-Jul**	0.67	0.015	
Southeast Alaska	**Heavy**	**Aug-Sep**	0.67	0.015	
Aniakchak	**Light**	**Jun-Jul**	0.61	0.014	
Aniakchak	**Light**	**Aug-Sep**	0.61	0.014	
Chukchi Sea	**Light**	**Aug-Sep**	0.61	0.014	
Prince William Sound	**Crude**	**Feb-Mar**	0.61	0.014	
Aleutians	**Heavy**	**Dec-Jan**	0.56	0.013	
Bristol Bay	**Light**	**Feb-Mar**	0.56	0.013	
Prince William Sound	**Crude**	**Oct-Nov**	0.56	0.013	
Aleutians	**Distillate**	**Aug-Sep**	0.50	0.011	
Aleutians	**Heavy**	**Feb-Mar**	0.50	0.011	
Cook Inlet	**Distillate**	**Feb-Mar**	0.50	0.011	
Cook Inlet	**Heavy**	**Jun-Jul**	0.50	0.011	
Prince William Sound	**Crude**	**Apr-May**	0.50	0.011	
Southeast Alaska	**Heavy**	**Jun-Jul**	0.50	0.011	
Aleutians	**Heavy**	**Oct-Nov**	0.44	0.010	
Bristol Bay	**Distillate**	**Apr-May**	0.44	0.010	
Hope Basin	**Light**	**Oct-Nov**	0.44	0.010	
Off Prince William Sound	**Light**	**Oct-Nov**	0.44	0.010	
Aleutians	**Distillate**	**Apr-May**	0.39	0.009	
Aleutians	**Heavy**	**Jun-Jul**	0.39	0.009	
Aniakchak	**Light**	**Apr-May**	0.39	0.009	
Bristol Bay	**Light**	**Oct-Nov**	0.39	0.009	
Cook Inlet	**Distillate**	**Dec-Jan**	0.39	0.009	
Cook Inlet	**Distillate**	**Oct-Nov**	0.39	0.009	
Cook Inlet	**Heavy**	**Apr-May**	0.39	0.009	
Cook Inlet	**Heavy**	**Oct-Nov**	0.39	0.009	
Kodiak/Shelikof	**Distillate**	**Apr-May**	0.39	0.009	
Norton/St. Lawrence	**Light**	**Feb-Mar**	0.39	0.009	
Off Prince William Sound	**Light**	**Dec-Jan**	0.39	0.009	
Prince William Sound	**Distillate**	**Dec-Jan**	0.39	0.009	
Prince William Sound	**Distillate**	**Feb-Mar**	0.39	0.009	
Southeast Alaska	**Heavy**	**Dec-Jan**	0.39	0.009	
Bristol Bay	**Distillate**	**Jun-Jul**	0.34	0.008	
Hope Basin	**Light**	**Aug-Sep**	0.33	0.007	

Table 42: Incident Frequencies by Region, Oil Type, and Period (1995 – 2012 Data)					
Region	**Oil Type**	**Period**	F_{rop}	R_{rop}	**Frequency Category**
Kodiak/Shelikof	**Distillate**	**Dec-Jan**	0.33	0.007	
Norton/St. Lawrence	**Light**	**Apr-May**	0.33	0.007	
Off Kenai Peninsula	**Distillate**	**Aug-Sep**	0.33	0.007	
Southeast Alaska	**Heavy**	**Feb-Mar**	0.33	0.007	
Southeast Alaska	**Heavy**	**Apr-May**	0.33	0.007	
Aleutians	**Distillate**	**Jun-Jul**	0.28	0.006	
Aleutians	**Distillate**	**Oct-Nov**	0.28	0.006	
Aniakchak	**Light**	**Oct-Nov**	0.28	0.006	
Bristol Bay	**Heavy**	**Jun-Jul**	0.28	0.006	
Bristol Bay	**Light**	**Dec-Jan**	0.28	0.006	
Cook Inlet	**Heavy**	**Dec-Jan**	0.28	0.006	
Cook Inlet	**Heavy**	**Feb-Mar**	0.28	0.006	
Hope Basin	**Light**	**Feb-Mar**	0.28	0.006	
Kodiak/Shelikof	**Distillate**	**Jun-Jul**	0.28	0.006	
Kodiak/Shelikof	**Heavy**	**Oct-Nov**	0.28	0.006	
Chukchi Sea	**Distillate**	**Aug-Sep**	0.28	0.006	
Norton/St. Lawrence	**Light**	**Dec-Jan**	0.28	0.006	
Prince William Sound	**Crude**	**Aug-Sep**	0.28	0.006	
Prince William Sound	**Distillate**	**Aug-Sep**	0.28	0.006	
Prince William Sound	**Heavy**	**Jun-Jul**	0.28	0.006	
Kodiak/Shelikof	**Distillate**	**Oct-Nov**	0.23	0.005	
Western Alaska	**Distillate**	**Apr-May**	0.23	0.005	
Aleutians	**Gasoline**	**Dec-Jan**	0.22	0.005	
Aleutians	**Heavy**	**Apr-May**	0.22	0.005	
Beaufort Sea	**Heavy**	**Aug-Sep**	0.22	0.005	
Chukchi Sea	**Light**	**Dec-Jan**	0.22	0.005	
Off Kenai Peninsula	**Distillate**	**Feb-Mar**	0.22	0.005	
Off Prince William Sound	**Distillate**	**Apr-May**	0.22	0.005	
Western Alaska	**Distillate**	**Dec-Jan**	0.22	0.005	
Norton/St. Lawrence	**Distillate**	**Jun-Jul**	0.18	0.004	
Bristol Bay	**Distillate**	**Aug-Sep**	0.17	0.004	
Hope Basin	**Light**	**Apr-May**	0.17	0.004	
Kodiak/Shelikof	**Heavy**	**Dec-Jan**	0.17	0.004	
Kodiak/Shelikof	**Heavy**	**Apr-May**	0.17	0.004	
Kodiak/Shelikof	**Heavy**	**Aug-Sep**	0.17	0.004	
Chukchi Sea	**Light**	**Feb-Mar**	0.17	0.004	
Chukchi Sea	**Light**	**Jun-Jul**	0.17	0.004	
Norton/St. Lawrence	**Distillate**	**Aug-Sep**	0.17	0.004	
Off Kenai Peninsula	**Distillate**	**Apr-May**	0.17	0.004	
Prince William Sound	**Heavy**	**Oct-Nov**	0.17	0.004	
Aleutians	**Distillate**	**Feb-Mar**	0.12	0.003	
Bristol Bay	**Distillate**	**Oct-Nov**	0.12	0.003	
Hope Basin	**Distillate**	**Jun-Jul**	0.12	0.003	
Norton/St. Lawrence	**Distillate**	**Dec-Jan**	0.12	0.003	
Aniakchak	**Crude**	**Apr-May**	0.11	0.002	
Aniakchak	**Heavy**	**Dec-Jan**	0.11	0.002	
Aniakchak	**Light**	**Dec-Jan**	0.11	0.002	
Beaufort Sea	**Distillate**	**Jun-Jul**	0.11	0.002	
Beaufort Sea	**Distillate**	**Aug-Sep**	0.11	0.002	
Bristol Bay	**Heavy**	**Aug-Sep**	0.11	0.002	

Table 42: Incident Frequencies by Region, Oil Type, and Period (1995 – 2012 Data)					
Region	**Oil Type**	**Period**	F_{rop}	R_{rop}	**Frequency Category**
Hope Basin	**Distillate**	**Aug-Sep**	0.11	0.002	
Hope Basin	**Light**	**Dec-Jan**	0.11	0.002	
Kodiak/Shelikof	**Crude**	**Feb-Mar**	0.11	0.002	
Kodiak/Shelikof	**Crude**	**Apr-May**	0.11	0.002	
Kodiak/Shelikof	**Distillate**	**Feb-Mar**	0.11	0.002	
Kodiak/Shelikof	**Distillate**	**Aug-Sep**	0.11	0.002	
Kodiak/Shelikof	**Heavy**	**Feb-Mar**	0.11	0.002	
Norton/St. Lawrence	**Distillate**	**Feb-Mar**	0.11	0.002	
Norton/St. Lawrence	**Heavy**	**Aug-Sep**	0.11	0.002	
Off Kenai Peninsula	**Distillate**	**Jun-Jul**	0.11	0.002	
Off Kenai Peninsula	**Heavy**	**Dec-Jan**	0.11	0.002	
Off Kenai Peninsula	**Heavy**	**Feb-Mar**	0.11	0.002	
Off Prince William Sound	**Crude**	**Dec-Jan**	0.11	0.002	
Off Prince William Sound	**Crude**	**Feb-Mar**	0.11	0.002	
Off Prince William Sound	**Distillate**	**Jun-Jul**	0.11	0.002	
Off Prince William Sound	**Distillate**	**Aug-Sep**	0.11	0.002	
Off Prince William Sound	**Heavy**	**Feb-Mar**	0.11	0.002	
Off Prince William Sound	**Heavy**	**Apr-May**	0.11	0.002	
Western Alaska	**Distillate**	**Feb-Mar**	0.11	0.002	
Western Alaska	**Heavy**	**Aug-Sep**	0.11	0.002	
Western Alaska	**Heavy**	**Oct-Nov**	0.11	0.002	
Aniakchak	**Distillate**	**Apr-May**	0.06	0.001	
Aniakchak	**Distillate**	**Jun-Jul**	0.06	0.001	
Aniakchak	**Distillate**	**Oct-Nov**	0.06	0.001	
Aniakchak	**Heavy**	**Jun-Jul**	0.06	0.001	
Aniakchak	**Heavy**	**Oct-Nov**	0.06	0.001	
Beaufort Sea	**Heavy**	**Oct-Nov**	0.06	0.001	
Bristol Bay	**Heavy**	**Feb-Mar**	0.06	0.001	
Bristol Bay	**Heavy**	**Apr-May**	0.06	0.001	
Hope Basin	**Distillate**	**Apr-May**	0.06	0.001	
Hope Basin	**Distillate**	**Oct-Nov**	0.06	0.001	
Hope Basin	**Heavy**	**Aug-Sep**	0.06	0.001	
Hope Basin	**Heavy**	**Oct-Nov**	0.06	0.001	
Kodiak/Shelikof	**Crude**	**Oct-Nov**	0.06	0.001	
Kodiak/Shelikof	**Heavy**	**Jun-Jul**	0.06	0.001	
Chukchi Sea	**Crude**	**Jun-Jul**	0.06	0.001	
Chukchi Sea	**Distillate**	**Feb-Mar**	0.06	0.001	
Chukchi Sea	**Distillate**	**Apr-May**	0.06	0.001	
Chukchi Sea	**Distillate**	**Jun-Jul**	0.06	0.001	
Chukchi Sea	**Heavy**	**Aug-Sep**	0.06	0.001	
Chukchi Sea	**Light**	**Oct-Nov**	0.06	0.001	
Norton/St. Lawrence	**Distillate**	**Apr-May**	0.06	0.001	
Norton/St. Lawrence	**Distillate**	**Oct-Nov**	0.06	0.001	
Norton/St. Lawrence	**Heavy**	**Jun-Jul**	0.06	0.001	
Off Kenai Peninsula	**Crude**	**Feb-Mar**	0.06	0.001	
Off Kenai Peninsula	**Distillate**	**Oct-Nov**	0.06	0.001	
Off Kenai Peninsula	**Heavy**	**Apr-May**	0.06	0.001	
Off Kenai Peninsula	**Heavy**	**Aug-Sep**	0.06	0.001	
Off Prince William Sound	**Crude**	**Apr-May**	0.06	0.001	
Off Prince William Sound	**Crude**	**Jun-Jul**	0.06	0.001	

Table 42: Incident Frequencies by Region, Oil Type, and Period (1995 – 2012 Data)					
Region	**Oil Type**	**Period**	F_{rop}	R_{rop}	**Frequency Category**
Off Prince William Sound	**Crude**	**Oct-Nov**	0.06	0.001	
Off Prince William Sound	**Heavy**	**Dec-Jan**	0.06	0.001	
Off Prince William Sound	**Heavy**	**Jun-Jul**	0.06	0.001	
Off Prince William Sound	**Heavy**	**Aug-Sep**	0.06	0.001	
Prince William Sound	**Heavy**	**Dec-Jan**	0.06	0.001	
Prince William Sound	**Heavy**	**Feb-Mar**	0.06	0.001	
Prince William Sound	**Heavy**	**Apr-May**	0.06	0.001	
Prince William Sound	**Heavy**	**Aug-Sep**	0.06	0.001	
Southeast Alaska	**Crude**	**Dec-Jan**	0.06	0.001	
Southeast Alaska	**Crude**	**Feb-Mar**	0.06	0.001	
Southeast Alaska	**Crude**	**Aug-Sep**	0.06	0.001	
Western Alaska	**Heavy**	**Apr-May**	0.06	0.001	
Aleutians	**Crude**	**Dec-Jan**	0.00	0.000	
Aleutians	**Crude**	**Feb-Mar**	0.00	0.000	
Aleutians	**Crude**	**Apr-May**	0.00	0.000	
Aleutians	**Crude**	**Jun-Jul**	0.00	0.000	
Aleutians	**Crude**	**Aug-Sep**	0.00	0.000	
Aleutians	**Crude**	**Oct-Nov**	0.00	0.000	
Aniakchak	**Crude**	**Dec-Jan**	0.00	0.000	
Aniakchak	**Crude**	**Feb-Mar**	0.00	0.000	
Aniakchak	**Crude**	**Jun-Jul**	0.00	0.000	
Aniakchak	**Crude**	**Aug-Sep**	0.00	0.000	
Aniakchak	**Crude**	**Oct-Nov**	0.00	0.000	
Aniakchak	**Distillate**	**Dec-Jan**	0.00	0.000	
Aniakchak	**Distillate**	**Feb-Mar**	0.00	0.000	
Aniakchak	**Distillate**	**Aug-Sep**	0.00	0.000	
Aniakchak	**Heavy**	**Feb-Mar**	0.00	0.000	
Aniakchak	**Heavy**	**Apr-May**	0.00	0.000	
Aniakchak	**Heavy**	**Aug-Sep**	0.00	0.000	
Beaufort Sea	**Distillate**	**Dec-Jan**	0.00	0.000	
Beaufort Sea	**Distillate**	**Feb-Mar**	0.00	0.000	**LOWEST (No Incidents)**
Beaufort Sea	**Distillate**	**Apr-May**	0.00	0.000	
Beaufort Sea	**Distillate**	**Oct-Nov**	0.00	0.000	
Beaufort Sea	**Heavy**	**Dec-Jan**	0.00	0.000	
Beaufort Sea	**Heavy**	**Feb-Mar**	0.00	0.000	
Beaufort Sea	**Heavy**	**Apr-May**	0.00	0.000	
Beaufort Sea	**Heavy**	**Jun-Jul**	0.00	0.000	
Bristol Bay	**Crude**	**Dec-Jan**	0.00	0.000	
Bristol Bay	**Crude**	**Feb-Mar**	0.00	0.000	
Bristol Bay	**Crude**	**Apr-May**	0.00	0.000	
Bristol Bay	**Crude**	**Jun-Jul**	0.00	0.000	
Bristol Bay	**Crude**	**Aug-Sep**	0.00	0.000	
Bristol Bay	**Crude**	**Oct-Nov**	0.00	0.000	
Bristol Bay	**Distillate**	**Dec-Jan**	0.00	0.000	
Bristol Bay	**Distillate**	**Feb-Mar**	0.00	0.000	
Bristol Bay	**Heavy**	**Dec-Jan**	0.00	0.000	
Bristol Bay	**Heavy**	**Oct-Nov**	0.00	0.000	
Hope Basin	**Crude**	**Dec-Jan**	0.00	0.000	
Hope Basin	**Crude**	**Feb-Mar**	0.00	0.000	
Hope Basin	**Crude**	**Apr-May**	0.00	0.000	

Table 42: Incident Frequencies by Region, Oil Type, and Period (1995 – 2012 Data)					
Region	**Oil Type**	**Period**	F_{rop}	R_{rop}	**Frequency Category**
Hope Basin	**Crude**	**Jun-Jul**	0.00	0.000	
Hope Basin	**Crude**	**Aug-Sep**	0.00	0.000	
Hope Basin	**Crude**	**Oct-Nov**	0.00	0.000	
Hope Basin	**Distillate**	**Dec-Jan**	0.00	0.000	
Hope Basin	**Distillate**	**Feb-Mar**	0.00	0.000	
Hope Basin	**Heavy**	**Dec-Jan**	0.00	0.000	
Hope Basin	**Heavy**	**Feb-Mar**	0.00	0.000	
Hope Basin	**Heavy**	**Apr-May**	0.00	0.000	
Hope Basin	**Heavy**	**Jun-Jul**	0.00	0.000	
Kodiak/Shelikof	**Crude**	**Dec-Jan**	0.00	0.000	
Kodiak/Shelikof	**Crude**	**Jun-Jul**	0.00	0.000	
Kodiak/Shelikof	**Crude**	**Aug-Sep**	0.00	0.000	
Chukchi Sea	**Crude**	**Dec-Jan**	0.00	0.000	
Chukchi Sea	**Crude**	**Feb-Mar**	0.00	0.000	
Chukchi Sea	**Crude**	**Apr-May**	0.00	0.000	
Chukchi Sea	**Crude**	**Aug-Sep**	0.00	0.000	
Chukchi Sea	**Crude**	**Oct-Nov**	0.00	0.000	
Chukchi Sea	**Distillate**	**Dec-Jan**	0.00	0.000	
Chukchi Sea	**Distillate**	**Oct-Nov**	0.00	0.000	
Chukchi Sea	**Heavy**	**Dec-Jan**	0.00	0.000	
Chukchi Sea	**Heavy**	**Feb-Mar**	0.00	0.000	
Chukchi Sea	**Heavy**	**Apr-May**	0.00	0.000	
Chukchi Sea	**Heavy**	**Jun-Jul**	0.00	0.000	
Chukchi Sea	**Heavy**	**Oct-Nov**	0.00	0.000	
Chukchi Sea	**Light**	**Apr-May**	0.00	0.000	
Norton/St. Lawrence	**Crude**	**Dec-Jan**	0.00	0.000	
Norton/St. Lawrence	**Crude**	**Feb-Mar**	0.00	0.000	
Norton/St. Lawrence	**Crude**	**Apr-May**	0.00	0.000	
Norton/St. Lawrence	**Crude**	**Jun-Jul**	0.00	0.000	
Norton/St. Lawrence	**Crude**	**Aug-Sep**	0.00	0.000	
Norton/St. Lawrence	**Crude**	**Oct-Nov**	0.00	0.000	
Norton/St. Lawrence	**Heavy**	**Dec-Jan**	0.00	0.000	
Norton/St. Lawrence	**Heavy**	**Feb-Mar**	0.00	0.000	
Norton/St. Lawrence	**Heavy**	**Apr-May**	0.00	0.000	
Norton/St. Lawrence	**Heavy**	**Oct-Nov**	0.00	0.000	
Off Kenai Peninsula	**Crude**	**Dec-Jan**	0.00	0.000	
Off Kenai Peninsula	**Crude**	**Apr-May**	0.00	0.000	
Off Kenai Peninsula	**Crude**	**Jun-Jul**	0.00	0.000	
Off Kenai Peninsula	**Crude**	**Aug-Sep**	0.00	0.000	
Off Kenai Peninsula	**Crude**	**Oct-Nov**	0.00	0.000	
Off Kenai Peninsula	**Distillate**	**Dec-Jan**	0.00	0.000	
Off Kenai Peninsula	**Heavy**	**Jun-Jul**	0.00	0.000	
Off Kenai Peninsula	**Heavy**	**Oct-Nov**	0.00	0.000	
Off Prince William Sound	**Crude**	**Aug-Sep**	0.00	0.000	
Off Prince William Sound	**Distillate**	**Dec-Jan**	0.00	0.000	
Off Prince William Sound	**Distillate**	**Feb-Mar**	0.00	0.000	
Off Prince William Sound	**Distillate**	**Oct-Nov**	0.00	0.000	
Off Prince William Sound	**Heavy**	**Oct-Nov**	0.00	0.000	
Southeast Alaska	**Crude**	**Apr-May**	0.00	0.000	
Southeast Alaska	**Crude**	**Jun-Jul**	0.00	0.000	

Table 42: Incident Frequencies by Region, Oil Type, and Period (1995 – 2012 Data)					
Region	**Oil Type**	**Period**	F_{rop}	R_{rop}	**Frequency Category**
Southeast Alaska	**Crude**	**Oct-Nov**	0.00	0.000	
Western Alaska	**Crude**	**Dec-Jan**	0.00	0.000	
Western Alaska	**Crude**	**Feb-Mar**	0.00	0.000	
Western Alaska	**Crude**	**Apr-May**	0.00	0.000	
Western Alaska	**Crude**	**Jun-Jul**	0.00	0.000	
Western Alaska	**Crude**	**Aug-Sep**	0.00	0.000	
Western Alaska	**Crude**	**Oct-Nov**	0.00	0.000	
Western Alaska	**Distillate**	**Oct-Nov**	0.00	0.000	
Western Alaska	**Heavy**	**Dec-Jan**	0.00	0.000	
Western Alaska	**Heavy**	**Feb-Mar**	0.00	0.000	
Western Alaska	**Heavy**	**Jun-Jul**	0.00	0.000	

3.17 Adjustment of Incident Rates for Risk Matrix Calculations

Out of the 336 incident type categories (14 regions x 4 oil types x 6 periods), there were 99 for which there were no incidents that occurred in the 18-year time period of 1995 through 2012. This could be because:

- There was no transport or usage of that particular type of oil in that region at any time of year or at particular times of year (e.g., no crude oil tanker transport or crude production and storage, or no larger vessels using heavy bunker fuel);
- The transport or usage of that particular oil type in that region at that time of year was very infrequent and there were very few opportunities for an incident to occur during 18 years (i.e., the return year period is actually considerably longer than 18 years); or
- There were particular prevention measures in place that eliminated or greatly reduced the frequency of such incidents; or
- By chance there were no incidents of that type during the 18-year time period, though there was the possibility for incidents given the nature of the oil transport and usage in that region.

The possible reasons for the lack of incidents and approaches for the application of these data to the risk matrix calculation process are explored in Table 43.

Table 43: Potential Reasons for Lack of Certain Incident Types (Region, Oil Type, Period)			
Region	**Oil Type**	**Period**	**Reason(s) and Approach for Risk Matrix**
Aleutians	**Crude**	**Dec-Jan**	Crude incidents never occurred in this region in 18 years. It is assumed that there was no crude transport or handling in this region. The incident rates were kept at zero for all time periods.
		Feb-Mar	
		Apr-May	
		Jun-Jul	
		Aug-Sep	
		Oct-Nov	
Aniakchak	**Crude**	**Dec-Jan**	There were two incidents in 18 years (1999 and 2000), both occurring in April – May at a facility. The incident rates were averaged across all periods.
		Feb-Mar	
		Jun-Jul	
		Aug-Sep	
		Oct-Nov	
	Distillate	**Dec-Jan**	There were three incidents in 18 years in different periods (April –

Table 43: Potential Reasons for Lack of Certain Incident Types (Region, Oil Type, Period)			
Region	**Oil Type**	**Period**	**Reason(s) and Approach for Risk Matrix**
		Feb-Mar	May, June – July, October – November). The incident rates were averaged across all periods.
		Aug-Sep	
	Heavy	**Feb-Mar**	There were four incidents in 18 years involving cargo vessels. The incidents occurred in winter, spring, and fall periods.). The incident rates were averaged across all periods.
		Apr-May	
		Aug-Sep	
Beaufort Sea	**Distillate**	**Dec-Jan**	There were four incidents in 18 years, all at facilities in summer. Incident rates were averaged over spring and fall months but not over winter months.
		Feb-Mar	
		Apr-May	
		Oct-Nov	
Beaufort Sea	**Heavy**	**Dec-Jan**	Five incidents occurred in 18 years, all during August – November from work boats and drilling facilities. It was assumed that these activities might also occur during spring and summer months but not in winter. The incident rates were averaged across all non-winter periods.
		Feb-Mar	
		Apr-May	
		Jun-Jul	
Bristol Bay	**Crude**	**Dec-Jan**	There were no incidents involving crude oil in Bristol Bay. There was no known crude transport or handling in this region. The incident rates were kept at zero for all periods.
		Feb-Mar	
		Apr-May	
		Jun-Jul	
		Aug-Sep	
		Oct-Nov	
	Distillate	**Dec-Jan**	There were incidents of distillate incidents in the winter months, and with ice cover in this area, it was unlikely that smaller vessels using gasoline would be in use. The incident rate was kept at zero for the winter months.
		Feb-Mar	
	Heavy	**Dec-Jan**	There were incidents of heavy oil incidents in the winter months, but since there was evidence of shipping and oil handling activity during this time based on incidents involving light oils, it was assumed that there was a possibility of heavy oil incidents in winter. The incident rate was averaged over these months .
		Oct-Nov	
Kotzebue Sound/ Hope Basin	**Crude**	**Dec-Jan**	There are no crude oil handling or transport activities in Hope Basin. The incident rate was kept as zero for all periods.
		Feb-Mar	
		Apr-May	
		Jun-Jul	
		Aug-Sep	
		Oct-Nov	
	Distillate	**Dec-Jan**	The most likely source of distillate in Hope Basin is smaller vessels, which were unlikely to operate during the ice in winter.
		Feb-Mar	
	Heavy	**Dec-Jan**	The most likely source of heavy fuel in Hope Basin is large vessels, which were unlikely to operate during the ice in winter. The low incident rate was averaged over spring and summer months only.
		Feb-Mar	
		Apr-May	
		Jun-Jul	
Kodiak/ Shelikof Strait	**Crude**	**Dec-Jan**	There was evidence of crude oil handling and transport during winter and summer months. The low incident rate was averaged over these months.
		Jun-Jul	
		Aug-Sep	
Chukchi Sea	**Crude**	**Dec-Jan**	There was evidence of crude oil handling during winter months. The very low incident rate was averaged over all months.
		Feb-Mar	
		Apr-May	
		Aug-Sep	
		Oct-Nov	
	Distillate	**Dec-Jan**	There was some evidence of transfer and usage of distillates during

Table 43: Potential Reasons for Lack of Certain Incident Types (Region, Oil Type, Period)			
Region	**Oil Type**	**Period**	**Reason(s) and Approach for Risk Matrix**
		Oct-Nov	winter months. The very low incident rate was averaged over all months.
	Heavy	**Dec-Jan**	The most likely source of heavy oil in this region was from vessels. Due to the presence of ice during winter months, it was assumed that there would be no incidents during December – March. The very low incident rate was averaged over the other months.
		Feb-Mar	
		Apr-May	
		Jun-Jul	
		Oct-Nov	
	Light	**Apr-May**	There was evidence of light oil handling and transport in all other periods. The incident rate was averaged over all periods.
Norton Sound/ St. Lawrence Island	**Crude**	**Dec-Jan**	There was no evidence of crude transport or handling in Norton Sound. The incident rate was kept at zero for all time periods.
		Feb-Mar	
		Apr-May	
		Jun-Jul	
		Aug-Sep	
		Oct-Nov	
	Heavy	**Dec-Jan**	The most likely source of heavy oil in Norton Sound was vessel bunkers. With ice coverage during winter, it was assumed there was no vessel traffic of larger vessels during this period. The incident rate wase kept at zero for winter months but averaged over spring and fall months.
		Feb-Mar	
		Apr-May	
		Oct-Nov	
Off Kenai Peninsula	**Crude**	**Dec-Jan**	There was the potential for crude transport in this area during all months. The very low incident rate was averaged over all months.
		Apr-May	
		Jun-Jul	
		Aug-Sep	
		Oct-Nov	
	Distillate	**Dec-Jan**	There was potential for distillate usage during this time. The incident rate was averaged over all months.
	Heavy	**Jun-Jul**	There was potential for heavy oil usage during this time. The incident rate was averaged over all months.
		Oct-Nov	
South-Central Alaska	**Crude**	**Aug-Sep**	There was potential for crude transport during this time. The incident rate was averaged over this period.
	Distillate	**Dec-Jan**	The most likely source of distillates in this time period was recreational boating, which was unlikely during fall and winter months. The incident rate was kept at zero for these time periods.
		Feb-Mar	
		Oct-Nov	
	Heavy	**Oct-Nov**	There was potential for heavy oil transport in bunkers during this time period. The incident rate was averaged over this period.
Southeast Alaska	**Crude**	**Apr-May**	There was potential for crude transport and handling in all months. The very low incident rate was averaged over all months.
		Jun-Jul	
		Oct-Nov	
Western Alaska	**Crude**	**Dec-Jan**	There was no evidence of crude transport or handling in the Western region. The incident rate was kept at zero for all periods.
		Feb-Mar	
		Apr-May	
		Jun-Jul	
		Aug-Sep	
		Oct-Nov	
	Distillate	**Oct-Nov**	There was evidence of distillate usage in the Western region in all other time periods. The incident rate was averaged over this period.
	Heavy	**Dec-Jan**	The most likely source of heavy oil was from large vessel bunkers. Due to ice coverage in winter, it was unlikely that there were heavy oil incidents. The incident rate was kept at zero in winter but averaged over the summer period.
		Feb-Mar	
		Jun-Jul	

Based on the rationale described in Table 42, the F_{rop} values were adjusted for the relevant incident types with the results summarized in Table 44. The normalized relative rates (R_{rop}) are shown in Table 45.

Table 44: Adjusted Incident Frequencies (F_{rop}) for Risk Matrix Calculation

Region	Period	Incidents/Year (F_{rop})			
		Crude	Distillate	Heavy	Light
Aleutians	Dec-Jan	0.00	0.12	0.56	11.28
	Feb-Mar	0.00	0.39	0.50	19.78
	Apr-May	0.00	0.28	0.22	12.44
	Jun-Jul	0.00	0.50	0.39	13.45
	Aug-Sep	0.00	0.28	0.67	16.44
	Oct-Nov	0.00	0.22	0.44	11.33
Aniakchak	Dec-Jan	0.02	0.03	0.04	0.11
	Feb-Mar	0.02	0.03	0.04	0.78
	Apr-May	0.02	0.03	0.04	0.39
	Jun-Jul	0.02	0.03	0.04	0.61
	Aug-Sep	0.02	0.03	0.04	0.61
	Oct-Nov	0.02	0.03	0.04	0.28
Beaufort Sea	Dec-Jan	1.83	0.00	0.00	10.67
	Feb-Mar	3.28	0.00	0.00	13.50
	Apr-May	3.72	0.06	0.07	12.00
	Jun-Jul	4.61	0.06	0.07	9.89
	Aug-Sep	2.89	0.06	0.07	9.33
	Oct-Nov	2.39	0.06	0.07	7.72
Bristol Bay	Dec-Jan	0.00	0.00	0.04	0.28
	Feb-Mar	0.00	0.00	0.04	0.56
	Apr-May	0.00	0.44	0.06	2.06
	Jun-Jul	0.00	0.34	0.28	6.45
	Aug-Sep	0.00	0.17	0.11	1.22
	Oct-Nov	0.00	0.12	0.04	0.39
Cook Inlet	Dec-Jan	1.33	0.39	0.28	6.78
	Feb-Mar	1.72	0.50	0.28	7.61
	Apr-May	2.88	1.11	0.39	9.89
	Jun-Jul	2.11	0.72	0.50	12.78
	Aug-Sep	2.94	0.83	0.67	11.39
	Oct-Nov	1.33	0.39	0.39	7.06
Kotzebue Sound/ Hope Basin	Dec-Jan	0.00	0.00	0.00	0.11
	Feb-Mar	0.00	0.00	0.00	0.28
	Apr-May	0.00	0.06	0.03	0.17
	Jun-Jul	0.00	0.12	0.03	0.72
	Aug-Sep	0.00	0.11	0.03	0.33
	Oct-Nov	0.00	0.06	0.03	0.44
Kodiak/ Shelikof Strait	Dec-Jan	0.05	0.33	0.17	7.00
	Feb-Mar	0.05	0.11	0.11	7.45
	Apr-May	0.05	0.39	0.17	7.28
	Jun-Jul	0.05	0.28	0.06	9.17
	Aug-Sep	0.05	0.11	0.17	6.89
	Oct-Nov	0.05	0.23	0.28	6.00
Chukchi Sea	Dec-Jan	0.01	0.07	0.00	0.22
	Feb-Mar	0.01	0.07	0.00	0.11
	Apr-May	0.01	0.07	0.02	0.11

Table 44: Adjusted Incident Frequencies (F_{rop}) for Risk Matrix Calculation					
Region	**Period**	**Incidents/Year (F_{rop})**			
		Crude	**Distillate**	**Heavy**	**Light**
	Jun-Jul	0.01	0.07	0.02	0.11
	Aug-Sep	0.01	0.07	0.02	0.61
	Oct-Nov	0.01	0.07	0.02	0.06
Norton Sound/ St. Lawrence Island	**Dec-Jan**	0.00	0.12	0.00	0.28
	Feb-Mar	0.00	0.11	0.00	0.39
	Apr-May	0.00	0.06	0.04	0.33
	Jun-Jul	0.00	0.18	0.05	1.50
	Aug-Sep	0.00	0.17	0.04	1.06
	Oct-Nov	0.00	0.06	0.04	0.72
Off Kenai Peninsula	**Dec-Jan**	0.01	0.11	0.11	1.28
	Feb-Mar	0.01	0.11	0.11	2.11
	Apr-May	0.01	0.17	0.03	2.61
	Jun-Jul	0.01	0.11	0.03	3.00
	Aug-Sep	0.01	0.33	0.03	2.22
	Oct-Nov	0.01	0.06	0.03	1.67
South-Central Alaska	**Dec-Jan**	0.11	0.00	0.05	0.39
	Feb-Mar	0.11	0.00	0.11	0.83
	Apr-May	0.05	0.22	0.11	1.11
	Jun-Jul	0.04	0.11	0.04	0.78
	Aug-Sep	0.04	0.11	0.04	0.94
	Oct-Nov	0.05	0.00	0.05	0.44
Prince William Sound	**Dec-Jan**	0.83	0.39	0.06	5.67
	Feb-Mar	0.61	0.39	0.06	6.22
	Apr-May	0.50	0.78	0.06	7.56
	Jun-Jul	0.67	0.84	0.28	12.17
	Aug-Sep	0.28	0.28	0.06	8.50
	Oct-Nov	0.56	0.73	0.17	5.00
Southeast Alaska	**Dec-Jan**	0.03	2.11	0.39	20.17
	Feb-Mar	0.03	1.61	0.33	27.56
	Apr-May	0.03	1.72	0.33	25.84
	Jun-Jul	0.03	3.72	0.50	44.28
	Aug-Sep	0.03	3.61	0.67	38.95
	Oct-Nov	0.03	2.83	0.78	26.17
Western Alaska	**Dec-Jan**	0.00	0.22	0.00	1.28
	Feb-Mar	0.00	0.11	0.00	1.67
	Apr-May	0.00	0.23	0.07	2.89
	Jun-Jul	0.00	0.72	0.07	4.00
	Aug-Sep	0.00	0.50	0.07	4.39
	Oct-Nov	0.00	0.50	0.07	1.72

Table 45: Adjusted Relative Incident Frequencies (R_{rop}) for Risk Matrix Calculation					
Region	**Period**	**Incidents/Year (F_{rop})**			
		Crude	**Distillate**	**Heavy**	**Light**
Aleutians	**Dec-Jan**	0.0000	0.0027	0.0126	0.2547
	Feb-Mar	0.0000	0.0088	0.0113	0.4467
	Apr-May	0.0000	0.0063	0.0050	0.2809
	Jun-Jul	0.0000	0.0113	0.0088	0.3037
	Aug-Sep	0.0000	0.0063	0.0151	0.3713
	Oct-Nov	0.0000	0.0050	0.0099	0.2559

Table 45: Adjusted Relative Incident Frequencies (R_{rop}) for Risk Matrix Calculation					
Region	**Period**	**Incidents/Year (F_{rop})**			
		Crude	**Distillate**	**Heavy**	**Light**
Aniakchak	**Dec-Jan**	0.0005	0.0007	0.0009	0.0025
	Feb-Mar	0.0005	0.0007	0.0009	0.0176
	Apr-May	0.0005	0.0007	0.0009	0.0088
	Jun-Jul	0.0005	0.0007	0.0009	0.0138
	Aug-Sep	0.0005	0.0007	0.0009	0.0138
	Oct-Nov	0.0005	0.0007	0.0009	0.0063
Beaufort Sea	**Dec-Jan**	0.0413	0.0000	0.0000	0.2410
	Feb-Mar	0.0741	0.0000	0.0000	0.3049
	Apr-May	0.0840	0.0014	0.0016	0.2710
	Jun-Jul	0.1041	0.0014	0.0016	0.2234
	Aug-Sep	0.0653	0.0014	0.0016	0.2107
	Oct-Nov	0.0540	0.0014	0.0016	0.1743
Bristol Bay	**Dec-Jan**	0.0000	0.0000	0.0009	0.0063
	Feb-Mar	0.0000	0.0000	0.0009	0.0126
	Apr-May	0.0000	0.0099	0.0014	0.0465
	Jun-Jul	0.0000	0.0077	0.0063	0.1457
	Aug-Sep	0.0000	0.0038	0.0025	0.0276
	Oct-Nov	0.0000	0.0027	0.0009	0.0088
Cook Inlet	**Dec-Jan**	0.0300	0.0088	0.0063	0.1531
	Feb-Mar	0.0388	0.0113	0.0063	0.1719
	Apr-May	0.0650	0.0251	0.0088	0.2234
	Jun-Jul	0.0477	0.0163	0.0113	0.2886
	Aug-Sep	0.0664	0.0187	0.0151	0.2572
	Oct-Nov	0.0300	0.0088	0.0088	0.1594
Kotzebue Sound/ Hope Basin	**Dec-Jan**	0.0000	0.0000	0.0000	0.0025
	Feb-Mar	0.0000	0.0000	0.0000	0.0063
	Apr-May	0.0000	0.0014	0.0007	0.0038
	Jun-Jul	0.0000	0.0027	0.0007	0.0163
	Aug-Sep	0.0000	0.0025	0.0007	0.0075
	Oct-Nov	0.0000	0.0014	0.0007	0.0099
Kodiak/ Shelikof Strait	**Dec-Jan**	0.0011	0.0075	0.0038	0.1581
	Feb-Mar	0.0011	0.0025	0.0025	0.1682
	Apr-May	0.0011	0.0088	0.0038	0.1644
	Jun-Jul	0.0011	0.0063	0.0014	0.2071
	Aug-Sep	0.0011	0.0025	0.0038	0.1556
	Oct-Nov	0.0011	0.0052	0.0063	0.1355
Chukchi Sea	**Dec-Jan**	0.0002	0.0016	0.0000	0.0050
	Feb-Mar	0.0002	0.0016	0.0000	0.0025
	Apr-May	0.0002	0.0016	0.0005	0.0025
	Jun-Jul	0.0002	0.0016	0.0005	0.0025
	Aug-Sep	0.0002	0.0016	0.0005	0.0138
	Oct-Nov	0.0002	0.0016	0.0005	0.0014
Norton Sound/ St. Lawrence Island	**Dec-Jan**	0.0000	0.0027	0.0000	0.0063
	Feb-Mar	0.0000	0.0025	0.0000	0.0088
	Apr-May	0.0000	0.0014	0.0009	0.0075
	Jun-Jul	0.0000	0.0041	0.0011	0.0339
	Aug-Sep	0.0000	0.0038	0.0009	0.0239
	Oct-Nov	0.0000	0.0014	0.0009	0.0163
Off Kenai	**Dec-Jan**	0.0002	0.0025	0.0025	0.0289

Table 45: Adjusted Relative Incident Frequencies (R_{rop}) for Risk Matrix Calculation					
Region	**Period**	**Incidents/Year (F_{rop})**			
		Crude	**Distillate**	**Heavy**	**Light**
Peninsula	**Feb-Mar**	0.0002	0.0025	0.0025	0.0477
	Apr-May	0.0002	0.0038	0.0007	0.0589
	Jun-Jul	0.0002	0.0025	0.0007	0.0678
	Aug-Sep	0.0002	0.0075	0.0007	0.0501
	Oct-Nov	0.0002	0.0014	0.0007	0.0377
South-Central Alaska	**Dec-Jan**	0.0025	0.0000	0.0011	0.0088
	Feb-Mar	0.0025	0.0000	0.0025	0.0187
	Apr-May	0.0011	0.0050	0.0025	0.0251
	Jun-Jul	0.0009	0.0025	0.0009	0.0176
	Aug-Sep	0.0009	0.0025	0.0009	0.0212
	Oct-Nov	0.0011	0.0000	0.0011	0.0099
Prince William Sound	**Dec-Jan**	0.0187	0.0088	0.0014	0.1280
	Feb-Mar	0.0138	0.0088	0.0014	0.1405
	Apr-May	0.0113	0.0176	0.0014	0.1707
	Jun-Jul	0.0151	0.0190	0.0063	0.2748
	Aug-Sep	0.0063	0.0063	0.0014	0.1920
	Oct-Nov	0.0126	0.0165	0.0038	0.1129
Southeast Alaska	**Dec-Jan**	0.0007	0.0477	0.0088	0.4555
	Feb-Mar	0.0007	0.0364	0.0075	0.6224
	Apr-May	0.0007	0.0388	0.0075	0.5836
	Jun-Jul	0.0007	0.0840	0.0113	1.0000
	Aug-Sep	0.0007	0.0815	0.0151	0.8796
	Oct-Nov	0.0007	0.0639	0.0176	0.5910
Western Alaska	**Dec-Jan**	0.0000	0.0050	0.0000	0.0289
	Feb-Mar	0.0000	0.0025	0.0000	0.0377
	Apr-May	0.0000	0.0052	0.0016	0.0653
	Jun-Jul	0.0000	0.0163	0.0016	0.0903
	Aug-Sep	0.0000	0.0113	0.0016	0.0991
	Oct-Nov	0.0000	0.0113	0.0016	0.0388

4 Analysis of Incident Sources

Analyses of sources and causes of incidents are essential for determining risk with respect to impacts and probabilities of occurrence because these factors determine the potential spill volume. In addition, this analysis forms the basis of projections of future patterns of incident probabilities by location and type.

Incident types were divided into two basic categories – vessels and facilities. The term "facility" is applied in a broad sense to any fixed point-source of oil spillage, including offshore platforms, offshore and onshore pipelines, and marine coastal facilities within the US Coast Guard area of jurisdiction. Incidents that occur from mobile sources at facilities that affect marine waters are included as "facility" spills.

4.1 Incident Sources – Vessels

A summary of the vessel types and incident numbers is shown in Table 46. A total of 7,404 vessel incidents, 67.4% of the total incidents, occurred from vessels. Of these vessel incidents, about 80% involved vessels smaller than 400 gross tonnage (GT). There are two main categories of vessels – tank vessels, which carry oil as cargo and fuel, and non-tank vessels, which only carry oil as fuel. Nearly 96%

of the incidents involved non-tank vessels. Smaller fishing vessels and recreational vessels made up 65.5% of the total incidents. Incident rates in order of frequency are shown in Table 47.

Table 46: Vessel Types for Incidents 1995 – 2012

Category	Vessel Type	Number of Incidents					
		< 400 GT[55]		> 400 GT		Total	
		#	#/yr	#	#/yr	#	#/yr
Non-Tank	Fishing Vessel	2,775	154.167	407	22.611	**3,182**	**176.778**
	Recreational Vessel	2,078	115.444	40	2.222	**2,118**	**117.667**
	Passenger Ship	328	18.222	17	0.944	**345**	**19.167**
	Towing Vessel	238	13.222	49	2.722	**287**	**15.944**
	Ferry	22	1.222	261	14.500	**283**	**15.722**
	Cruise Ship	0	0.000	178	9.889	**178**	**9.889**
	Military Vessel	144	8.000	13	0.722	**157**	**8.722**
	Industrial Vessel	122	6.778	14	0.778	**136**	**7.556**
	Freight Barge	36	2.000	60	3.333	**96**	**5.333**
	General Cargo Ship	26	1.444	54	3.000	**80**	**4.444**
	Research Vessel	44	2.444	25	1.389	**69**	**3.833**
	Offshore Supply Vessel	34	1.889	7	0.389	**41**	**2.278**
	Oil Recovery Vessel	24	1.333	17	0.944	**41**	**2.278**
	Container Ship	0	0.000	34	1.889	**34**	**1.889**
	Bulk Carrier	0	0.000	23	1.278	**23**	**1.278**
	Mobile Offshore Drilling Unit	2	0.111	0	0.000	**2**	**0.111**
	Vehicle Carrier	0	0.000	2	0.111	**2**	**0.111**
Tank	Tank Barge	65	3.611	133	7.389	**198**	**11.000**
	Tank Ship < 90,000DWT[56]	0	0.000	73	4.056	**73**	**4.056**
	Tank Ship > 90,000DWT	0	0.000	59	3.278	**59**	**3.278**
Total	Total All Vessels	**5,938**	**329.889**	**1,466**	**81.444**	**7,404**	**411.333**
	Total Non-Tank Vessels	**5,873**	**326.278**	**1,201**	**66.722**	**7,074**	**393.000**
	Total Tank Vessels	**65**	**3.611**	**265**	**14.722**	**330**	**18.333**

Table 47: Ordered Incident Rates by Vessel Type and Size Category

Vessel Type	Size Category	Incidents/Year	Return Years
Fishing Vessel	< 400 GT	154.167	0.006
Recreational Vessel	< 400 GT	115.444	0.009
Fishing Vessel	> 400 GT	22.611	0.044
Passenger Ship	< 400 GT	18.222	0.055
Ferry	> 400 GT	14.500	0.069
Towing Vessel	< 400 GT	13.222	0.076
Cruise Ship	> 400 GT	9.889	0.101
Military Vessel	< 400 GT	8.000	0.125
Tank Barge	> 400 GT	7.389	0.135
Industrial Vessel	< 400 GT	6.778	0.148
Tank Ship < 90,000DWT	> 400 GT	4.056	0.247
Tank Barge	< 400 GT	3.611	0.277
Freight Barge	> 400 GT	3.333	0.300
Tank Ship > 90,000DWT	> 400 GT	3.278	0.305
General Cargo Ship	> 400 GT	3.000	0.333
Towing Vessel	> 400 GT	2.722	0.367

[55] GT = gross tonnage
[56] DWT = deadweight tonnage

Table 47: Ordered Incident Rates by Vessel Type and Size Category			
Vessel Type	**Size Category**	**Incidents/Year**	**Return Years**
Research Vessel	**< 400 GT**	2.444	0.409
Recreational Vessel	**> 400 GT**	2.222	0.450
Freight Barge	**< 400 GT**	2.000	0.500
Offshore Supply Vessel	**< 400 GT**	1.889	0.529
Container Ship	**> 400 GT**	1.889	0.529
General Cargo Ship	**< 400 GT**	1.444	0.693
Research Vessel	**> 400 GT**	1.389	0.720
Oil Recovery Vessel	**< 400 GT**	1.333	0.750
Bulk Carrier	**> 400 GT**	1.278	0.782
Ferry	**< 400 GT**	1.222	0.818
Passenger Ship	**> 400 GT**	0.944	1.059
Oil Recovery Vessel	**> 400 GT**	0.944	1.059
Industrial Vessel	**> 400 GT**	0.778	1.285
Military Vessel	**> 400 GT**	0.722	1.385
Offshore Supply Vessel	**> 400 GT**	0.389	2.571
Mobile Offshore Drilling Unit	**< 400 GT**	0.111	9.009
Vehicle Carrier	**> 400 GT**	0.111	9.009

The most frequent type of vessel incident is one involving a small fishing vessel. The next most frequent incident is one involving a small recreational vessel, and then a large fishing vessel. On average, small fishing vessel incidents occur every two days. Recreational vessel incidents occur every three days. Incidents involving smaller (<90,000 DWT) tank ships occur, on average, every 90 days, while larger tank ship incidents occur about every 111 days. Tank ship incidents of one size or the other occur, on average, every 50 days.

A breakdown of the types of non-tank vessels, general size categories, and geographic regions is shown in Table 48. The incident numbers are shown as annual incident rates in Table 49. The same data breakdowns are shown for tank vessels are shown in Tables 50 and 51.

Table 48: Non-Tank Vessel Incidents by Region (1995 – 2012)															
Vessel Type	**Aleut-ians**	**Aniak-chak**	**Beau-fort**	**Bristol Bay**	**Cook Inlet**	**Kotze-bue**	**Kodiak**	**Chuk-chi**	**Norton Sound**	**Off Kenai**	**South-Cent**	**PWS**	**South-east**	**West-ern**	**Total**
> 400 GT															
Bulk	8	2	0	0	1	1	1	0	0	0	4	0	5	1	**23**
Container	12	1	0	0	5	0	5	0	0	1	0	0	10	0	**34**
Cruise	2	1	0	0	0	0	1	0	0	2	0	5	166	1	**178**
Ferry	7	0	0	0	9	0	12	0	0	3	2	35	193	0	**261**
Fishing	263	5	1	10	8	0	6	0	0	1	4	16	36	57	**407**
Freight	10	0	2	2	3	1	7	0	0	1	1	8	22	3	**60**
Gen Cargo	27	1	0	1	9	2	1	0	0	0	4	1	6	2	**54**
Industrial	3	0	0	0	2	0	1	0	0	0	0	1	6	1	**14**
Military	0	0	0	0	0	0	9	0	0	1	1	0	2	0	**13**
MODU[57]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Offshore	1	0	0	0	1	0	0	0	0	0	0	4	1	0	**7**
Oil Recov	0	0	1	0	5	0	0	0	0	1	0	10	0	0	**17**
Passenger	0	0	0	0	0	0	0	0	0	1	0	5	11	0	**17**
Recreation	4	0	0	1	3	0	0	1	0	0	0	5	24	2	**40**
Research	3	0	1	0	10	0	0	0	0	1	0	6	3	1	**25**
Towing	8	0	0	4	3	1	2	8	2	0	0	13	5	3	**49**
Veh Carr	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
Total >400	**59**	**5**	**45**	**9**	**2**	**12**	**16**	**109**	**490**	**71**	**59**	**5**	**45**	**9**	**1,201**
< 400 GT															
Bulk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Container	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Cruise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Ferry	0	0	0	0	0	0	0	0	0	0	0	1	21	0	**22**
Fishing	763	22	3	102	199	1	438	0	5	78	40	165	899	60	**2,775**
Freight	1	0	0	4	1	2	1	0	3	2	0	1	16	5	**36**
Gen Cargo	1	0	0	4	2	0	4	0	0	0	0	0	15	0	**26**
Industrial	3	0	3	4	8	1	1	1	1	7	1	44	47	1	**122**
Military	7	0	0	0	3	0	65	0	0	7	2	6	53	1	**144**
MODU	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
Offshore	7	0	1	1	4	0	4	0	1	1	1	10	4	0	**34**
Oil Recov	1	0	1	1	5	0	1	0	0	0	0	14	1	0	**24**

[57] MODU = mobile offshore drilling unit

Table 48: Non-Tank Vessel Incidents by Region (1995 – 2012)															
Vessel Type	**Aleut-ians**	**Aniak-chak**	**Beau-fort**	**Bristol Bay**	**Cook Inlet**	**Kotze-bue**	**Kodiak**	**Chuk-chi**	**Norton Sound**	**Off Kenai**	**South-Cent**	**PWS**	**South-east**	**West-ern**	**Total**
Passenger	8	0	3	0	38	0	11	0	0	33	1	42	192	0	**328**
Recreation	194	1	2	19	107	0	173	0	3	67	8	203	1,285	16	**2,078**
Research	10	0	0	0	6	0	10	0	0	1	0	1	16	0	**44**
Towing	35	1	0	7	20	1	17	0	4	11	5	47	71	19	**238**
Veh Carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total < 400	**393**	**5**	**725**	**1**	**17**	**207**	**58**	**534**	**2,620**	**102**	**393**	**5**	**725**	**1**	**5,873**
Total	**452**	**10**	**770**	**10**	**19**	**219**	**74**	**643**	**3,110**	**173**	**452**	**10**	**770**	**10**	**7,074**

Table 49: Non-Tank Vessel Annual Incident Rates by Region (1995 – 2012)															
Vessel Type	**Aleut-ians**	**Aniak-chak**	**Beau-fort**	**Bristol Bay**	**Cook Inlet**	**Kotze-bue**	**Kodiak**	**Chuk-chi**	**Norton Sound**	**Off Kenai**	**South-Cent**	**PWS**	**South-east**	**West-ern**	**Total**
> 400 GT															
Bulk	0.444	0.111	0.000	0.000	0.056	0.056	0.056	0.000	0.000	0.000	0.222	0.000	0.278	0.056	**1.278**
Container	0.667	0.056	0.000	0.000	0.278	0.000	0.278	0.000	0.000	0.056	0.000	0.000	0.556	0.000	**1.889**
Cruise	0.111	0.056	0.000	0.000	0.000	0.000	0.056	0.000	0.000	0.111	0.000	0.278	9.222	0.056	**9.889**
Ferry	0.389	0.000	0.000	0.000	0.500	0.000	0.667	0.000	0.000	0.167	0.111	1.944	10.722	0.000	**14.500**
Fishing	14.611	0.278	0.056	0.556	0.444	0.000	0.333	0.000	0.000	0.056	0.222	0.889	2.000	3.167	**22.611**
Freight	0.556	0.000	0.111	0.111	0.167	0.056	0.389	0.000	0.000	0.056	0.056	0.444	1.222	0.167	**3.333**
Gen Cargo	1.500	0.056	0.000	0.056	0.500	0.111	0.056	0.000	0.000	0.000	0.222	0.056	0.333	0.111	**3.000**
Industrial	0.167	0.000	0.000	0.000	0.111	0.000	0.056	0.000	0.000	0.000	0.000	0.056	0.333	0.056	**0.778**
Military	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.000	0.000	0.056	0.056	0.000	0.111	0.000	**0.722**
MODU[58]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Offshore	0.056	0.000	0.000	0.000	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.222	0.056	0.000	**0.389**
Oil Recov	0.000	0.000	0.056	0.000	0.278	0.000	0.000	0.000	0.000	0.056	0.000	0.556	0.000	0.000	**0.944**
Passenger	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.278	0.611	0.000	**0.944**
Recreation	0.222	0.000	0.000	0.056	0.167	0.000	0.000	0.056	0.000	0.000	0.000	0.278	1.333	0.111	**2.222**
Research	0.167	0.000	0.056	0.000	0.556	0.000	0.000	0.000	0.000	0.056	0.000	0.333	0.167	0.056	**1.389**
Towing	0.444	0.000	0.000	0.222	0.167	0.056	0.111	0.444	0.111	0.000	0.000	0.722	0.278	0.167	**2.722**
Veh Carr	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.111**
Total >400	**19.444**	**0.556**	**0.278**	**1.000**	**3.278**	**0.278**	**2.500**	**0.500**	**0.111**	**0.667**	**0.889**	**6.056**	**27.222**	**3.944**	**66.722**
< 400 GT															
Bulk	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**

[58] MODU = mobile offshore drilling unit

Table 49: Non-Tank Vessel Annual Incident Rates by Region (1995 – 2012)															
Vessel Type	**Aleut-ians**	**Aniak-chak**	**Beau-fort**	**Bristol Bay**	**Cook Inlet**	**Kotze-bue**	**Kodiak**	**Chuk-chi**	**Norton Sound**	**Off Kenai**	**South-Cent**	**PWS**	**South-east**	**West-ern**	**Total**
Container	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Cruise	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Ferry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056	1.167	0.000	**1.222**
Fishing	42.389	1.222	0.167	5.667	11.056	0.056	24.333	0.000	0.278	4.333	2.222	9.167	49.944	3.333	**154.167**
Freight	0.056	0.000	0.000	0.222	0.056	0.111	0.056	0.000	0.167	0.111	0.000	0.056	0.889	0.278	**2.000**
Gen Cargo	0.056	0.000	0.000	0.222	0.111	0.000	0.222	0.000	0.000	0.000	0.000	0.000	0.833	0.000	**1.444**
Industrial	0.167	0.000	0.167	0.222	0.444	0.056	0.056	0.056	0.056	0.389	0.056	2.444	2.611	0.056	**6.778**
Military	0.389	0.000	0.000	0.000	0.167	0.000	3.611	0.000	0.000	0.389	0.111	0.333	2.944	0.056	**8.000**
MODU[59]	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.111**
Offshore	0.389	0.000	0.056	0.056	0.222	0.000	0.222	0.000	0.056	0.056	0.056	0.556	0.222	0.000	**1.889**
Oil Recov	0.056	0.000	0.056	0.056	0.278	0.000	0.056	0.000	0.000	0.000	0.000	0.778	0.056	0.000	**1.333**
Passenger	0.444	0.000	0.167	0.000	2.111	0.000	0.611	0.000	0.000	1.833	0.056	2.333	10.667	0.000	**18.222**
Recreation	10.778	0.056	0.111	1.056	5.944	0.000	9.611	0.000	0.167	3.722	0.444	11.278	71.389	0.889	**115.444**
Research	0.556	0.000	0.000	0.000	0.333	0.000	0.556	0.000	0.000	0.056	0.000	0.056	0.889	0.000	**2.444**
Towing	1.944	0.056	0.000	0.389	1.111	0.056	0.944	0.000	0.222	0.611	0.278	2.611	3.944	1.056	**13.222**
Veh Carr[60]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Total < 400	**57.333**	**1.333**	**0.722**	**7.889**	**21.833**	**0.278**	**40.278**	**0.056**	**0.944**	**11.500**	**3.222**	**29.667**	**145.556**	**5.667**	**326.278**
Total	**76.778**	**1.889**	**1.000**	**8.889**	**25.111**	**0.556**	**42.778**	**0.556**	**1.056**	**12.167**	**4.111**	**35.722**	**172.778**	**9.611**	**393.000**

[59] MODU = mobile offshore drilling unit
[60] Vehicle carrier

Table 50: Tank Vessel Incidents by Region (1995 – 2012)															
Vessel Type[61]	**Aleut-ian**	**Aniak-chak**	**Beau-fort**	**Bristol Bay**	**Cook Inlet**	**Kotze-bue**	**Kodiak**	**Chuk**	**Norton Sound**	**Off Kenai**	**South-Cent**	**PWS**	**South-east**	**West-ern**	**Total**
S T Barge	12	1	0	10	9	0	1	0	1	1	1	13	10	6	**65**
L T Barge	22	3	1	9	16	4	3	0	12	0	0	17	24	22	**133**
S Tanker	4	2	1	0	21	0	1	0	0	1	5	35	3	0	**73**
L Tanker	0	0	0	0	2	0	1	0	0	0	8	45	3	0	**59**
Total	**38**	**6**	**2**	**19**	**48**	**4**	**6**	**0**	**13**	**2**	**14**	**110**	**40**	**28**	**330**

Table 51: Tank Vessel Annual Incident Rates by Region (1995 – 2012)															
Vessel Type	**Aleut-ian**	**Aniak-chak**	**Beau-fort**	**Bristol Bay**	**Cook Inlet**	**Kotze-bue**	**Kodiak**	**Chuk**	**Norton Sound**	**Off Kenai**	**South-Cent**	**PWS**	**South-east**	**West-ern**	**Total**
S T Barge	0.667	0.056	0.000	0.556	0.500	0.000	0.056	0.000	0.056	0.056	0.056	0.722	0.556	0.333	**3.611**
L T Barge	1.222	0.167	0.056	0.500	0.889	0.222	0.167	0.000	0.667	0.000	0.000	0.944	1.333	1.222	**7.389**
S Tanker	0.222	0.111	0.056	0.000	1.167	0.000	0.056	0.000	0.000	0.056	0.278	1.944	0.167	0.000	**4.056**
L Tanker	0.000	0.000	0.000	0.000	0.111	0.000	0.056	0.000	0.000	0.000	0.444	2.500	0.167	0.000	**3.278**
Total	**2.111**	**0.333**	**0.111**	**1.056**	**2.667**	**0.222**	**0.333**	**0.000**	**0.722**	**0.111**	**0.778**	**6.111**	**2.222**	**1.556**	**18.333**

[61] S = small; L = large; T = tank.

The incident rates are shown in order of highest probability (incidents/year) in Table 52.

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region

Vessel Type	Size Category	Region	Annual Incident Rate	Return Years	Frequency Category
Recreation	Small	Southeastern	71.389	0.014	HIGHEST >20/Year
Fishing	Small	Southeastern	49.944	0.020	
Fishing	Small	Aleutian	42.389	0.024	
Fishing	Small	Kodiak/Shelikof	24.333	0.041	
Fishing	Large	Aleutian	14.611	0.068	VERY HIGH 10-20/Year
Recreation	Small	PWS	11.278	0.089	
Fishing	Small	Cook Inlet	11.056	0.090	
Recreation	Small	Aleutian	10.778	0.093	
Ferry	Large	Southeastern	10.722	0.093	
Passenger	Small	Southeastern	10.667	0.094	
Recreation	Small	Kodiak/Shelikof	9.611	0.104	HIGH 5 – 9/Year
Cruise	Large	Southeastern	9.222	0.108	
Fishing	Small	PWS	9.167	0.109	
Recreation	Small	Cook Inlet	5.944	0.168	
Fishing	Small	Bristol Bay	5.667	0.176	
Fishing	Small	Off Kenai	4.333	0.231	MODERATE 2-4/Year
Towing	Small	Southeastern	3.944	0.254	
Recreation	Small	Off Kenai	3.722	0.269	
Military	Small	Kodiak/Shelikof	3.611	0.277	
Fishing	Small	Western	3.333	0.300	
Fishing	Large	Western	3.167	0.316	
Military	Small	Southeastern	2.944	0.340	
Industrial	Small	Southeastern	2.611	0.383	
Towing	Small	PWS	2.611	0.383	
Tanker >90	Large	PWS	2.500	0.400	
Industrial	Small	PWS	2.444	0.409	
Passenger	Small	PWS	2.333	0.429	
Fishing	Small	South-Central	2.222	0.450	
Passenger	Small	Cook Inlet	2.111	0.474	
Fishing	Large	Southeastern	2.000	0.500	
Ferry	Large	PWS	1.944	0.514	LOW 1/Year
Towing	Small	Aleutian	1.944	0.514	
Tanker <90	Large	PWS	1.944	0.514	
Passenger	Small	Off Kenai	1.833	0.546	
Gen Cargo	Large	Aleutian	1.500	0.667	
Recreation	Large	Southeastern	1.333	0.750	
Tank Barge	Large	Southeastern	1.333	0.750	
Freight	Large	Southeastern	1.222	0.818	
Fishing	Small	Aniakchak	1.222	0.818	
Tank Barge	Large	Aleutian	1.222	0.818	
Tank Barge	Large	Western	1.222	0.818	
Ferry	Small	Southeastern	1.167	0.857	
Tanker <90	Large	Cook Inlet	1.167	0.857	
Towing	Small	Cook Inlet	1.111	0.900	
Recreation	Small	Bristol Bay	1.056	0.947	
Towing	Small	Western	1.056	0.947	
Towing	Small	Kodiak/Shelikof	0.944	1.059	

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Tank Barge	**Large**	**PWS**	0.944	1.059	
Fishing	**Large**	**PWS**	0.889	1.125	
Freight	**Small**	**Southeastern**	0.889	1.125	
Recreation	**Small**	**Western**	0.889	1.125	
Research	**Small**	**Southeastern**	0.889	1.125	
Tank Barge	**Large**	**Cook Inlet**	0.889	1.125	
Gen Cargo	**Small**	**Southeastern**	0.833	1.200	
Oil Recov	**Small**	**PWS**	0.778	1.285	
Towing	**Large**	**PWS**	0.722	1.385	
Tank Barge	**Small**	**PWS**	0.722	1.385	
Container	**Large**	**Aleutian**	0.667	1.499	
Ferry	**Large**	**Kodiak/Shelikof**	0.667	1.499	
Tank Barge	**Small**	**Aleutian**	0.667	1.499	
Tank Barge	**Large**	**Norton/St. Lawrence**	0.667	1.499	
Passenger	**Large**	**Southeastern**	0.611	1.637	
Passenger	**Small**	**Kodiak/Shelikof**	0.611	1.637	
Towing	**Small**	**Off Kenai**	0.611	1.637	
Container	**Large**	**Southeastern**	0.556	1.799	
Fishing	**Large**	**Bristol Bay**	0.556	1.799	
Freight	**Large**	**Aleutian**	0.556	1.799	
Oil Recov	**Large**	**PWS**	0.556	1.799	
Research	**Large**	**Cook Inlet**	0.556	1.799	
Tank Barge	**Small**	**Bristol Bay**	0.556	1.799	
Tank Barge	**Small**	**Southeastern**	0.556	1.799	
Offshore	**Small**	**PWS**	0.556	1.799	
Research	**Small**	**Aleutian**	0.556	1.799	
Research	**Small**	**Kodiak/Shelikof**	0.556	1.799	
Ferry	**Large**	**Cook Inlet**	0.500	2.000	
Gen Cargo	**Large**	**Cook Inlet**	0.500	2.000	
Military	**Large**	**Kodiak/Shelikof**	0.500	2.000	
Tank Barge	**Small**	**Cook Inlet**	0.500	2.000	
Tank Barge	**Large**	**Bristol Bay**	0.500	2.000	
Bulk	**Large**	**Aleutian**	0.444	2.252	
Fishing	**Large**	**Cook Inlet**	0.444	2.252	
Freight	**Large**	**PWS**	0.444	2.252	
Towing	**Large**	**Aleutian**	0.444	2.252	
Towing	**Large**	**Chukchi**	0.444	2.252	
Industrial	**Small**	**Cook Inlet**	0.444	2.252	
Passenger	**Small**	**Aleutian**	0.444	2.252	
Recreation	**Small**	**South-Central**	0.444	2.252	
Tanker >90	**Large**	**South-Central**	0.444	2.252	**VERY LOW < 1/Year**
Ferry	**Large**	**Aleutian**	0.389	2.571	
Freight	**Large**	**Kodiak/Shelikof**	0.389	2.571	
Industrial	**Small**	**Off Kenai**	0.389	2.571	
Military	**Small**	**Aleutian**	0.389	2.571	
Military	**Small**	**Off Kenai**	0.389	2.571	
Offshore	**Small**	**Aleutian**	0.389	2.571	
Towing	**Small**	**Bristol Bay**	0.389	2.571	
Fishing	**Large**	**Kodiak/Shelikof**	0.333	3.003	

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Gen Cargo	**Large**	**Southeastern**	0.333	3.003	
Industrial	**Large**	**Southeastern**	0.333	3.003	
Research	**Large**	**PWS**	0.333	3.003	
Tank Barge	**Small**	**Western**	0.333	3.003	
Military	**Small**	**PWS**	0.333	3.003	
Research	**Small**	**Cook Inlet**	0.333	3.003	
Bulk	**Large**	**Southeastern**	0.278	3.597	
Container	**Large**	**Cook Inlet**	0.278	3.597	
Container	**Large**	**Kodiak/Shelikof**	0.278	3.597	
Cruise	**Large**	**PWS**	0.278	3.597	
Fishing	**Large**	**Aniakchak**	0.278	3.597	
Oil Recov	**Large**	**Cook Inlet**	0.278	3.597	
Passenger	**Large**	**PWS**	0.278	3.597	
Recreation	**Large**	**PWS**	0.278	3.597	
Towing	**Large**	**Southeastern**	0.278	3.597	
Fishing	**Small**	**Norton/St. Lawrence**	0.278	3.597	
Freight	**Small**	**Western**	0.278	3.597	
Oil Recov	**Small**	**Cook Inlet**	0.278	3.597	
Towing	**Small**	**South-Central**	0.278	3.597	
Tanker <90	**Large**	**South-Central**	0.278	3.597	
Bulk	**Large**	**South-Central**	0.222	4.505	
Fishing	**Large**	**South-Central**	0.222	4.505	
Gen Cargo	**Large**	**South-Central**	0.222	4.505	
Offshore	**Large**	**PWS**	0.222	4.505	
Recreation	**Large**	**Aleutian**	0.222	4.505	
Towing	**Large**	**Bristol Bay**	0.222	4.505	
Freight	**Small**	**Bristol Bay**	0.222	4.505	
Gen Cargo	**Small**	**Bristol Bay**	0.222	4.505	
Gen Cargo	**Small**	**Kodiak/Shelikof**	0.222	4.505	
Industrial	**Small**	**Bristol Bay**	0.222	4.505	
Offshore	**Small**	**Cook Inlet**	0.222	4.505	
Offshore	**Small**	**Kodiak/Shelikof**	0.222	4.505	
Offshore	**Small**	**Southeastern**	0.222	4.505	
Towing	**Small**	**Norton/St. Lawrence**	0.222	4.505	
Tank Barge	**Large**	**Kotzebue/Hope**	0.222	4.505	
Tanker <90	**Large**	**Aleutian**	0.222	4.505	
Ferry	**Large**	**Off Kenai**	0.167	5.988	
Freight	**Large**	**Cook Inlet**	0.167	5.988	
Freight	**Large**	**Western**	0.167	5.988	
Industrial	**Large**	**Aleutian**	0.167	5.988	
Recreation	**Large**	**Cook Inlet**	0.167	5.988	
Research	**Large**	**Aleutian**	0.167	5.988	
Research	**Large**	**Southeastern**	0.167	5.988	
Towing	**Large**	**Cook Inlet**	0.167	5.988	
Towing	**Large**	**Western**	0.167	5.988	
Fishing	**Small**	**Beaufort**	0.167	5.988	
Freight	**Small**	**Norton/St. Lawrence**	0.167	5.988	
Industrial	**Small**	**Aleutian**	0.167	5.988	
Industrial	**Small**	**Beaufort**	0.167	5.988	

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Military	**Small**	**Cook Inlet**	0.167	5.988	
Passenger	**Small**	**Beaufort**	0.167	5.988	
Recreation	**Small**	**Norton/St. Lawrence**	0.167	5.988	
Tank Barge	**Large**	**Aniakchak**	0.167	5.988	
Tank Barge	**Large**	**Kodiak/Shelikof**	0.167	5.988	
Tanker <90	**Large**	**Southeastern**	0.167	5.988	
Tanker >90	**Large**	**Southeastern**	0.167	5.988	
Bulk	**Large**	**Aniakchak**	0.111	9.009	
Cruise	**Large**	**Aleutian**	0.111	9.009	
Cruise	**Large**	**Off Kenai**	0.111	9.009	
Ferry	**Large**	**South-Central**	0.111	9.009	
Freight	**Large**	**Beaufort**	0.111	9.009	
Freight	**Large**	**Bristol Bay**	0.111	9.009	
Gen Cargo	**Large**	**Kotzebue/Hope**	0.111	9.009	
Gen Cargo	**Large**	**Western**	0.111	9.009	
Industrial	**Large**	**Cook Inlet**	0.111	9.009	
Military	**Large**	**Southeastern**	0.111	9.009	
Recreation	**Large**	**Western**	0.111	9.009	
Towing	**Large**	**Kodiak/Shelikof**	0.111	9.009	
Towing	**Large**	**Norton/St. Lawrence**	0.111	9.009	
Veh Carr	**Large**	**Aleutian**	0.111	9.009	
Freight	**Small**	**Kotzebue/Hope**	0.111	9.009	
Freight	**Small**	**Off Kenai**	0.111	9.009	
Gen Cargo	**Small**	**Cook Inlet**	0.111	9.009	
Military	**Small**	**South-Central**	0.111	9.009	
MODU[62]	**Small**	**Aleutian**	0.111	9.009	
Recreation	**Small**	**Beaufort**	0.111	9.009	
Tanker <90	**Large**	**Aniakchak**	0.111	9.009	
Tanker >90	**Large**	**Cook Inlet**	0.111	9.009	
Bulk	**Large**	**Cook Inlet**	0.056	17.857	
Bulk	**Large**	**Kotzebue/Hope**	0.056	17.857	
Bulk	**Large**	**Kodiak/Shelikof**	0.056	17.857	
Bulk	**Large**	**Western**	0.056	17.857	
Container	**Large**	**Aniakchak**	0.056	17.857	
Container	**Large**	**Off Kenai**	0.056	17.857	
Cruise	**Large**	**Aniakchak**	0.056	17.857	
Cruise	**Large**	**Kodiak/Shelikof**	0.056	17.857	
Cruise	**Large**	**Western**	0.056	17.857	
Fishing	**Large**	**Beaufort**	0.056	17.857	
Fishing	**Large**	**Off Kenai**	0.056	17.857	
Freight	**Large**	**Kotzebue/Hope**	0.056	17.857	
Freight	**Large**	**Off Kenai**	0.056	17.857	
Freight	**Large**	**South-Central**	0.056	17.857	
Gen Cargo	**Large**	**Aniakchak**	0.056	17.857	
Gen Cargo	**Large**	**Bristol Bay**	0.056	17.857	
Gen Cargo	**Large**	**Kodiak/Shelikof**	0.056	17.857	
Gen Cargo	**Large**	**PWS**	0.056	17.857	

[62] MODU = mobile offshore drilling unit

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Industrial	**Large**	**Kodiak/Shelikof**	0.056	17.857	
Industrial	**Large**	**PWS**	0.056	17.857	
Industrial	**Large**	**Western**	0.056	17.857	
Military	**Large**	**Off Kenai**	0.056	17.857	
Military	**Large**	**South-Central**	0.056	17.857	
Offshore	**Large**	**Aleutian**	0.056	17.857	
Offshore	**Large**	**Cook Inlet**	0.056	17.857	
Offshore	**Large**	**Southeastern**	0.056	17.857	
Oil Recov	**Large**	**Beaufort**	0.056	17.857	
Oil Recov	**Large**	**Off Kenai**	0.056	17.857	
Passenger	**Large**	**Off Kenai**	0.056	17.857	
Recreation	**Large**	**Bristol Bay**	0.056	17.857	
Recreation	**Large**	**Chukchi**	0.056	17.857	
Research	**Large**	**Beaufort**	0.056	17.857	
Research	**Large**	**Off Kenai**	0.056	17.857	
Research	**Large**	**Western**	0.056	17.857	
Towing	**Large**	**Kotzebue/Hope**	0.056	17.857	
Tank Barge	**Small**	**Aniakchak**	0.056	17.857	
Tank Barge	**Small**	**Kodiak/Shelikof**	0.056	17.857	
Tank Barge	**Small**	**Norton/St. Lawrence**	0.056	17.857	
Tank Barge	**Small**	**Off Kenai**	0.056	17.857	
Tank Barge	**Small**	**South-Central**	0.056	17.857	
Ferry	**Small**	**PWS**	0.056	17.857	
Fishing	**Small**	**Kotzebue/Hope**	0.056	17.857	
Freight	**Small**	**Aleutian**	0.056	17.857	
Freight	**Small**	**Cook Inlet**	0.056	17.857	
Freight	**Small**	**Kodiak/Shelikof**	0.056	17.857	
Freight	**Small**	**PWS**	0.056	17.857	
Gen Cargo	**Small**	**Aleutian**	0.056	17.857	
Industrial	**Small**	**Kotzebue/Hope**	0.056	17.857	
Industrial	**Small**	**Kodiak/Shelikof**	0.056	17.857	
Industrial	**Small**	**Chukchi**	0.056	17.857	
Industrial	**Small**	**Norton/St. Lawrence**	0.056	17.857	
Industrial	**Small**	**South-Central**	0.056	17.857	
Industrial	**Small**	**Western**	0.056	17.857	
Military	**Small**	**Western**	0.056	17.857	
Offshore	**Small**	**Beaufort**	0.056	17.857	
Offshore	**Small**	**Bristol Bay**	0.056	17.857	
Offshore	**Small**	**Norton/St. Lawrence**	0.056	17.857	
Offshore	**Small**	**Off Kenai**	0.056	17.857	
Offshore	**Small**	**South-Central**	0.056	17.857	
Oil Recov	**Small**	**Aleutian**	0.056	17.857	
Oil Recov	**Small**	**Beaufort**	0.056	17.857	
Oil Recov	**Small**	**Bristol Bay**	0.056	17.857	
Oil Recov	**Small**	**Kodiak/Shelikof**	0.056	17.857	
Oil Recov	**Small**	**Southeastern**	0.056	17.857	
Passenger	**Small**	**South-Central**	0.056	17.857	
Recreation	**Small**	**Aniakchak**	0.056	17.857	
Research	**Small**	**Off Kenai**	0.056	17.857	

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Research	**Small**	**PWS**	0.056	17.857	
Towing	**Small**	**Aniakchak**	0.056	17.857	
Towing	**Small**	**Kotzebue/Hope**	0.056	17.857	
Tank Barge	**Large**	**Beaufort**	0.056	17.857	
Tanker <90	**Large**	**Beaufort**	0.056	17.857	
Tanker <90	**Large**	**Kodiak/Shelikof**	0.056	17.857	
Tanker <90	**Large**	**Off Kenai**	0.056	17.857	
Tanker >90	**Large**	**Kodiak/Shelikof**	0.056	17.857	
Bulk	**Large**	**Beaufort**	0.000	0.000	
Bulk	**Large**	**Bristol Bay**	0.000	0.000	
Bulk	**Large**	**Chukchi**	0.000	0.000	
Bulk	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Bulk	**Large**	**Off Kenai**	0.000	0.000	
Bulk	**Large**	**PWS**	0.000	0.000	
Container	**Large**	**Beaufort**	0.000	0.000	
Container	**Large**	**Bristol Bay**	0.000	0.000	
Container	**Large**	**Kotzebue/Hope**	0.000	0.000	
Container	**Large**	**Chukchi**	0.000	0.000	
Container	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Container	**Large**	**South-Central**	0.000	0.000	
Container	**Large**	**PWS**	0.000	0.000	
Container	**Large**	**Western**	0.000	0.000	
Cruise	**Large**	**Beaufort**	0.000	0.000	
Cruise	**Large**	**Bristol Bay**	0.000	0.000	
Cruise	**Large**	**Cook Inlet**	0.000	0.000	
Cruise	**Large**	**Kotzebue/Hope**	0.000	0.000	
Cruise	**Large**	**Chukchi**	0.000	0.000	
Cruise	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Cruise	**Large**	**South-Central**	0.000	0.000	**LOWEST (No Incidents)**
Ferry	**Large**	**Aniakchak**	0.000	0.000	
Ferry	**Large**	**Beaufort**	0.000	0.000	
Ferry	**Large**	**Bristol Bay**	0.000	0.000	
Ferry	**Large**	**Kotzebue/Hope**	0.000	0.000	
Ferry	**Large**	**Chukchi**	0.000	0.000	
Ferry	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Ferry	**Large**	**Western**	0.000	0.000	
Fishing	**Large**	**Kotzebue/Hope**	0.000	0.000	
Fishing	**Large**	**Chukchi**	0.000	0.000	
Fishing	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Freight	**Large**	**Aniakchak**	0.000	0.000	
Freight	**Large**	**Chukchi**	0.000	0.000	
Freight	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Gen Cargo	**Large**	**Beaufort**	0.000	0.000	
Gen Cargo	**Large**	**Chukchi**	0.000	0.000	
Gen Cargo	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Gen Cargo	**Large**	**Off Kenai**	0.000	0.000	
Industrial	**Large**	**Aniakchak**	0.000	0.000	
Industrial	**Large**	**Beaufort**	0.000	0.000	
Industrial	**Large**	**Bristol Bay**	0.000	0.000	

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Industrial	**Large**	**Kotzebue/Hope**	0.000	0.000	
Industrial	**Large**	**Chukchi**	0.000	0.000	
Industrial	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Industrial	**Large**	**Off Kenai**	0.000	0.000	
Industrial	**Large**	**South-Central**	0.000	0.000	
Military	**Large**	**Aleutian**	0.000	0.000	
Military	**Large**	**Aniakchak**	0.000	0.000	
Military	**Large**	**Beaufort**	0.000	0.000	
Military	**Large**	**Bristol Bay**	0.000	0.000	
Military	**Large**	**Cook Inlet**	0.000	0.000	
Military	**Large**	**Kotzebue/Hope**	0.000	0.000	
Military	**Large**	**Chukchi**	0.000	0.000	
Military	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Military	**Large**	**PWS**	0.000	0.000	
Military	**Large**	**Western**	0.000	0.000	
MODU[63]	**Large**	**Aleutian**	0.000	0.000	
MODU	**Large**	**Aniakchak**	0.000	0.000	
MODU	**Large**	**Beaufort**	0.000	0.000	
MODU	**Large**	**Bristol Bay**	0.000	0.000	
MODU	**Large**	**Cook Inlet**	0.000	0.000	
MODU	**Large**	**Kotzebue/Hope**	0.000	0.000	
MODU	**Large**	**Kodiak/Shelikof**	0.000	0.000	
MODU	**Large**	**Chukchi**	0.000	0.000	
MODU	**Large**	**Norton/St. Lawrence**	0.000	0.000	
MODU	**Large**	**Off Kenai**	0.000	0.000	
MODU	**Large**	**South-Central**	0.000	0.000	
MODU	**Large**	**PWS**	0.000	0.000	
MODU	**Large**	**Southeastern**	0.000	0.000	
MODU	**Large**	**Western**	0.000	0.000	
Offshore	**Large**	**Aniakchak**	0.000	0.000	
Offshore	**Large**	**Beaufort**	0.000	0.000	
Offshore	**Large**	**Bristol Bay**	0.000	0.000	
Offshore	**Large**	**Kotzebue/Hope**	0.000	0.000	
Offshore	**Large**	**Kodiak/Shelikof**	0.000	0.000	
Offshore	**Large**	**Chukchi**	0.000	0.000	
Offshore	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Offshore	**Large**	**Off Kenai**	0.000	0.000	
Offshore	**Large**	**South-Central**	0.000	0.000	
Offshore	**Large**	**Western**	0.000	0.000	
Oil Recov	**Large**	**Aleutian**	0.000	0.000	
Oil Recov	**Large**	**Aniakchak**	0.000	0.000	
Oil Recov	**Large**	**Bristol Bay**	0.000	0.000	
Oil Recov	**Large**	**Kotzebue/Hope**	0.000	0.000	
Oil Recov	**Large**	**Kodiak/Shelikof**	0.000	0.000	
Oil Recov	**Large**	**Chukchi**	0.000	0.000	
Oil Recov	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Oil Recov	**Large**	**South-Central**	0.000	0.000	

[63] MODU = mobile offshore drilling unit

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Oil Recov	**Large**	**Southeastern**	0.000	0.000	
Oil Recov	**Large**	**Western**	0.000	0.000	
Passenger	**Large**	**Aleutian**	0.000	0.000	
Passenger	**Large**	**Aniakchak**	0.000	0.000	
Passenger	**Large**	**Beaufort**	0.000	0.000	
Passenger	**Large**	**Bristol Bay**	0.000	0.000	
Passenger	**Large**	**Cook Inlet**	0.000	0.000	
Passenger	**Large**	**Kotzebue/Hope**	0.000	0.000	
Passenger	**Large**	**Kodiak/Shelikof**	0.000	0.000	
Passenger	**Large**	**Chukchi**	0.000	0.000	
Passenger	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Passenger	**Large**	**South-Central**	0.000	0.000	
Passenger	**Large**	**Western**	0.000	0.000	
Recreation	**Large**	**Aniakchak**	0.000	0.000	
Recreation	**Large**	**Beaufort**	0.000	0.000	
Recreation	**Large**	**Kotzebue/Hope**	0.000	0.000	
Recreation	**Large**	**Kodiak/Shelikof**	0.000	0.000	
Recreation	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Recreation	**Large**	**Off Kenai**	0.000	0.000	
Recreation	**Large**	**South-Central**	0.000	0.000	
Research	**Large**	**Aniakchak**	0.000	0.000	
Research	**Large**	**Bristol Bay**	0.000	0.000	
Research	**Large**	**Kotzebue/Hope**	0.000	0.000	
Research	**Large**	**Kodiak/Shelikof**	0.000	0.000	
Research	**Large**	**Chukchi**	0.000	0.000	
Research	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Research	**Large**	**South-Central**	0.000	0.000	
Towing	**Large**	**Aniakchak**	0.000	0.000	
Towing	**Large**	**Beaufort**	0.000	0.000	
Towing	**Large**	**Off Kenai**	0.000	0.000	
Towing	**Large**	**South-Central**	0.000	0.000	
Veh Carr	**Large**	**Aniakchak**	0.000	0.000	
Veh Carr	**Large**	**Beaufort**	0.000	0.000	
Veh Carr	**Large**	**Bristol Bay**	0.000	0.000	
Veh Carr	**Large**	**Cook Inlet**	0.000	0.000	
Veh Carr	**Large**	**Kotzebue/Hope**	0.000	0.000	
Veh Carr	**Large**	**Kodiak/Shelikof**	0.000	0.000	
Veh Carr	**Large**	**Chukchi**	0.000	0.000	
Veh Carr	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Veh Carr	**Large**	**Off Kenai**	0.000	0.000	
Veh Carr	**Large**	**South-Central**	0.000	0.000	
Veh Carr	**Large**	**PWS**	0.000	0.000	
Veh Carr	**Large**	**Southeastern**	0.000	0.000	
Veh Carr	**Large**	**Western**	0.000	0.000	
Tank Barge	**Small**	**Beaufort**	0.000	0.000	
Tank Barge	**Small**	**Kotzebue/Hope**	0.000	0.000	
Tank Barge	**Small**	**Chukchi**	0.000	0.000	
Tanker <90	**Small**	**Aleutian**	0.000	0.000	
Tanker <90	**Small**	**Aniakchak**	0.000	0.000	

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Tanker <90	**Small**	**Beaufort**	0.000	0.000	
Tanker <90	**Small**	**Bristol Bay**	0.000	0.000	
Tanker <90	**Small**	**Cook Inlet**	0.000	0.000	
Tanker <90	**Small**	**Kotzebue/Hope**	0.000	0.000	
Tanker <90	**Small**	**Kodiak/Shelikof**	0.000	0.000	
Tanker <90	**Small**	**Chukchi**	0.000	0.000	
Tanker <90	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Tanker <90	**Small**	**Off Kenai**	0.000	0.000	
Tanker <90	**Small**	**South-Central**	0.000	0.000	
Tanker <90	**Small**	**PWS**	0.000	0.000	
Tanker <90	**Small**	**Southeastern**	0.000	0.000	
Tanker <90	**Small**	**Western**	0.000	0.000	
Tanker >90	**Small**	**Aleutian**	0.000	0.000	
Tanker >90	**Small**	**Aniakchak**	0.000	0.000	
Tanker >90	**Small**	**Beaufort**	0.000	0.000	
Tanker >90	**Small**	**Bristol Bay**	0.000	0.000	
Tanker >90	**Small**	**Cook Inlet**	0.000	0.000	
Tanker >90	**Small**	**Kotzebue/Hope**	0.000	0.000	
Tanker >90	**Small**	**Kodiak/Shelikof**	0.000	0.000	
Tanker >90	**Small**	**Chukchi**	0.000	0.000	
Tanker >90	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Tanker >90	**Small**	**Off Kenai**	0.000	0.000	
Tanker >90	**Small**	**South-Central**	0.000	0.000	
Tanker >90	**Small**	**PWS**	0.000	0.000	
Tanker >90	**Small**	**Southeastern**	0.000	0.000	
Tanker >90	**Small**	**Western**	0.000	0.000	
Bulk	**Small**	**Aleutian**	0.000	0.000	
Bulk	**Small**	**Aniakchak**	0.000	0.000	
Bulk	**Small**	**Beaufort**	0.000	0.000	
Bulk	**Small**	**Bristol Bay**	0.000	0.000	
Bulk	**Small**	**Cook Inlet**	0.000	0.000	
Bulk	**Small**	**Kotzebue/Hope**	0.000	0.000	
Bulk	**Small**	**Kodiak/Shelikof**	0.000	0.000	
Bulk	**Small**	**Chukchi**	0.000	0.000	
Bulk	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Bulk	**Small**	**Off Kenai**	0.000	0.000	
Bulk	**Small**	**South-Central**	0.000	0.000	
Bulk	**Small**	**PWS**	0.000	0.000	
Bulk	**Small**	**Southeastern**	0.000	0.000	
Bulk	**Small**	**Western**	0.000	0.000	
Container	**Small**	**Aleutian**	0.000	0.000	
Container	**Small**	**Aniakchak**	0.000	0.000	
Container	**Small**	**Beaufort**	0.000	0.000	
Container	**Small**	**Bristol Bay**	0.000	0.000	
Container	**Small**	**Cook Inlet**	0.000	0.000	
Container	**Small**	**Kotzebue/Hope**	0.000	0.000	
Container	**Small**	**Kodiak/Shelikof**	0.000	0.000	
Container	**Small**	**Chukchi**	0.000	0.000	
Container	**Small**	**Norton/St. Lawrence**	0.000	0.000	

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Container	**Small**	**Off Kenai**	0.000	0.000	
Container	**Small**	**South-Central**	0.000	0.000	
Container	**Small**	**PWS**	0.000	0.000	
Container	**Small**	**Southeastern**	0.000	0.000	
Container	**Small**	**Western**	0.000	0.000	
Cruise	**Small**	**Aleutian**	0.000	0.000	
Cruise	**Small**	**Aniakchak**	0.000	0.000	
Cruise	**Small**	**Beaufort**	0.000	0.000	
Cruise	**Small**	**Bristol Bay**	0.000	0.000	
Cruise	**Small**	**Cook Inlet**	0.000	0.000	
Cruise	**Small**	**Kotzebue/Hope**	0.000	0.000	
Cruise	**Small**	**Kodiak/Shelikof**	0.000	0.000	
Cruise	**Small**	**Chukchi**	0.000	0.000	
Cruise	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Cruise	**Small**	**Off Kenai**	0.000	0.000	
Cruise	**Small**	**South-Central**	0.000	0.000	
Cruise	**Small**	**PWS**	0.000	0.000	
Cruise	**Small**	**Southeastern**	0.000	0.000	
Cruise	**Small**	**Western**	0.000	0.000	
Ferry	**Small**	**Aleutian**	0.000	0.000	
Ferry	**Small**	**Aniakchak**	0.000	0.000	
Ferry	**Small**	**Beaufort**	0.000	0.000	
Ferry	**Small**	**Bristol Bay**	0.000	0.000	
Ferry	**Small**	**Cook Inlet**	0.000	0.000	
Ferry	**Small**	**Kotzebue/Hope**	0.000	0.000	
Ferry	**Small**	**Kodiak/Shelikof**	0.000	0.000	
Ferry	**Small**	**Chukchi**	0.000	0.000	
Ferry	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Ferry	**Small**	**Off Kenai**	0.000	0.000	
Ferry	**Small**	**South-Central**	0.000	0.000	
Ferry	**Small**	**Western**	0.000	0.000	
Fishing	**Small**	**Chukchi**	0.000	0.000	
Freight	**Small**	**Aniakchak**	0.000	0.000	
Freight	**Small**	**Beaufort**	0.000	0.000	
Freight	**Small**	**Chukchi**	0.000	0.000	
Freight	**Small**	**South-Central**	0.000	0.000	
Gen Cargo	**Small**	**Aniakchak**	0.000	0.000	
Gen Cargo	**Small**	**Beaufort**	0.000	0.000	
Gen Cargo	**Small**	**Kotzebue/Hope**	0.000	0.000	
Gen Cargo	**Small**	**Chukchi**	0.000	0.000	
Gen Cargo	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Gen Cargo	**Small**	**Off Kenai**	0.000	0.000	
Gen Cargo	**Small**	**South-Central**	0.000	0.000	
Gen Cargo	**Small**	**PWS**	0.000	0.000	
Gen Cargo	**Small**	**Western**	0.000	0.000	
Industrial	**Small**	**Aniakchak**	0.000	0.000	
Military	**Small**	**Aniakchak**	0.000	0.000	
Military	**Small**	**Beaufort**	0.000	0.000	
Military	**Small**	**Bristol Bay**	0.000	0.000	

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Military	**Small**	**Kotzebue/Hope**	0.000	0.000	
Military	**Small**	**Chukchi**	0.000	0.000	
Military	**Small**	**Norton/St. Lawrence**	0.000	0.000	
MODU	**Small**	**Aniakchak**	0.000	0.000	
MODU	**Small**	**Beaufort**	0.000	0.000	
MODU	**Small**	**Bristol Bay**	0.000	0.000	
MODU	**Small**	**Cook Inlet**	0.000	0.000	
MODU	**Small**	**Kotzebue/Hope**	0.000	0.000	
MODU	**Small**	**Kodiak/Shelikof**	0.000	0.000	
MODU	**Small**	**Chukchi**	0.000	0.000	
MODU	**Small**	**Norton/St. Lawrence**	0.000	0.000	
MODU	**Small**	**Off Kenai**	0.000	0.000	
MODU	**Small**	**South-Central**	0.000	0.000	
MODU	**Small**	**PWS**	0.000	0.000	
MODU	**Small**	**Southeastern**	0.000	0.000	
MODU	**Small**	**Western**	0.000	0.000	
Offshore	**Small**	**Aniakchak**	0.000	0.000	
Offshore	**Small**	**Kotzebue/Hope**	0.000	0.000	
Offshore	**Small**	**Chukchi**	0.000	0.000	
Offshore	**Small**	**Western**	0.000	0.000	
Oil Recov	**Small**	**Aniakchak**	0.000	0.000	
Oil Recov	**Small**	**Kotzebue/Hope**	0.000	0.000	
Oil Recov	**Small**	**Chukchi**	0.000	0.000	
Oil Recov	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Oil Recov	**Small**	**Off Kenai**	0.000	0.000	
Oil Recov	**Small**	**South-Central**	0.000	0.000	
Oil Recov	**Small**	**Western**	0.000	0.000	
Passenger	**Small**	**Aniakchak**	0.000	0.000	
Passenger	**Small**	**Bristol Bay**	0.000	0.000	
Passenger	**Small**	**Kotzebue/Hope**	0.000	0.000	
Passenger	**Small**	**Chukchi**	0.000	0.000	
Passenger	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Passenger	**Small**	**Western**	0.000	0.000	
Recreation	**Small**	**Kotzebue/Hope**	0.000	0.000	
Recreation	**Small**	**Chukchi**	0.000	0.000	
Research	**Small**	**Aniakchak**	0.000	0.000	
Research	**Small**	**Beaufort**	0.000	0.000	
Research	**Small**	**Bristol Bay**	0.000	0.000	
Research	**Small**	**Kotzebue/Hope**	0.000	0.000	
Research	**Small**	**Chukchi**	0.000	0.000	
Research	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Research	**Small**	**South-Central**	0.000	0.000	
Research	**Small**	**Western**	0.000	0.000	
Towing	**Small**	**Beaufort**	0.000	0.000	
Towing	**Small**	**Chukchi**	0.000	0.000	
Veh Carr	**Small**	**Aleutian**	0.000	0.000	
Veh Carr	**Small**	**Aniakchak**	0.000	0.000	
Veh Carr	**Small**	**Beaufort**	0.000	0.000	
Veh Carr	**Small**	**Bristol Bay**	0.000	0.000	

Table 52: Ordered Incident Rates by Vessel Type, Size, and Region					
Vessel Type	**Size Category**	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Veh Carr	**Small**	**Cook Inlet**	0.000	0.000	
Veh Carr	**Small**	**Kotzebue/Hope**	0.000	0.000	
Veh Carr	**Small**	**Kodiak/Shelikof**	0.000	0.000	
Veh Carr	**Small**	**Chukchi**	0.000	0.000	
Veh Carr	**Small**	**Norton/St. Lawrence**	0.000	0.000	
Veh Carr	**Small**	**Off Kenai**	0.000	0.000	
Veh Carr	**Small**	**South-Central**	0.000	0.000	
Veh Carr	**Small**	**PWS**	0.000	0.000	
Veh Carr	**Small**	**Southeastern**	0.000	0.000	
Veh Carr	**Small**	**Western**	0.000	0.000	
Tank Barge	**Large**	**Chukchi**	0.000	0.000	
Tank Barge	**Large**	**Off Kenai**	0.000	0.000	
Tank Barge	**Large**	**South-Central**	0.000	0.000	
Tanker <90	**Large**	**Bristol Bay**	0.000	0.000	
Tanker <90	**Large**	**Kotzebue/Hope**	0.000	0.000	
Tanker <90	**Large**	**Chukchi**	0.000	0.000	
Tanker <90	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Tanker <90	**Large**	**Western**	0.000	0.000	
Tanker >90	**Large**	**Aleutian**	0.000	0.000	
Tanker >90	**Large**	**Aniakchak**	0.000	0.000	
Tanker >90	**Large**	**Beaufort**	0.000	0.000	
Tanker >90	**Large**	**Bristol Bay**	0.000	0.000	
Tanker >90	**Large**	**Kotzebue/Hope**	0.000	0.000	
Tanker >90	**Large**	**Chukchi**	0.000	0.000	
Tanker >90	**Large**	**Norton/St. Lawrence**	0.000	0.000	
Tanker >90	**Large**	**Off Kenai**	0.000	0.000	
Tanker >90	**Large**	**Western**	0.000	0.000	

4.2 Incident Sources – Facilities

A summary of the facility types and incident numbers is shown in Table 53. The incidents are divided into native corporation-related incidents[64] and all other incidents. Incidents at facilities associated with native corporations make up only 2.6% of incidents. The greatest number of facility-sourced incidents occurred from facilities involved in oil exploration and production activities, which made up 55% of incidents. An incident occurred at an oil exploration and production facility, on average, every 3.3 days. The next most frequent facility incident type was one that occurred at a small boat harbor, which made up 8% of the incidents; an incident of this type occurred once every 23 days.[65] On average, a facility incident occurs every 1.8 days or nearly 200 times per year. Table 54 shows the incident rates in decreasing order of frequency. A breakdown of facility incidents by type and geographic region is shown in Table 55. The incident numbers are shown as annual incident rates in Table 56. The annual incident rates and return-years by facility type and region are shown in Table 57 in order of frequency. The highest numbers of facility incidents are from Beaufort Sea and Cook Inlet offshore oil exploration and production facilities.

[64] Native corporation and non-native corporation facilities are divided here strictly for the purpose of tracking for jurisdictional purposes as needed.

[65] Note that small boat harbor incidents do not include those incidents that originate from vessels in the harbor. Those are counted under vessel incidents.

Table 53: Facility Types for Incidents 1995 – 2012				
Facility Category	**Facility Type**	**Incident Number**	**Incidents/Year**	**Return Years**
Not a Native Corporation	**Airport**	17	0.944	1.059
	Barge Terminal	17	0.944	1.059
	Bulk Chemical Facility	21	1.167	0.857
	Construction Site	15	0.833	1.200
	Container Terminal	17	0.944	1.059
	Cruise Ship Terminal	41	2.278	0.439
	Drydock Facility	4	0.222	4.500
	Ferry Terminal	18	1.000	1.000
	Fuel Terminal	152	8.444	0.118
	Logging Terminal	16	0.889	1.125
	Marine Services	12	0.667	1.500
	Military Facility	44	2.444	0.409
	Mining Operations	7	0.389	2.571
	Municipal Fuel Storage Facility	89	4.944	0.202
	Offshore Services	12	0.667	1.500
	Oil Exploration/Production	1,979	109.944	0.009
	Other	28	1.556	0.643
	Petroleum Terminal	101	5.611	0.178
	Pipeline Transport (Onshore)	5	0.278	3.600
	Power Plant	115	6.389	0.157
	Refinery	230	12.778	0.078
	Residential	21	1.167	0.857
	Seafood Industry	122	6.778	0.148
	Ship Terminal (Cargo)[66]	9	0.500	2.000
	Small Boat Harbor	285	15.833	0.063
	Unknown	99	5.500	0.182
	Vehicle	10	0.556	1.800
Native Corporation[67]	**Barge Terminal**	1	0.056	18.000
	Construction Site	1	0.056	18.000
	Fuel Terminal	10	0.556	1.800
	Marine Services	1	0.056	18.000
	Municipal Fuel Storage	43	2.389	0.419
	Oil Exploration/Production	2	0.111	9.000
	Other	6	0.333	3.000
	Power Plant	11	0.611	1.636
	Seafood Industry	13	0.722	1.385
	Small Boat Harbor	5	0.278	3.600
	Unknown	2	0.111	9.000
Combined	**Airport**	17	0.944	1.059
	Barge Terminal	18	1.000	1.000
	Bulk Chemical Facility	21	1.167	0.857
	Construction Site	16	0.889	1.125
	Container Terminal	17	0.944	1.059
	Cruise Ship Terminal	41	2.278	0.439
	Drydock Facility	4	0.222	4.500
	Ferry Terminal	18	1.000	1.000
	Fuel Terminal	162	9.000	0.111

[66] Terminal for loading and unloading of cargo vessels other than container ships, bulk carriers, and tank vessels.
[67] Includes Alaskan native corporations, village councils, and other Indian organizations.

Table 53: Facility Types for Incidents 1995 – 2012				
Facility Category	**Facility Type**	**Incident Number**	**Incidents/Year**	**Return Years**
	Logging Terminal	16	0.889	1.125
	Marine Services	13	0.722	1.385
	Military Facility	44	2.444	0.409
	Mining Operations	7	0.389	2.571
	Municipal Fuel Storage Facility	132	7.333	0.136
	Offshore Services	12	0.667	1.500
	Oil Exploration/Production	1,981	110.056	0.009
	Other	34	1.889	0.529
	Petroleum Terminal	101	5.611	0.178
	Pipeline Transport (Onshore)	5	0.278	3.600
	Power Plant	126	7.000	0.143
	Refinery	230	12.778	0.078
	Residential	21	1.167	0.857
	Seafood Industry	135	7.500	0.133
	Ship Terminal (Cargo)	9	0.500	2.000
	Small Boat Harbor	290	16.111	0.062
	Unknown	101	5.611	0.178
	Vehicle	10	0.556	1.800
Total		**3,581**	**198.944**	**0.005**

Table 54: Ordered Incident Rates by Facility Type		
Vessel Type	**Incidents/Year**	**Return Years**
Oil Exploration/Production	110.056	0.009
Small Boat Harbor	16.111	0.062
Refinery	12.778	0.078
Fuel Terminal	9.000	0.111
Seafood Industry	7.500	0.133
Municipal Fuel Storage Facility	7.333	0.136
Power Plant	7.000	0.143
Petroleum Terminal	5.611	0.178
Unknown	5.611	0.178
Military Facility	2.444	0.409
Cruise Ship Terminal	2.278	0.439
Other	1.889	0.529
Bulk Chemical Facility	1.167	0.857
Residential	1.167	0.857
Barge Terminal	1.000	1.000
Ferry Terminal	1.000	1.000
Airport	0.944	1.059
Container Terminal	0.944	1.059
Construction Site	0.889	1.125
Logging Terminal	0.889	1.125
Marine Services	0.722	1.385
Offshore Services	0.667	1.500
Vehicle	0.556	1.800
Ship Terminal (Cargo)	0.500	2.000
Mining Operations	0.389	2.571
Pipeline Transport (Onshore)	0.278	3.600
Drydock Facility	0.222	4.500

Table 55: Facility Incidents by Region (1995 – 2012)

Facility Type	Aleut-ian	Aniak-chak	Beau-fort	Bristol Bay	Cook Inlet	Kotze-bue	Kodiak	Chuk	Norton Sound	Off Kenai	South-Cent	PWS	South-east	West-ern	Total
Airport	1	0	0	0	2	0	0	0	1	1	0	0	10	2	**17**
Barge Ter[68]	0	0	0	1	1	0	2	0	5	0	0	1	3	5	**18**
Bulk Chem[69]	0	0	0	0	17	0	0	0	0	0	0	0	4	0	**21**
Construction	2	2	1	0	3	0	0	0	1	0	0	0	3	4	**16**
Container	6	0	0	0	3	0	0	0	0	2	0	4	2	0	**17**
Cruise	0	0	0	0	0	0	0	0	0	3	0	0	38	0	**41**
Drydock	1	0	0	0	0	0	0	0	0	0	0	0	3	0	**4**
Ferry	0	0	0	0	1	0	0	0	0	0	1	3	13	0	**18**
Fuel Term	38	0	0	12	15	4	6	1	8	2	0	6	48	22	**162**
Logging	0	0	0	0	0	0	1	0	0	0	1	0	14	0	**16**
Marine Svs[70]	0	0	0	0	2	2	0	0	2	1	0	1	3	2	**13**
Military	12	0	0	1	2	0	11	0	4	1	1	2	10	0	**44**
Mining	0	0	0	0	0	6	0	0	0	0	0	0	1	0	**7**
Municipal	7	1	2	10	4	4	4	7	23	0	0	4	6	60	**132**
Offshore	6	0	0	0	5	0	0	0	0	0	0	1	0	0	**12**
Oil E/P	0	1	1,458	0	511	0	1	10	0	0	0	0	0	0	**1,981**
Other	2	0	1	0	4	3	2	1	3	0	0	2	15	1	**34**
Petroleum	0	0	0	0	20	0	0	0	0	0	0	79	2	0	**101**
Pipeline	0	0	0	0	5	0	0	0	0	0	0	0	0	0	**5**
Power[71]	6	1	0	8	25	10	9	3	7	7	7	5	8	30	**126**
Refinery	0	0	0	0	181	0	2	0	0	0	0	47	0	0	**230**
Residential	0	1	0	0	1	1	0	0	0	0	0	1	17	0	**21**
Seafood	91	11	0	12	3	0	2	0	1	2	1	0	10	2	**135**
Ship Term	0	0	0	0	1	0	2	0	0	3	0	1	2	0	**9**
Sm Harbor[72]	10	2	0	1	23	0	13	0	4	7	4	29	193	4	**290**

[68] Barge terminal
[69] Bulk chemical facility
[70] Marine services facility
[71] Power-generating facility

Table 55: Facility Incidents by Region (1995 – 2012)															
Facility Type	**Aleut-ian**	**Aniak-chak**	**Beau-fort**	**Bristol Bay**	**Cook Inlet**	**Kotze-bue**	**Kodiak**	**Chuk**	**Norton Sound**	**Off Kenai**	**South-Cent**	**PWS**	**South-east**	**West-ern**	**Total**
Unknown	6	0	1	0	8	1	4	0	1	5	0	7	67	1	**101**
Vehicle	0	0	0	0	0	0	0	0	0	0	0	1	9	0	**10**
Total	**188**	**19**	**1,463**	**45**	**837**	**31**	**59**	**22**	**60**	**34**	**15**	**194**	**481**	**133**	**3,581**

Table 56: Annual Incident Rates for Facility Incidents by Region (1995 – 2012)															
Facility Type	**Aleut-ian**	**Aniak-chak**	**Beau-fort**	**Bristol Bay**	**Cook Inlet**	**Kotze-bue**	**Kodiak**	**Chuk**	**Norton Sound**	**Off Kenai**	**South-Cent**	**PWS**	**South-east**	**West-ern**	**Total**
Airport	0.056	0.000	0.000	0.000	0.111	0.000	0.000	0.000	0.056	0.056	0.000	0.000	0.556	0.111	**0.944**
Barge Ter	0.000	0.000	0.000	0.056	0.056	0.000	0.111	0.000	0.278	0.000	0.000	0.056	0.167	0.278	**1.000**
Bulk Chem	0.000	0.000	0.000	0.000	0.944	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.222	0.000	**1.167**
Construct	0.111	0.111	0.056	0.000	0.167	0.000	0.000	0.000	0.056	0.000	0.000	0.000	0.167	0.222	**0.889**
Container	0.333	0.000	0.000	0.000	0.167	0.000	0.000	0.000	0.000	0.111	0.000	0.222	0.111	0.000	**0.944**
Cruise	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.167	0.000	0.000	2.111	0.000	**2.278**
Drydock	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.167	0.000	**0.222**
Ferry	0.000	0.000	0.000	0.000	0.056	0.000	0.000	0.000	0.000	0.000	0.056	0.167	0.722	0.000	**1.000**
Fuel Term	2.111	0.000	0.000	0.667	0.833	0.222	0.333	0.056	0.444	0.111	0.000	0.333	2.667	1.222	**9.000**
Logging	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.000	0.000	0.056	0.000	0.778	0.000	**0.889**
Marine Svs	0.000	0.000	0.000	0.000	0.111	0.111	0.000	0.000	0.111	0.056	0.000	0.056	0.167	0.111	**0.722**
Military	0.667	0.000	0.000	0.056	0.111	0.000	0.611	0.000	0.222	0.056	0.056	0.111	0.556	0.000	**2.444**
Mining	0.000	0.000	0.000	0.000	0.000	0.333	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	**0.389**
Municipal	0.389	0.056	0.111	0.556	0.222	0.222	0.222	0.389	1.278	0.000	0.000	0.222	0.333	3.333	**7.333**
Offshore	0.333	0.000	0.000	0.000	0.278	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.000	**0.667**
Oil E/P	0.000	0.056	81.000	0.000	28.389	0.000	0.056	0.556	0.000	0.000	0.000	0.000	0.000	0.000	**110.056**
Other	0.111	0.000	0.056	0.000	0.222	0.167	0.111	0.056	0.167	0.000	0.000	0.111	0.833	0.056	**1.889**
Petroleum	0.000	0.000	0.000	0.000	1.111	0.000	0.000	0.000	0.000	0.000	0.000	4.389	0.111	0.000	**5.611**
Pipeline	0.000	0.000	0.000	0.000	0.278	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.278**
Power	0.333	0.056	0.000	0.444	1.389	0.556	0.500	0.167	0.389	0.389	0.389	0.278	0.444	1.667	**7.000**
Refinery	0.000	0.000	0.000	0.000	10.056	0.000	0.111	0.000	0.000	0.000	0.000	2.611	0.000	0.000	**12.778**
Residential	0.000	0.056	0.000	0.000	0.056	0.056	0.000	0.000	0.000	0.000	0.000	0.056	0.944	0.000	**1.167**
Seafood	5.056	0.611	0.000	0.667	0.167	0.000	0.111	0.000	0.056	0.111	0.056	0.000	0.556	0.111	**7.500**
Ship Term	0.000	0.000	0.000	0.000	0.056	0.000	0.111	0.000	0.000	0.167	0.000	0.056	0.111	0.000	**0.500**

[72] Small boat harbor

Table 56: Annual Incident Rates for Facility Incidents by Region (1995 – 2012)															
Facility Type	**Aleut-ian**	**Aniak-chak**	**Beau-fort**	**Bristol Bay**	**Cook Inlet**	**Kotze-bue**	**Kodiak**	**Chuk**	**Norton Sound**	**Off Kenai**	**South-Cent**	**PWS**	**South-east**	**West-ern**	**Total**
Sm Harbor	0.556	0.111	0.000	0.056	1.278	0.000	0.722	0.000	0.222	0.389	0.222	1.611	10.722	0.222	**16.111**
Unknown	0.333	0.000	0.056	0.000	0.444	0.056	0.222	0.000	0.056	0.278	0.000	0.389	3.722	0.056	**5.611**
Vehicle	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.500	0.000	**0.556**
Total	**10.444**	**1.056**	**81.278**	**2.500**	**46.500**	**1.722**	**3.278**	**1.222**	**3.333**	**1.889**	**0.833**	**10.778**	**26.722**	**7.389**	**198.944**

Table 57: Ordered Incident Rates by Facility Type and Region				
Facility Type	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Oil E/P	**Beaufort Sea**	81.000	0.012	**HIGHEST >20/yr**
Oil E/P	**Cook Inlet**	28.389	0.035	
Small Harbor	**Southeast Alaska**	10.722	0.093	**VERY HIGH 10 – 20/yr**
Refinery	**Cook Inlet**	10.056	0.099	
Seafood	**Aleutians**	5.056	0.198	**MODERATE 4 – 9/yr**
Petroleum	**Prince William Sound**	4.389	0.228	
Unknown	**Southeast Alaska**	3.722	0.269	
Municipal	**Western Alaska**	3.333	0.300	**LOW 1 – 3/yr**
Fuel Terminal	**Southeast Alaska**	2.667	0.375	
Refinery	**Prince William Sound**	2.611	0.383	
Fuel Terminal	**Aleutians**	2.111	0.474	
Cruise	**Southeast Alaska**	2.111	0.474	
Power	**Western Alaska**	1.667	0.600	
Small Harbor	**Prince William Sound**	1.611	0.621	
Power	**Cook Inlet**	1.389	0.720	
Small Harbor	**Cook Inlet**	1.278	0.783	
Municipal	**Norton S/St. Lawrence**	1.278	0.783	
Fuel Terminal	**Western Alaska**	1.222	0.818	
Petroleum	**Cook Inlet**	1.111	0.900	
Bulk Chemical	**Cook Inlet**	0.944	1.059	
Residential	**Southeast Alaska**	0.944	1.059	
Fuel Terminal	**Cook Inlet**	0.833	1.200	
Other	**Southeast Alaska**	0.833	1.200	
Logging	**Southeast Alaska**	0.778	1.286	
Small Harbor	**Kodiak**	0.722	1.385	
Ferry	**Southeast Alaska**	0.722	1.385	
Military	**Aleutians**	0.667	1.500	
Fuel Terminal	**Bristol Bay**	0.667	1.500	
Seafood	**Bristol Bay**	0.667	1.500	
Seafood	**Aniakchak**	0.611	1.636	
Military	**Kodiak**	0.611	1.636	
Small Harbor	**Aleutians**	0.556	1.800	
Municipal	**Bristol Bay**	0.556	1.800	
Power	**Kotzebue/Hope**	0.556	1.800	
Oil E/P	**Chukchi Sea**	0.556	1.800	
Airport	**Southeast Alaska**	0.556	1.800	
Military	**Southeast Alaska**	0.556	1.800	
Seafood	**Southeast Alaska**	0.556	1.800	
Power	**Kodiak**	0.500	2.000	**VERY LOW <1/yr**
Vehicle	**Southeast Alaska**	0.500	2.000	
Power	**Bristol Bay**	0.444	2.250	
Unknown	**Cook Inlet**	0.444	2.250	
Fuel Terminal	**Norton S/St. Lawrence**	0.444	2.250	
Power	**Southeast Alaska**	0.444	2.250	
Municipal	**Aleutians**	0.389	2.571	
Municipal	**Chukchi Sea**	0.389	2.571	
Power	**Norton S/St. Lawrence**	0.389	2.571	
Power	**Off Kenai Peninsula**	0.389	2.571	

Table 57: Ordered Incident Rates by Facility Type and Region				
Facility Type	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Small Harbor	**Off Kenai Peninsula**	0.389	2.571	
Power	**South-Central**	0.389	2.571	
Unknown	**Prince William Sound**	0.389	2.571	
Container	**Aleutians**	0.333	3.000	
Offshore	**Aleutians**	0.333	3.000	
Power	**Aleutians**	0.333	3.000	
Unknown	**Aleutians**	0.333	3.000	
Mining	**Kotzebue/Hope**	0.333	3.000	
Fuel Terminal	**Kodiak**	0.333	3.000	
Fuel Terminal	**Prince William Sound**	0.333	3.000	
Municipal	**Southeast Alaska**	0.333	3.000	
Offshore	**Cook Inlet**	0.278	3.600	
Pipeline	**Cook Inlet**	0.278	3.600	
Barge Terminal	**Norton S/St. Lawrence**	0.278	3.600	
Unknown	**Off Kenai Peninsula**	0.278	3.600	
Power	**Prince William Sound**	0.278	3.600	
Barge Terminal	**Western Alaska**	0.278	3.600	
Municipal	**Cook Inlet**	0.222	4.500	
Other	**Cook Inlet**	0.222	4.500	
Fuel Terminal	**Kotzebue/Hope**	0.222	4.500	
Municipal	**Kotzebue/Hope**	0.222	4.500	
Municipal	**Kodiak**	0.222	4.500	
Unknown	**Kodiak**	0.222	4.500	
Military	**Norton S/St. Lawrence**	0.222	4.500	
Small Harbor	**Norton S/St. Lawrence**	0.222	4.500	
Small Harbor	**South-Central**	0.222	4.500	
Container	**Prince William Sound**	0.222	4.500	
Municipal	**Prince William Sound**	0.222	4.500	
Bulk Chemical	**Southeast Alaska**	0.222	4.500	
Construct	**Western Alaska**	0.222	4.500	
Small Harbor	**Western Alaska**	0.222	4.500	
Construct	**Cook Inlet**	0.167	6.000	
Container	**Cook Inlet**	0.167	6.000	
Seafood	**Cook Inlet**	0.167	6.000	
Other	**Kotzebue/Hope**	0.167	6.000	
Power	**Chukchi Sea**	0.167	6.000	
Other	**Norton S/St. Lawrence**	0.167	6.000	
Cruise	**Off Kenai Peninsula**	0.167	6.000	
Ship Terminal	**Off Kenai Peninsula**	0.167	6.000	
Ferry	**Prince William Sound**	0.167	6.000	
Barge Terminal	**Southeast Alaska**	0.167	6.000	
Construct	**Southeast Alaska**	0.167	6.000	
Drydock	**Southeast Alaska**	0.167	6.000	
Marine Svs	**Southeast Alaska**	0.167	6.000	
Construct	**Aleutians**	0.111	9.000	
Other	**Aleutians**	0.111	9.000	
Construct	**Aniakchak**	0.111	9.000	
Small Harbor	**Aniakchak**	0.111	9.000	
Municipal	**Beaufort Sea**	0.111	9.000	

Table 57: Ordered Incident Rates by Facility Type and Region				
Facility Type	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Airport	**Cook Inlet**	0.111	9.000	
Marine Svs	**Cook Inlet**	0.111	9.000	
Military	**Cook Inlet**	0.111	9.000	
Marine Svs	**Kotzebue/Hope**	0.111	9.000	
Barge Terminal	**Kodiak**	0.111	9.000	
Other	**Kodiak**	0.111	9.000	
Refinery	**Kodiak**	0.111	9.000	
Seafood	**Kodiak**	0.111	9.000	
Ship Terminal	**Kodiak**	0.111	9.000	
Marine Svs	**Norton S/St. Lawrence**	0.111	9.000	
Container	**Off Kenai Peninsula**	0.111	9.000	
Fuel Terminal	**Off Kenai Peninsula**	0.111	9.000	
Seafood	**Off Kenai Peninsula**	0.111	9.000	
Military	**Prince William Sound**	0.111	9.000	
Other	**Prince William Sound**	0.111	9.000	
Container	**Southeast Alaska**	0.111	9.000	
Petroleum	**Southeast Alaska**	0.111	9.000	
Ship Terminal	**Southeast Alaska**	0.111	9.000	
Airport	**Western Alaska**	0.111	9.000	
Marine Svs	**Western Alaska**	0.111	9.000	
Seafood	**Western Alaska**	0.111	9.000	
Airport	**Aleutians**	0.056	18.000	
Drydock	**Aleutians**	0.056	18.000	
Municipal	**Aniakchak**	0.056	18.000	
Oil E/P	**Aniakchak**	0.056	18.000	
Power	**Aniakchak**	0.056	18.000	
Residential	**Aniakchak**	0.056	18.000	
Construct	**Beaufort Sea**	0.056	18.000	
Other	**Beaufort Sea**	0.056	18.000	
Unknown	**Beaufort Sea**	0.056	18.000	
Barge Terminal	**Bristol Bay**	0.056	18.000	
Military	**Bristol Bay**	0.056	18.000	
Small Harbor	**Bristol Bay**	0.056	18.000	
Barge Terminal	**Cook Inlet**	0.056	18.000	
Ferry	**Cook Inlet**	0.056	18.000	
Residential	**Cook Inlet**	0.056	18.000	
Ship Terminal	**Cook Inlet**	0.056	18.000	
Residential	**Kotzebue/Hope**	0.056	18.000	
Unknown	**Kotzebue/Hope**	0.056	18.000	
Logging	**Kodiak**	0.056	18.000	
Oil E/P	**Kodiak**	0.056	18.000	
Fuel Terminal	**Chukchi Sea**	0.056	18.000	
Other	**Chukchi Sea**	0.056	18.000	
Airport	**Norton S/St. Lawrence**	0.056	18.000	
Construct	**Norton S/St. Lawrence**	0.056	18.000	
Seafood	**Norton S/St. Lawrence**	0.056	18.000	
Unknown	**Norton S/St. Lawrence**	0.056	18.000	
Airport	**Off Kenai Peninsula**	0.056	18.000	
Marine Svs	**Off Kenai Peninsula**	0.056	18.000	

Table 57: Ordered Incident Rates by Facility Type and Region				
Facility Type	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Military	**Off Kenai Peninsula**	0.056	18.000	
Ferry	**South-Central**	0.056	18.000	
Logging	**South-Central**	0.056	18.000	
Military	**South-Central**	0.056	18.000	
Seafood	**South-Central**	0.056	18.000	
Barge Terminal	**Prince William Sound**	0.056	18.000	
Marine Svs	**Prince William Sound**	0.056	18.000	
Offshore	**Prince William Sound**	0.056	18.000	
Residential	**Prince William Sound**	0.056	18.000	
Ship Terminal	**Prince William Sound**	0.056	18.000	
Vehicle	**Prince William Sound**	0.056	18.000	
Mining	**Southeast Alaska**	0.056	18.000	
Other	**Western Alaska**	0.056	18.000	
Unknown	**Western Alaska**	0.056	18.000	
Barge Terminal	**Aleutians**	0.000	0.000	**LOWEST 0/yr**
Bulk Chemical	**Aleutians**	0.000	0.000	
Cruise	**Aleutians**	0.000	0.000	
Ferry	**Aleutians**	0.000	0.000	
Logging	**Aleutians**	0.000	0.000	
Marine Svs	**Aleutians**	0.000	0.000	
Mining	**Aleutians**	0.000	0.000	
Oil E/P	**Aleutians**	0.000	0.000	
Petroleum	**Aleutians**	0.000	0.000	
Pipeline	**Aleutians**	0.000	0.000	
Refinery	**Aleutians**	0.000	0.000	
Residential	**Aleutians**	0.000	0.000	
Ship Terminal	**Aleutians**	0.000	0.000	
Vehicle	**Aleutians**	0.000	0.000	
Airport	**Aniakchak**	0.000	0.000	
Barge Terminal	**Aniakchak**	0.000	0.000	
Bulk Chemical	**Aniakchak**	0.000	0.000	
Container	**Aniakchak**	0.000	0.000	
Cruise	**Aniakchak**	0.000	0.000	
Drydock	**Aniakchak**	0.000	0.000	
Ferry	**Aniakchak**	0.000	0.000	
Fuel Terminal	**Aniakchak**	0.000	0.000	
Logging	**Aniakchak**	0.000	0.000	
Marine Svs	**Aniakchak**	0.000	0.000	
Military	**Aniakchak**	0.000	0.000	
Mining	**Aniakchak**	0.000	0.000	
Offshore	**Aniakchak**	0.000	0.000	
Other	**Aniakchak**	0.000	0.000	
Petroleum	**Aniakchak**	0.000	0.000	
Pipeline	**Aniakchak**	0.000	0.000	
Refinery	**Aniakchak**	0.000	0.000	
Ship Terminal	**Aniakchak**	0.000	0.000	
Unknown	**Aniakchak**	0.000	0.000	
Vehicle	**Aniakchak**	0.000	0.000	
Airport	**Beaufort Sea**	0.000	0.000	

Table 57: Ordered Incident Rates by Facility Type and Region				
Facility Type	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Barge Terminal	**Beaufort Sea**	0.000	0.000	
Bulk Chemical	**Beaufort Sea**	0.000	0.000	
Container	**Beaufort Sea**	0.000	0.000	
Cruise	**Beaufort Sea**	0.000	0.000	
Drydock	**Beaufort Sea**	0.000	0.000	
Ferry	**Beaufort Sea**	0.000	0.000	
Fuel Terminal	**Beaufort Sea**	0.000	0.000	
Logging	**Beaufort Sea**	0.000	0.000	
Marine Svs	**Beaufort Sea**	0.000	0.000	
Military	**Beaufort Sea**	0.000	0.000	
Mining	**Beaufort Sea**	0.000	0.000	
Offshore	**Beaufort Sea**	0.000	0.000	
Petroleum	**Beaufort Sea**	0.000	0.000	
Pipeline	**Beaufort Sea**	0.000	0.000	
Power	**Beaufort Sea**	0.000	0.000	
Refinery	**Beaufort Sea**	0.000	0.000	
Residential	**Beaufort Sea**	0.000	0.000	
Seafood	**Beaufort Sea**	0.000	0.000	
Ship Terminal	**Beaufort Sea**	0.000	0.000	
Small Harbor	**Beaufort Sea**	0.000	0.000	
Vehicle	**Beaufort Sea**	0.000	0.000	
Airport	**Bristol Bay**	0.000	0.000	
Bulk Chemical	**Bristol Bay**	0.000	0.000	
Construct	**Bristol Bay**	0.000	0.000	
Container	**Bristol Bay**	0.000	0.000	
Cruise	**Bristol Bay**	0.000	0.000	
Drydock	**Bristol Bay**	0.000	0.000	
Ferry	**Bristol Bay**	0.000	0.000	
Logging	**Bristol Bay**	0.000	0.000	
Marine Svs	**Bristol Bay**	0.000	0.000	
Mining	**Bristol Bay**	0.000	0.000	
Offshore	**Bristol Bay**	0.000	0.000	
Oil E/P	**Bristol Bay**	0.000	0.000	
Other	**Bristol Bay**	0.000	0.000	
Petroleum	**Bristol Bay**	0.000	0.000	
Pipeline	**Bristol Bay**	0.000	0.000	
Refinery	**Bristol Bay**	0.000	0.000	
Residential	**Bristol Bay**	0.000	0.000	
Ship Terminal	**Bristol Bay**	0.000	0.000	
Unknown	**Bristol Bay**	0.000	0.000	
Vehicle	**Bristol Bay**	0.000	0.000	
Cruise	**Cook Inlet**	0.000	0.000	
Drydock	**Cook Inlet**	0.000	0.000	
Logging	**Cook Inlet**	0.000	0.000	
Mining	**Cook Inlet**	0.000	0.000	
Vehicle	**Cook Inlet**	0.000	0.000	
Airport	**Kotzebue/Hope**	0.000	0.000	
Barge Terminal	**Kotzebue/Hope**	0.000	0.000	
Bulk Chemical	**Kotzebue/Hope**	0.000	0.000	

Table 57: Ordered Incident Rates by Facility Type and Region				
Facility Type	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Construct	**Kotzebue/Hope**	0.000	0.000	
Container	**Kotzebue/Hope**	0.000	0.000	
Cruise	**Kotzebue/Hope**	0.000	0.000	
Drydock	**Kotzebue/Hope**	0.000	0.000	
Ferry	**Kotzebue/Hope**	0.000	0.000	
Logging	**Kotzebue/Hope**	0.000	0.000	
Military	**Kotzebue/Hope**	0.000	0.000	
Offshore	**Kotzebue/Hope**	0.000	0.000	
Oil E/P	**Kotzebue/Hope**	0.000	0.000	
Petroleum	**Kotzebue/Hope**	0.000	0.000	
Pipeline	**Kotzebue/Hope**	0.000	0.000	
Refinery	**Kotzebue/Hope**	0.000	0.000	
Seafood	**Kotzebue/Hope**	0.000	0.000	
Ship Terminal	**Kotzebue/Hope**	0.000	0.000	
Small Harbor	**Kotzebue/Hope**	0.000	0.000	
Vehicle	**Kotzebue/Hope**	0.000	0.000	
Airport	**Kodiak**	0.000	0.000	
Bulk Chemical	**Kodiak**	0.000	0.000	
Construct	**Kodiak**	0.000	0.000	
Container	**Kodiak**	0.000	0.000	
Cruise	**Kodiak**	0.000	0.000	
Drydock	**Kodiak**	0.000	0.000	
Ferry	**Kodiak**	0.000	0.000	
Marine Svs	**Kodiak**	0.000	0.000	
Mining	**Kodiak**	0.000	0.000	
Offshore	**Kodiak**	0.000	0.000	
Petroleum	**Kodiak**	0.000	0.000	
Pipeline	**Kodiak**	0.000	0.000	
Residential	**Kodiak**	0.000	0.000	
Vehicle	**Kodiak**	0.000	0.000	
Airport	**Chukchi Sea**	0.000	0.000	
Barge Terminal	**Chukchi Sea**	0.000	0.000	
Bulk Chemical	**Chukchi Sea**	0.000	0.000	
Construct	**Chukchi Sea**	0.000	0.000	
Container	**Chukchi Sea**	0.000	0.000	
Cruise	**Chukchi Sea**	0.000	0.000	
Drydock	**Chukchi Sea**	0.000	0.000	
Ferry	**Chukchi Sea**	0.000	0.000	
Logging	**Chukchi Sea**	0.000	0.000	
Marine Svs	**Chukchi Sea**	0.000	0.000	
Military	**Chukchi Sea**	0.000	0.000	
Mining	**Chukchi Sea**	0.000	0.000	
Offshore	**Chukchi Sea**	0.000	0.000	
Petroleum	**Chukchi Sea**	0.000	0.000	
Pipeline	**Chukchi Sea**	0.000	0.000	
Refinery	**Chukchi Sea**	0.000	0.000	
Residential	**Chukchi Sea**	0.000	0.000	
Seafood	**Chukchi Sea**	0.000	0.000	
Ship Terminal	**Chukchi Sea**	0.000	0.000	

Table 57: Ordered Incident Rates by Facility Type and Region				
Facility Type	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Small Harbor	**Chukchi Sea**	0.000	0.000	
Unknown	**Chukchi Sea**	0.000	0.000	
Vehicle	**Chukchi Sea**	0.000	0.000	
Bulk Chemical	**Norton S/St. Lawrence**	0.000	0.000	
Container	**Norton S/St. Lawrence**	0.000	0.000	
Cruise	**Norton S/St. Lawrence**	0.000	0.000	
Drydock	**Norton S/St. Lawrence**	0.000	0.000	
Ferry	**Norton S/St. Lawrence**	0.000	0.000	
Logging	**Norton S/St. Lawrence**	0.000	0.000	
Mining	**Norton S/St. Lawrence**	0.000	0.000	
Offshore	**Norton S/St. Lawrence**	0.000	0.000	
Oil E/P	**Norton S/St. Lawrence**	0.000	0.000	
Petroleum	**Norton S/St. Lawrence**	0.000	0.000	
Pipeline	**Norton S/St. Lawrence**	0.000	0.000	
Refinery	**Norton S/St. Lawrence**	0.000	0.000	
Residential	**Norton S/St. Lawrence**	0.000	0.000	
Ship Terminal	**Norton S/St. Lawrence**	0.000	0.000	
Vehicle	**Norton S/St. Lawrence**	0.000	0.000	
Barge Terminal	**Off Kenai Peninsula**	0.000	0.000	
Bulk Chemical	**Off Kenai Peninsula**	0.000	0.000	
Construct	**Off Kenai Peninsula**	0.000	0.000	
Drydock	**Off Kenai Peninsula**	0.000	0.000	
Ferry	**Off Kenai Peninsula**	0.000	0.000	
Logging	**Off Kenai Peninsula**	0.000	0.000	
Mining	**Off Kenai Peninsula**	0.000	0.000	
Municipal	**Off Kenai Peninsula**	0.000	0.000	
Offshore	**Off Kenai Peninsula**	0.000	0.000	
Oil E/P	**Off Kenai Peninsula**	0.000	0.000	
Other	**Off Kenai Peninsula**	0.000	0.000	
Petroleum	**Off Kenai Peninsula**	0.000	0.000	
Pipeline	**Off Kenai Peninsula**	0.000	0.000	
Refinery	**Off Kenai Peninsula**	0.000	0.000	
Residential	**Off Kenai Peninsula**	0.000	0.000	
Vehicle	**Off Kenai Peninsula**	0.000	0.000	
Airport	**South-Central**	0.000	0.000	
Barge Terminal	**South-Central**	0.000	0.000	
Bulk Chemical	**South-Central**	0.000	0.000	
Construct	**South-Central**	0.000	0.000	
Container	**South-Central**	0.000	0.000	
Cruise	**South-Central**	0.000	0.000	
Drydock	**South-Central**	0.000	0.000	
Fuel Terminal	**South-Central**	0.000	0.000	
Marine Svs	**South-Central**	0.000	0.000	
Mining	**South-Central**	0.000	0.000	
Municipal	**South-Central**	0.000	0.000	
Offshore	**South-Central**	0.000	0.000	
Oil E/P	**South-Central**	0.000	0.000	
Other	**South-Central**	0.000	0.000	
Petroleum	**South-Central**	0.000	0.000	

Table 57: Ordered Incident Rates by Facility Type and Region				
Facility Type	**Region**	**Annual Incident Rate**	**Return Years**	**Frequency Category**
Pipeline	**South-Central**	0.000	0.000	
Refinery	**South-Central**	0.000	0.000	
Residential	**South-Central**	0.000	0.000	
Ship Terminal	**South-Central**	0.000	0.000	
Unknown	**South-Central**	0.000	0.000	
Vehicle	**South-Central**	0.000	0.000	
Airport	**Prince William Sound**	0.000	0.000	
Bulk Chemical	**Prince William Sound**	0.000	0.000	
Construct	**Prince William Sound**	0.000	0.000	
Cruise	**Prince William Sound**	0.000	0.000	
Drydock	**Prince William Sound**	0.000	0.000	
Logging	**Prince William Sound**	0.000	0.000	
Mining	**Prince William Sound**	0.000	0.000	
Oil E/P	**Prince William Sound**	0.000	0.000	
Pipeline	**Prince William Sound**	0.000	0.000	
Seafood	**Prince William Sound**	0.000	0.000	
Offshore	**Southeast Alaska**	0.000	0.000	
Oil E/P	**Southeast Alaska**	0.000	0.000	
Pipeline	**Southeast Alaska**	0.000	0.000	
Refinery	**Southeast Alaska**	0.000	0.000	
Bulk Chemical	**Western Alaska**	0.000	0.000	
Container	**Western Alaska**	0.000	0.000	
Cruise	**Western Alaska**	0.000	0.000	
Drydock	**Western Alaska**	0.000	0.000	
Ferry	**Western Alaska**	0.000	0.000	
Logging	**Western Alaska**	0.000	0.000	
Military	**Western Alaska**	0.000	0.000	
Mining	**Western Alaska**	0.000	0.000	
Offshore	**Western Alaska**	0.000	0.000	
Oil E/P	**Western Alaska**	0.000	0.000	
Petroleum	**Western Alaska**	0.000	0.000	
Pipeline	**Western Alaska**	0.000	0.000	
Refinery	**Western Alaska**	0.000	0.000	
Residential	**Western Alaska**	0.000	0.000	
Ship Terminal	**Western Alaska**	0.000	0.000	
Vehicle	**Western Alaska**	0.000	0.000	

4.3 Combined Vessel and Facility Incident Rates (Source and Region)

The incident rates by source and by region in Tables 53 and 58 were combined to create the ordered incident rates in Table 59. This includes all types of vessels and all facility types. The incident rates have also been normalized based on the highest rate of 81.0/year, so that that rate is 1.0. The “lowest” category, i.e., the incident types for which there were no incidents during 1995 – 2012 are not shown in this table.

Table 59: Ordered Combined Vessel and Facility Incident Rates

Type	Region	Annual Rate	Return Years	Normalized Frequency	Frequency Category
Oil Exp/Prod Facility	**Beaufort**	81.000	0.012	1.0000	**Highest >20/year**
Recreational Vessel <400GT	**Southeast Alaska**	71.389	0.014	0.8813	
Fishing Vessel <400GT	**Southeast Alaska**	49.944	0.020	0.6166	
Fishing Vessel <400GT	**Aleutians**	42.389	0.024	0.5233	
Oil Exp/Prod Facility	**Cook Inlet**	28.389	0.035	0.3505	
Fishing Vessel <400GT	**Kodiak/Shelikof**	24.333	0.041	0.3004	
Fishing Vessel >400GT	**Aleutians**	14.611	0.068	0.1804	**Very High 10 – 20/yr**
Recreational Vessel <400GT	**Prince William Sound**	11.278	0.089	0.1392	
Fishing Vessel <400GT	**Cook Inlet**	11.056	0.090	0.1365	
Recreational Vessel <400GT	**Aleutians**	10.778	0.093	0.1331	
Ferry >400GT	**Southeast Alaska**	10.722	0.093	0.1324	
Small Boat Harbor	**Southeast Alaska**	10.722	0.093	0.1324	
Passenger Ship <400GT	**Southeast Alaska**	10.667	0.094	0.1317	
Refinery	**Cook Inlet**	10.056	0.099	0.1241	
Recreational Vessel <400GT	**Kodiak/Shelikof**	9.611	0.104	0.1187	**High 5 – 9/yr**
Cruise Ship >400GT	**Southeast Alaska**	9.222	0.108	0.1139	
Fishing Vessel <400GT	**Prince William Sound**	9.167	0.109	0.1132	
Recreational Vessel <400GT	**Cook Inlet**	5.944	0.168	0.0734	
Fishing Vessel <400GT	**Bristol Bay**	5.667	0.176	0.0700	
Seafood Facility	**Aleutians**	5.056	0.198	0.0624	
Petroleum Terminal	**Prince William Sound**	4.389	0.228	0.0542	**Moderate 2 – 4 /yr**
Fishing Vessel <400GT	**Off Kenai Peninsula**	4.333	0.231	0.0535	
Towing Vessel <400GT	**Southeast Alaska**	3.944	0.254	0.0487	
Recreational Vessel <400GT	**Off Kenai Peninsula**	3.722	0.269	0.0460	
Unknown Land Source	**Southeast Alaska**	3.722	0.269	0.0460	
Military Vessel <400GT	**Kodiak/Shelikof**	3.611	0.277	0.0446	
Fishing Vessel <400GT	**Western Alaska**	3.333	0.300	0.0411	
Municipal Fuel Storage	**Western Alaska**	3.333	0.300	0.0411	
Fishing Vessel >400GT	**Western Alaska**	3.167	0.316	0.0391	
Military Vessel <400GT	**Southeast Alaska**	2.944	0.340	0.0363	
Fuel Terminal	**Southeast Alaska**	2.667	0.375	0.0329	
Industrial Vessel <400 GT	**Southeast Alaska**	2.611	0.383	0.0322	
Refinery	**Prince William Sound**	2.611	0.383	0.0322	
Towing Vessel <400GT	**Prince William Sound**	2.611	0.383	0.0322	
Tanker >90,000DWT	**Prince William Sound**	2.500	0.400	0.0309	
Industrial Vessel <400 GT	**Prince William Sound**	2.444	0.409	0.0302	
Passenger Ship <400GT	**Prince William Sound**	2.333	0.429	0.0288	
Fishing Vessel <400GT	**South-Central**	2.222	0.450	0.0274	
Cruise Terminal	**Southeast Alaska**	2.111	0.474	0.0261	
Fuel Terminal	**Aleutians**	2.111	0.474	0.0261	
Passenger Ship <400GT	**Cook Inlet**	2.111	0.474	0.0261	
Fishing Vessel >400GT	**Southeast Alaska**	2.000	0.500	0.0247	
Ferry >400GT	**Prince William Sound**	1.944	0.514	0.0240	**Low 1/yr**
Tanker <90,000DWT	**Prince William Sound**	1.944	0.514	0.0240	
Towing Vessel <400GT	**Aleutians**	1.944	0.514	0.0240	
Passenger Ship <400GT	**Off Kenai Peninsula**	1.833	0.546	0.0226	
Power Plant	**Western Alaska**	1.667	0.600	0.0206	
Small Boat Harbor	**Prince William Sound**	1.611	0.621	0.0199	
General Cargo Ship >400GT	**Aleutians**	1.500	0.667	0.0185	

Table 59: Ordered Combined Vessel and Facility Incident Rates					
Type	**Region**	**Annual Rate**	**Return Years**	**Normalized Frequency**	**Frequency Category**
Power Plant	**Cook Inlet**	1.389	0.720	0.0171	
Recreational Vessel >400GT	**Southeast Alaska**	1.333	0.750	0.0165	
Tank Barge >400GT	**Southeast Alaska**	1.333	0.750	0.0165	
Municipal Fuel Storage	**Norton S/St. Lawrence**	1.278	0.783	0.0158	
Small Boat Harbor	**Cook Inlet**	1.278	0.783	0.0158	
Fishing Vessel <400GT	**Aniakchak**	1.222	0.818	0.0151	
Freight Barge >400GT	**Southeast Alaska**	1.222	0.818	0.0151	
Fuel Terminal	**Western Alaska**	1.222	0.818	0.0151	
Tank Barge >400GT	**Aleutians**	1.222	0.818	0.0151	
Tank Barge >400GT	**Western Alaska**	1.222	0.818	0.0151	
Ferry <400GT	**Southeast Alaska**	1.167	0.857	0.0144	
Tanker <90,000DWT	**Cook Inlet**	1.167	0.857	0.0144	
Petroleum Terminal	**Cook Inlet**	1.111	0.900	0.0137	
Towing Vessel <400GT	**Cook Inlet**	1.111	0.900	0.0137	
Recreational Vessel <400GT	**Bristol Bay**	1.056	0.947	0.0130	
Towing Vessel <400GT	**Western Alaska**	1.056	0.947	0.0130	
Bulk Chemical Facility	**Cook Inlet**	0.944	1.059	0.0117	
Residential Facility	**Southeast Alaska**	0.944	1.059	0.0117	
Tank Barge >400GT	**Prince William Sound**	0.944	1.059	0.0117	
Towing Vessel <400GT	**Kodiak/Shelikof**	0.944	1.059	0.0117	
Fishing Vessel >400GT	**Prince William Sound**	0.889	1.125	0.0110	
Freight Barge <400GT	**Southeast Alaska**	0.889	1.125	0.0110	
Recreational Vessel <400GT	**Western Alaska**	0.889	1.125	0.0110	
Research Vessel <400GT	**Southeast Alaska**	0.889	1.125	0.0110	
Tank Barge >400GT	**Cook Inlet**	0.889	1.125	0.0110	
Fuel Terminal	**Cook Inlet**	0.833	1.200	0.0103	
General Cargo Ship <400GT	**Southeast Alaska**	0.833	1.200	0.0103	
Other Facility	**Southeast Alaska**	0.833	1.200	0.0103	
Logging Facility	**Southeast Alaska**	0.778	1.286	0.0096	
Oil Recovery Vessel <400GT	**Prince William Sound**	0.778	1.285	0.0096	
Ferry Terminal	**Southeast Alaska**	0.722	1.385	0.0089	
Small Boat Harbor	**Kodiak/Shelikof**	0.722	1.385	0.0089	
Tank Barge <400GT	**Prince William Sound**	0.722	1.385	0.0089	**Very Low < 1/yr**
Towing Vessel >400GT	**Prince William Sound**	0.722	1.385	0.0089	
Container Ship >400GT	**Aleutians**	0.667	1.499	0.0082	
Ferry >400GT	**Kodiak/Shelikof**	0.667	1.499	0.0082	
Fuel Terminal	**Bristol Bay**	0.667	1.500	0.0082	
Military Facility	**Aleutians**	0.667	1.500	0.0082	
Seafood Facility	**Bristol Bay**	0.667	1.500	0.0082	
Tank Barge >400GT	**Norton**	0.667	1.499	0.0082	
Tank Barge <400GT	**Aleutians**	0.667	1.499	0.0082	
Military Facility	**Kodiak/Shelikof**	0.611	1.636	0.0075	
Passenger Ship >400GT	**Southeast Alaska**	0.611	1.637	0.0075	
Passenger Ship <400GT	**Kodiak/Shelikof**	0.611	1.637	0.0075	
Seafood Facility	**Aniakchak**	0.611	1.636	0.0075	
Towing Vessel <400GT	**Off Kenai Peninsula**	0.611	1.637	0.0075	
Airport	**Southeast Alaska**	0.556	1.800	0.0069	
Container Ship >400GT	**Southeast Alaska**	0.556	1.799	0.0069	
Fishing Vessel >400GT	**Bristol Bay**	0.556	1.799	0.0069	

Table 59: Ordered Combined Vessel and Facility Incident Rates					
Type	**Region**	**Annual Rate**	**Return Years**	**Normalized Frequency**	**Frequency Category**
Freight Barge >400GT	**Aleutians**	0.556	1.799	0.0069	
Military Facility	**Southeast Alaska**	0.556	1.800	0.0069	
Municipal Fuel Storage	**Bristol Bay**	0.556	1.800	0.0069	
Offshore Supply Vessel <400GT	**Prince William Sound**	0.556	1.799	0.0069	
Oil Exp/Prod Facility	**N Chuk**	0.556	1.800	0.0069	
Oil Recovery Vessel >400GT	**Prince William Sound**	0.556	1.799	0.0069	
Power Plant	**Kotzebue/Hope**	0.556	1.800	0.0069	
Research Vessel >400GT	**Cook Inlet**	0.556	1.799	0.0069	
Research Vessel <400GT	**Aleutians**	0.556	1.799	0.0069	
Research Vessel <400GT	**Kodiak/Shelikof**	0.556	1.799	0.0069	
Seafood Facility	**Southeast Alaska**	0.556	1.800	0.0069	
Small Boat Harbor	**Aleutians**	0.556	1.800	0.0069	
Tank Barge <400GT	**Bristol Bay**	0.556	1.799	0.0069	
Tank Barge <400GT	**Southeast Alaska**	0.556	1.799	0.0069	
Ferry >400GT	**Cook Inlet**	0.500	2.000	0.0062	
General Cargo Ship >400GT	**Cook Inlet**	0.500	2.000	0.0062	
Military Vessel >400GT	**Kodiak/Shelikof**	0.500	2.000	0.0062	
Power Plant	**Kodiak/Shelikof**	0.500	2.000	0.0062	
Tank Barge >400GT	**Bristol Bay**	0.500	2.000	0.0062	
Tank Barge <400GT	**Cook Inlet**	0.500	2.000	0.0062	
Vehicle	**Southeast Alaska**	0.500	2.000	0.0062	
Bulk Carrier >400GT	**Aleutians**	0.444	2.252	0.0055	
Fishing Vessel >400GT	**Cook Inlet**	0.444	2.252	0.0055	
Freight Barge >400GT	**Prince William Sound**	0.444	2.252	0.0055	
Fuel Terminal	**Norton S/St. Lawrence**	0.444	2.250	0.0055	
Industrial Vessel <400 GT	**Cook Inlet**	0.444	2.252	0.0055	
Passenger Ship <400GT	**Aleutians**	0.444	2.252	0.0055	
Power Plant	**Bristol Bay**	0.444	2.250	0.0055	
Power Plant	**Southeast Alaska**	0.444	2.250	0.0055	
Recreational Vessel <400GT	**South-Central**	0.444	2.252	0.0055	
Tanker >90,000DWT	**South-Central**	0.444	2.252	0.0055	
Towing Vessel >400GT	**Aleutians**	0.444	2.252	0.0055	
Towing Vessel >400GT	**Chukchi**	0.444	2.252	0.0055	
Unknown Land Source	**Cook Inlet**	0.444	2.250	0.0055	
Ferry >400GT	**Aleutians**	0.389	2.571	0.0048	
Freight Barge >400GT	**Kodiak/Shelikof**	0.389	2.571	0.0048	
Industrial Vessel <400 GT	**Off Kenai Peninsula**	0.389	2.571	0.0048	
Military Vessel <400GT	**Aleutians**	0.389	2.571	0.0048	
Military Vessel <400GT	**Off Kenai Peninsula**	0.389	2.571	0.0048	
Municipal Fuel Storage	**Aleutians**	0.389	2.571	0.0048	
Municipal Fuel Storage	**N Chuk**	0.389	2.571	0.0048	
Offshore Supply Vessel <400GT	**Aleutians**	0.389	2.571	0.0048	
Power Plant	**Norton S/St. Lawrence**	0.389	2.571	0.0048	
Power Plant	**Off Kenai Peninsula**	0.389	2.571	0.0048	
Power Plant	**South-Central**	0.389	2.571	0.0048	
Small Boat Harbor	**Off Kenai Peninsula**	0.389	2.571	0.0048	
Towing Vessel <400GT	**Bristol Bay**	0.389	2.571	0.0048	
Unknown Land Source	**Prince William Sound**	0.389	2.571	0.0048	
Container Terminal	**Aleutians**	0.333	3.000	0.0041	

Table 59: Ordered Combined Vessel and Facility Incident Rates					
Type	**Region**	**Annual Rate**	**Return Years**	**Normalized Frequency**	**Frequency Category**
Fishing Vessel >400GT	**Kodiak/Shelikof**	0.333	3.003	0.0041	
Fuel Terminal	**Kodiak/Shelikof**	0.333	3.000	0.0041	
Fuel Terminal	**Prince William Sound**	0.333	3.000	0.0041	
General Cargo Ship >400GT	**Southeast Alaska**	0.333	3.003	0.0041	
Industrial Vessel >400 GT	**Southeast Alaska**	0.333	3.003	0.0041	
Military Vessel <400GT	**Prince William Sound**	0.333	3.003	0.0041	
Mining Facility	**Kotzebue/Hope**	0.333	3.000	0.0041	
Municipal Fuel Storage	**Southeast Alaska**	0.333	3.000	0.0041	
Offshore Supply Facility	**Aleutians**	0.333	3.000	0.0041	
Power Plant	**Aleutians**	0.333	3.000	0.0041	
Research Vessel >400GT	**Prince William Sound**	0.333	3.003	0.0041	
Research Vessel <400GT	**Cook Inlet**	0.333	3.003	0.0041	
Tank Barge <400GT	**Western Alaska**	0.333	3.003	0.0041	
Unknown Land Source	**Aleutians**	0.333	3.000	0.0041	
Barge Terminal	**Norton S/St. Lawrence**	0.278	3.600	0.0034	
Barge Terminal	**Western Alaska**	0.278	3.600	0.0034	
Bulk Carrier >400GT	**Southeast Alaska**	0.278	3.597	0.0034	
Container Ship >400GT	**Cook Inlet**	0.278	3.597	0.0034	
Container Ship >400GT	**Kodiak/Shelikof**	0.278	3.597	0.0034	
Cruise Ship >400GT	**Prince William Sound**	0.278	3.597	0.0034	
Fishing Vessel >400GT	**Aniakchak**	0.278	3.597	0.0034	
Fishing Vessel <400GT	**Norton**	0.278	3.597	0.0034	
Freight Barge <400GT	**Western Alaska**	0.278	3.597	0.0034	
Offshore Supply Facility	**Cook Inlet**	0.278	3.600	0.0034	
Oil Recovery Vessel >400GT	**Cook Inlet**	0.278	3.597	0.0034	
Oil Recovery Vessel <400GT	**Cook Inlet**	0.278	3.597	0.0034	
Passenger Ship >400GT	**Prince William Sound**	0.278	3.597	0.0034	
Pipeline Facility	**Cook Inlet**	0.278	3.600	0.0034	
Power Plant	**Prince William Sound**	0.278	3.600	0.0034	
Recreational Vessel >400GT	**Prince William Sound**	0.278	3.597	0.0034	
Tanker <90,000DWT	**South-Central**	0.278	3.597	0.0034	
Towing Vessel >400GT	**Southeast Alaska**	0.278	3.597	0.0034	
Towing Vessel <400GT	**South-Central**	0.278	3.597	0.0034	
Unknown Land Source	**Off Kenai Peninsula**	0.278	3.600	0.0034	
Bulk Carrier >400GT	**South-Central**	0.222	4.505	0.0027	
Bulk Chemical Facility	**Southeast Alaska**	0.222	4.500	0.0027	
Construction Site	**Western Alaska**	0.222	4.500	0.0027	
Container Terminal	**Prince William Sound**	0.222	4.500	0.0027	
Fishing Vessel >400GT	**South-Central**	0.222	4.505	0.0027	
Freight Barge <400GT	**Bristol Bay**	0.222	4.505	0.0027	
Fuel Terminal	**Kotzebue/Hope**	0.222	4.500	0.0027	
General Cargo Ship >400GT	**South-Central**	0.222	4.505	0.0027	
General Cargo Ship <400GT	**Bristol Bay**	0.222	4.505	0.0027	
General Cargo Ship <400GT	**Kodiak/Shelikof**	0.222	4.505	0.0027	
Industrial Vessel <400 GT	**Bristol Bay**	0.222	4.505	0.0027	
Military Facility	**Norton S/St. Lawrence**	0.222	4.500	0.0027	
Municipal Fuel Storage	**Cook Inlet**	0.222	4.500	0.0027	
Municipal Fuel Storage	**Kotzebue/Hope**	0.222	4.500	0.0027	
Municipal Fuel Storage	**Kodiak/Shelikof**	0.222	4.500	0.0027	

Table 59: Ordered Combined Vessel and Facility Incident Rates					
Type	**Region**	**Annual Rate**	**Return Years**	**Normalized Frequency**	**Frequency Category**
Municipal Fuel Storage	**Prince William Sound**	0.222	4.500	0.0027	
Offshore Supply Vessel >400GT	**Prince William Sound**	0.222	4.505	0.0027	
Offshore Supply Vessel <400GT	**Cook Inlet**	0.222	4.505	0.0027	
Offshore Supply Vessel <400GT	**Kodiak/Shelikof**	0.222	4.505	0.0027	
Offshore Supply Vessel <400GT	**Southeast Alaska**	0.222	4.505	0.0027	
Other Facility	**Cook Inlet**	0.222	4.500	0.0027	
Recreational Vessel >400GT	**Aleutians**	0.222	4.505	0.0027	
Small Boat Harbor	**Norton S/St. Lawrence**	0.222	4.500	0.0027	
Small Boat Harbor	**South-Central**	0.222	4.500	0.0027	
Small Boat Harbor	**Western Alaska**	0.222	4.500	0.0027	
Tank Barge >400GT	**Kotzebue/Hope**	0.222	4.505	0.0027	
Tanker <90,000DWT	**Aleutians**	0.222	4.505	0.0027	
Towing Vessel >400GT	**Bristol Bay**	0.222	4.505	0.0027	
Towing Vessel <400GT	**Norton**	0.222	4.505	0.0027	
Unknown Land Source	**Kodiak/Shelikof**	0.222	4.500	0.0027	
Barge Terminal	**Southeast Alaska**	0.167	6.000	0.0021	
Construction Site	**Cook Inlet**	0.167	6.000	0.0021	
Construction Site	**Southeast Alaska**	0.167	6.000	0.0021	
Container Terminal	**Cook Inlet**	0.167	6.000	0.0021	
Cruise Terminal	**Off Kenai Peninsula**	0.167	6.000	0.0021	
Drydock Facility	**Southeast Alaska**	0.167	6.000	0.0021	
Ferry >400GT	**Off Kenai Peninsula**	0.167	5.988	0.0021	
Ferry Terminal	**Prince William Sound**	0.167	6.000	0.0021	
Fishing Vessel <400GT	**Beaufort**	0.167	5.988	0.0021	
Freight Barge >400GT	**Cook Inlet**	0.167	5.988	0.0021	
Freight Barge >400GT	**Western Alaska**	0.167	5.988	0.0021	
Freight Barge <400GT	**Norton**	0.167	5.988	0.0021	
Industrial Vessel >400 GT	**Aleutians**	0.167	5.988	0.0021	
Industrial Vessel <400 GT	**Aleutians**	0.167	5.988	0.0021	
Industrial Vessel <400 GT	**Beaufort**	0.167	5.988	0.0021	
Marine Services Facility	**Southeast Alaska**	0.167	6.000	0.0021	
Military Vessel <400GT	**Cook Inlet**	0.167	5.988	0.0021	
Other Facility	**Kotzebue/Hope**	0.167	6.000	0.0021	
Other Facility	**Norton S/St. Lawrence**	0.167	6.000	0.0021	
Passenger Ship <400GT	**Beaufort**	0.167	5.988	0.0021	
Power Plant	**N Chuk**	0.167	6.000	0.0021	
Recreational Vessel >400GT	**Cook Inlet**	0.167	5.988	0.0021	
Recreational Vessel <400GT	**Norton**	0.167	5.988	0.0021	
Research Vessel >400GT	**Aleutians**	0.167	5.988	0.0021	
Research Vessel >400GT	**Southeast Alaska**	0.167	5.988	0.0021	
Seafood Facility	**Cook Inlet**	0.167	6.000	0.0021	
Ship Terminal	**Off Kenai Peninsula**	0.167	6.000	0.0021	
Tank Barge >400GT	**Aniakchak**	0.167	5.988	0.0021	
Tank Barge >400GT	**Kodiak/Shelikof**	0.167	5.988	0.0021	
Tanker <90,000DWT	**Southeast Alaska**	0.167	5.988	0.0021	
Tanker >90,000DWT	**Southeast Alaska**	0.167	5.988	0.0021	
Towing Vessel >400GT	**Cook Inlet**	0.167	5.988	0.0021	
Towing Vessel >400GT	**Western Alaska**	0.167	5.988	0.0021	
Airport	**Cook Inlet**	0.111	9.000	0.0014	

Table 59: Ordered Combined Vessel and Facility Incident Rates					
Type	**Region**	**Annual Rate**	**Return Years**	**Normalized Frequency**	**Frequency Category**
Airport	**Western Alaska**	0.111	9.000	0.0014	
Barge Terminal	**Kodiak/Shelikof**	0.111	9.000	0.0014	
Bulk Carrier >400GT	**Aniakchak**	0.111	9.009	0.0014	
Construction Site	**Aleutians**	0.111	9.000	0.0014	
Construction Site	**Aniakchak**	0.111	9.000	0.0014	
Container Terminal	**Off Kenai Peninsula**	0.111	9.000	0.0014	
Container Terminal	**Southeast Alaska**	0.111	9.000	0.0014	
Cruise Ship >400GT	**Aleutians**	0.111	9.009	0.0014	
Cruise Ship >400GT	**Off Kenai Peninsula**	0.111	9.009	0.0014	
Ferry >400GT	**South-Central**	0.111	9.009	0.0014	
Freight Barge >400GT	**Beaufort**	0.111	9.009	0.0014	
Freight Barge >400GT	**Bristol Bay**	0.111	9.009	0.0014	
Freight Barge <400GT	**Kotzebue/Hope**	0.111	9.009	0.0014	
Freight Barge <400GT	**Off Kenai Peninsula**	0.111	9.009	0.0014	
Fuel Terminal	**Off Kenai Peninsula**	0.111	9.000	0.0014	
General Cargo Ship >400GT	**Kotzebue/Hope**	0.111	9.009	0.0014	
General Cargo Ship >400GT	**Western Alaska**	0.111	9.009	0.0014	
General Cargo Ship <400GT	**Cook Inlet**	0.111	9.009	0.0014	
Industrial Vessel >400 GT	**Cook Inlet**	0.111	9.009	0.0014	
Marine Services Facility	**Cook Inlet**	0.111	9.000	0.0014	
Marine Services Facility	**Kotzebue/Hope**	0.111	9.000	0.0014	
Marine Services Facility	**Norton S/St. Lawrence**	0.111	9.000	0.0014	
Marine Services Facility	**Western Alaska**	0.111	9.000	0.0014	
Military Vessel >400GT	**Southeast Alaska**	0.111	9.009	0.0014	
Military Vessel <400GT	**South-Central**	0.111	9.009	0.0014	
Military Facility	**Cook Inlet**	0.111	9.000	0.0014	
Military Facility	**Prince William Sound**	0.111	9.000	0.0014	
MODU <400GT	**Aleutians**	0.111	9.009	0.0014	
Municipal Fuel Storage	**Beaufort**	0.111	9.000	0.0014	
Other Facility	**Aleutians**	0.111	9.000	0.0014	
Other Facility	**Kodiak/Shelikof**	0.111	9.000	0.0014	
Other Facility	**Prince William Sound**	0.111	9.000	0.0014	
Petroleum Terminal	**Southeast Alaska**	0.111	9.000	0.0014	
Recreational Vessel >400GT	**Western Alaska**	0.111	9.009	0.0014	
Recreational Vessel <400GT	**Beaufort**	0.111	9.009	0.0014	
Refinery	**Kodiak/Shelikof**	0.111	9.000	0.0014	
Seafood Facility	**Kodiak/Shelikof**	0.111	9.000	0.0014	
Seafood Facility	**Off Kenai Peninsula**	0.111	9.000	0.0014	
Seafood Facility	**Western Alaska**	0.111	9.000	0.0014	
Ship Terminal	**Kodiak/Shelikof**	0.111	9.000	0.0014	
Ship Terminal	**Southeast Alaska**	0.111	9.000	0.0014	
Small Boat Harbor	**Aniakchak**	0.111	9.000	0.0014	
Tanker <90,000DWT	**Aniakchak**	0.111	9.009	0.0014	
Tanker >90,000DWT	**Cook Inlet**	0.111	9.009	0.0014	
Towing Vessel >400GT	**Kodiak/Shelikof**	0.111	9.009	0.0014	
Towing Vessel >400GT	**Norton**	0.111	9.009	0.0014	
Vehicle Carrier Ship >400GT	**Aleutians**	0.111	9.009	0.0014	
Airport	**Aleutians**	0.056	18.000	0.0007	
Airport	**Norton S/St. Lawrence**	0.056	18.000	0.0007	

Table 59: Ordered Combined Vessel and Facility Incident Rates					
Type	**Region**	**Annual Rate**	**Return Years**	**Normalized Frequency**	**Frequency Category**
Airport	**Off Kenai Peninsula**	0.056	18.000	0.0007	
Barge Terminal	**Bristol Bay**	0.056	18.000	0.0007	
Barge Terminal	**Cook Inlet**	0.056	18.000	0.0007	
Barge Terminal	**Prince William Sound**	0.056	18.000	0.0007	
Bulk Carrier >400GT	**Cook Inlet**	0.056	17.857	0.0007	
Bulk Carrier >400GT	**Kotzebue/Hope**	0.056	17.857	0.0007	
Bulk Carrier >400GT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
Bulk Carrier >400GT	**Western Alaska**	0.056	17.857	0.0007	
Construction Site	**Beaufort**	0.056	18.000	0.0007	
Construction Site	**Norton S/St. Lawrence**	0.056	18.000	0.0007	
Container Ship >400GT	**Aniakchak**	0.056	17.857	0.0007	
Container Ship >400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Cruise Ship >400GT	**Aniakchak**	0.056	17.857	0.0007	
Cruise Ship >400GT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
Cruise Ship >400GT	**Western Alaska**	0.056	17.857	0.0007	
Drydock Facility	**Aleutians**	0.056	18.000	0.0007	
Ferry <400GT	**Prince William Sound**	0.056	17.857	0.0007	
Ferry Terminal	**Cook Inlet**	0.056	18.000	0.0007	
Ferry Terminal	**South-Central**	0.056	18.000	0.0007	
Fishing Vessel >400GT	**Beaufort**	0.056	17.857	0.0007	
Fishing Vessel >400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Fishing Vessel <400GT	**Kotzebue/Hope**	0.056	17.857	0.0007	
Freight Barge >400GT	**Kotzebue/Hope**	0.056	17.857	0.0007	
Freight Barge >400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Freight Barge >400GT	**South-Central**	0.056	17.857	0.0007	
Freight Barge <400GT	**Aleutians**	0.056	17.857	0.0007	
Freight Barge <400GT	**Cook Inlet**	0.056	17.857	0.0007	
Freight Barge <400GT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
Freight Barge <400GT	**Prince William Sound**	0.056	17.857	0.0007	
Fuel Terminal	**N Chuk**	0.056	18.000	0.0007	
General Cargo Ship >400GT	**Aniakchak**	0.056	17.857	0.0007	
General Cargo Ship >400GT	**Bristol Bay**	0.056	17.857	0.0007	
General Cargo Ship >400GT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
General Cargo Ship >400GT	**Prince William Sound**	0.056	17.857	0.0007	
General Cargo Ship <400GT	**Aleutians**	0.056	17.857	0.0007	
Industrial Vessel >400 GT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
Industrial Vessel >400 GT	**Prince William Sound**	0.056	17.857	0.0007	
Industrial Vessel >400 GT	**Western Alaska**	0.056	17.857	0.0007	
Industrial Vessel <400 GT	**Kotzebue/Hope**	0.056	17.857	0.0007	
Industrial Vessel <400 GT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
Industrial Vessel <400 GT	**Chukchi**	0.056	17.857	0.0007	
Industrial Vessel <400 GT	**Norton**	0.056	17.857	0.0007	
Industrial Vessel <400 GT	**South-Central**	0.056	17.857	0.0007	
Industrial Vessel <400 GT	**Western Alaska**	0.056	17.857	0.0007	
Logging Facility	**Kodiak/Shelikof**	0.056	18.000	0.0007	
Logging Facility	**South-Central**	0.056	18.000	0.0007	
Marine Services Facility	**Off Kenai Peninsula**	0.056	18.000	0.0007	
Marine Services Facility	**Prince William Sound**	0.056	18.000	0.0007	
Military Vessel >400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	

Table 59: Ordered Combined Vessel and Facility Incident Rates					
Type	**Region**	**Annual Rate**	**Return Years**	**Normalized Frequency**	**Frequency Category**
Military Vessel >400GT	**South-Central**	0.056	17.857	0.0007	
Military Vessel <400GT	**Western Alaska**	0.056	17.857	0.0007	
Military Facility	**Bristol Bay**	0.056	18.000	0.0007	
Military Facility	**Off Kenai Peninsula**	0.056	18.000	0.0007	
Military Facility	**South-Central**	0.056	18.000	0.0007	
Mining Facility	**Southeast Alaska**	0.056	18.000	0.0007	
Municipal Fuel Storage	**Aniakchak**	0.056	18.000	0.0007	
Offshore Supply Vessel >400GT	**Aleutians**	0.056	17.857	0.0007	
Offshore Supply Vessel >400GT	**Cook Inlet**	0.056	17.857	0.0007	
Offshore Supply Vessel >400GT	**Southeast Alaska**	0.056	17.857	0.0007	
Offshore Supply Vessel <400GT	**Beaufort**	0.056	17.857	0.0007	
Offshore Supply Vessel <400GT	**Bristol Bay**	0.056	17.857	0.0007	
Offshore Supply Vessel <400GT	**Norton**	0.056	17.857	0.0007	
Offshore Supply Vessel <400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Offshore Supply Vessel <400GT	**South-Central**	0.056	17.857	0.0007	
Offshore Supply Facility	**Prince William Sound**	0.056	18.000	0.0007	
Oil Exp/Prod Facility	**Aniakchak**	0.056	18.000	0.0007	
Oil Exp/Prod Facility	**Kodiak/Shelikof**	0.056	18.000	0.0007	
Oil Recovery Vessel >400GT	**Beaufort**	0.056	17.857	0.0007	
Oil Recovery Vessel >400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Oil Recovery Vessel <400GT	**Aleutians**	0.056	17.857	0.0007	
Oil Recovery Vessel <400GT	**Beaufort**	0.056	17.857	0.0007	
Oil Recovery Vessel <400GT	**Bristol Bay**	0.056	17.857	0.0007	
Oil Recovery Vessel <400GT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
Oil Recovery Vessel <400GT	**Southeast Alaska**	0.056	17.857	0.0007	
Other Facility	**Beaufort**	0.056	18.000	0.0007	
Other Facility	**N Chuk**	0.056	18.000	0.0007	
Other Facility	**Western Alaska**	0.056	18.000	0.0007	
Passenger Ship >400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Passenger Ship <400GT	**South-Central**	0.056	17.857	0.0007	
Power Plant	**Aniakchak**	0.056	18.000	0.0007	
Recreational Vessel >400GT	**Bristol Bay**	0.056	17.857	0.0007	
Recreational Vessel >400GT	**Chukchi**	0.056	17.857	0.0007	
Recreational Vessel <400GT	**Aniakchak**	0.056	17.857	0.0007	
Research Vessel >400GT	**Beaufort**	0.056	17.857	0.0007	
Research Vessel >400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Research Vessel >400GT	**Western Alaska**	0.056	17.857	0.0007	
Research Vessel <400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Research Vessel <400GT	**Prince William Sound**	0.056	17.857	0.0007	
Residential Facility	**Aniakchak**	0.056	18.000	0.0007	
Residential Facility	**Cook Inlet**	0.056	18.000	0.0007	
Residential Facility	**Kotzebue/Hope**	0.056	18.000	0.0007	
Residential Facility	**Prince William Sound**	0.056	18.000	0.0007	
Seafood Facility	**Norton S/St. Lawrence**	0.056	18.000	0.0007	
Seafood Facility	**South-Central**	0.056	18.000	0.0007	
Ship Terminal	**Cook Inlet**	0.056	18.000	0.0007	
Ship Terminal	**Prince William Sound**	0.056	18.000	0.0007	
Small Boat Harbor	**Bristol Bay**	0.056	18.000	0.0007	
Tank Barge >400GT	**Beaufort**	0.056	17.857	0.0007	

Table 59: Ordered Combined Vessel and Facility Incident Rates					
Type	**Region**	**Annual Rate**	**Return Years**	**Normalized Frequency**	**Frequency Category**
Tank Barge <400GT	**Aniakchak**	0.056	17.857	0.0007	
Tank Barge <400GT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
Tank Barge <400GT	**Norton**	0.056	17.857	0.0007	
Tank Barge <400GT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Tank Barge <400GT	**South-Central**	0.056	17.857	0.0007	
Tanker <90,000DWT	**Beaufort**	0.056	17.857	0.0007	
Tanker <90,000DWT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
Tanker <90,000DWT	**Off Kenai Peninsula**	0.056	17.857	0.0007	
Tanker >90,000DWT	**Kodiak/Shelikof**	0.056	17.857	0.0007	
Towing Vessel >400GT	**Kotzebue/Hope**	0.056	17.857	0.0007	
Towing Vessel <400GT	**Aniakchak**	0.056	17.857	0.0007	
Towing Vessel <400GT	**Kotzebue/Hope**	0.056	17.857	0.0007	
Unknown Land Source	**Beaufort**	0.056	18.000	0.0007	
Unknown Land Source	**Kotzebue/Hope**	0.056	18.000	0.0007	
Unknown Land Source	**Norton S/St. Lawrence**	0.056	18.000	0.0007	
Unknown Land Source	**Western Alaska**	0.056	18.000	0.0007	
Vehicle	**Prince William Sound**	0.056	18.000	0.0007	

5 Analysis of Potential Spill Volumes

The degree of environmental impact from spills varies not only by the oil type, season, and region, but also by the relative volume of spillage. For the overall environmental risk assessment, the spill volume for each of the region-season-oil type matrix cells (as in Tables 44 and 45) is required for the modeling of impacts. In this analysis, the "worst-case discharge" (WCD) and "maximum most probable" (MMPD) discharge volumes are applied to the environmental impact modeling.

For each of the 336 risk matrix cells (14 regions, 6 periods, 4 oil types), there is a theoretical distribution of potential spill volumes. These distributions of spill volume are based on the applicable source types (vessel or facility), and source sizes (volume of oil capacity), for the sources that contain each type of oil in that particular region and time period.

5.1 Spill Volumes for Impact Modeling – Worst Case Discharges

Worst-case discharges (WCD) for each of the risk matrix cells will be based on the largest capacity source in that region by oil type and season.

For an onshore facility or deep-water port or facility, the worst-case discharge is defined as "the largest foreseeable discharge in adverse weather conditions".[73] The calculations of WCD volumes for facilities are considerably more complex. The WCD for each facility will depend on the capacity of storage tanks, the numbers and lengths of pipelines between control points (shut-off valves, etc.), the pressure in the pipelines, the diameters of the pipelines, the lengths of time between pipeline inspections and the time it would typically take to detect a loss of oil, and other factors.

[73] 33 CFR 154.1020.

For offshore wells, the WCDs depend on the type of well (e.g., exploratory, production, completion, wildcat, appraisal), the pressure in the well reservoir and the flow rate, the size and type of pipe or riser, the type of blowout preventer, the length of time before a discharge is detected, and the length of time to natural bridging,[74] capping of the well or stemming of the flow of oil through relief wells. The EPA's regulations for response preparedness stipulate that the WCD for a well be defined as 30 days of flow at the maximum daily production rate for wells that are 10,000 feet or less, and 45 days of flow at the daily production rate for wells that are 10,000 feet or more. But, for this risk analysis study, BOEM's catastrophic discharge event assumptions[75] were applied (as per communication with BOEM) due to the greater likelihood of a longer duration of flow due to the inherent logistical challenges in responding to a blowout. BOEM applies the assumptions shown in Table 60 in determining volumes and durations of flow.

Table 60: BOEM OCS Catastrophic Discharge Event[76]

Program Area	Total Volume (bbl)	Duration (days)	Factors Affecting Duration
Chukchi Sea	1,400,000 – 2,200,000	40 – 75	Type of drill rig used and rig availability to drill relief well during open water season
Beaufort Sea	1,700,000 – 3,900,000	60 – 300	Type of drill rig, timing of drilling relative to ice conditions, and rig availability to drill relief well

Potential flow rates (bbl/day) vary considerably between wells. The estimated flow rate for the Macondo MC252 well was estimated to be between 35,900 bbl/day to 70,000 bbl/day.[77] Maximum flow rates may, however, by considerably higher. For example, the Shell Appomattox MC-391 well has a maximum flow rate of 405,000 bbl/day.[78] For the Chukchi Sea, the highest potential flow rate, based on available

[74] Natural bridging occurs when sediment naturally fills the well pipe or riser to such an extent that flow ceases. International analyses indicate that this occurs in 84% of well blowouts within 0.5 to 5 days (Holand 2013).
[75] BOEM 2012.
[76] The GOM OCS Region has estimated the discharge rate and duration for a catastrophic spill event for both shallow and deep water (in part) based on information gathered from shallow water and deepwater well tests and flow rates validated by the Ixtoc (1979) and the DWH (2010) oil spills. The Alaska OCS Region has estimated a very large oil-spill scenario based on a reasonable, maximum flow rate for each OCS planning area, taking into consideration geologic conditions and well log data. The Alaska OCS Region modeled the flow of fluids from a representative reservoir into the well and flow up through the borehole based on formation thickness, porosity, and permeability; oil saturation, viscosity, and gas content; and reservoir pressure and temperature. The number of days until a hypothetical blowout and discharge from a well could be contained was also estimated. Different assumptions about the type of drilling rig, timing of drilling, nature of ice conditions, and relief well operations underlie the CDE scenarios in the Chukchi Sea and Beaufort Sea; therefore, the scenarios are not directly comparable. The time period required to drill a relief well and kill the well in the Chukchi Sea is explained in detail in BOEMRE (2011). The relief well is drilled and killed within the open water season. Over half of the 75-day estimate includes transport of relief well rig to the site and drilling of the actual relief well. The greater range in spill duration in the Beaufort reflects different assumptions about the drilling rig and timing of drilling relative to seasonal ice conditions. The scenario range incorporates both open- and late open-water season and winter blowout scenarios (the late open-water season may delay the relief well drilling until the following open-water season). These are discharge volumes and do not account for decreases in volume from bridging, containment, or response operations. Note that under BOEM and BSEE regulations, exploration and development plans and oil spill response plans must incorporate a separate worst-case discharge calculation derived from individual well parameters and characteristics.
[77] Oldenburg et al. 2012; McNutt et al. 2012a; McNutt et al. 2012b.
[78] Shell 2010.

information, is 25,000 bbl/day.[79] For the Beaufort Sea, the highest potential flow rate, based on available information, is 69,000 bbl/day.[80]

Based on the application of these assumptions, the worst-case discharge (WCD) assigned to OCS offshore wells for Chukchi Sea is 2.2 million bbl and for Beaufort Sea is 3.9 million bbl. For all other regions with offshore wells (Cook Inlet, Kodiak/Shelikof Strait, and Aniakchak), the WCD is assumed to be 39,000 bbl based on information on the production rates of wells in state waters.

The estimated WCD volumes for the various types of facilities included in these analyses are shown in Table 61.

Table 61: Estimated WCD Volumes for Facilities by Type

Facility Type	Estimated WCD Volume (bbl)[81]	% Oil Types[82]			
		Distillate	Light	Crude	Heavy
Airport	50,000	47.1%	53.9%	0%	0%
Barge Terminal	1,000	11.1%	88.9%	0%	0%
Bulk Chemical	10,000	100%	0%	0%	0%
Construction	100	100%	0%	0%	0%
Container Terminal	1,000	5.9%	88.2%	0%	5.9%
Cruise Ship Terminal	1,000	4.9%	90.2%	0%	4.9%
Drydock	1,000	100%	0%	0%	0%
Ferry Terminal	1,000	5.6%	94.4%	0%	0%
Fuel Terminal	30,000	24.7%	72.8%	1.9%	0.6%
Logging	1,000	100%	0%	0%	0%
Marine Services	1,000	23.1%	76.9%	0%	0%
Military	10,000	11.4%	88.6%	0%	0%
Mining	100	100%	0%	0%	0%
Municipal Fuel Storage	1,000	13.6%	85.6%	0%	0.8%
Offshore Services	1,000	0%	83.3%	16.7%	0%
Oil Exploration and Production Wells[83]	39,000 (Cook/Kodiak/Aniakchak)	0.5%	73.8%	25.3%	0.04%
	2,200,000 (Chukchi Sea)				
	3,900,000 (Beaufort Sea)				
Other	100	29.4%	67.6%	0%	2.9%
Petroleum Terminal	200,000	15.7%	10.8%	1.0%	72.5%
Pipeline Transport	45,000	0%	60%	40%	0%
Power Plant	50,000	2.4%	97.6%	0%	0%
Refinery	200,000[84]	10.5%	11.4%	21.8%	56.4%
Residential	10	23.8%	71.4%	4.8%	0%
Seafood Industry	1,000	5.2%	94.8%	0%	0.8%

[79] Shell 2011.
[80] Memorandum from Bureau of Ocean Energy Management to NOAA regarding "Estimate of Very Large Oil Spill from an Exploration Well in the Beaufort Sea OCS Planning Area, Alaska," 28 March 2014. 12 p.
[81] Based on general review of oil capacities for facilities conducted for the EPA in the development of the database of spill incidents (1980 – 2003) as in Etkin (2004; 2006); and analyses of facility capacities for Etkin (2002; 2003), and Etkin, et al. (2009).
[82] Based on 1995 – 2012 incident data.
[83] Oil exploration and production facilities include not only the oil in the well, but also storage of other oils, particularly diesel. For the purposes of WCD calculations, it is assumed that the large WCD values are for well releases and that for the non-crude spillage, the WCDs would be similar to those of smaller facilities that hold approximately 1,000 bbl.
[84] Based on US Energy Information Agency Data.

Table 61: Estimated WCD Volumes for Facilities by Type					
Facility Type	**Estimated WCD Volume (bbl)[81]**	**% Oil Types[82]**			
		Distillate	**Light**	**Crude**	**Heavy**
Ship Terminal	10,000	100%	0%	0%	0%
Small Boat Harbor	1,000	6.6%	92.8%	0%	0.7%
Unknown	100	5.9%	88.1%	1.0%	4.9%
Vehicle	2	30.0%	70.0%	0%	0%

According to US Coast Guard regulations, the WCD volume for a particular vessel is defined as the total release of the maximum capacity of oil on board.[85] For a tank vessel (tank barge or tanker), this would include both the bunker fuel tanks and the oil cargo tanks.

For a non-tank vessel (e.g., cargo vessel), this would include the bunker fuel tanks.[86] The calculations for determining the WCD for vessels is relatively straightforward if the size (gross tonnage or deadweight tonnage) of the vessel or the actual bunker and/or oil cargo capacities are known.

The estimated WCD volumes for the vessel type and size categories applied in this study are shown in Table 62. WCD volumes are based on the largest vessel capacity in that category (e.g., the largest bulk carrier's capacity).

The estimated WCD volume for tankers and tank barges is based on the formula: [87]

$$K_o = 6.795 \cdot DWT$$

Where K_o = actual tank ship cargo load (in barrels) [88]
DWT = deadweight tonnage of tank vessel.

The bunker capacity for general cargo vessels, bulk carriers, and other larger vessels is based on the formula, which is based on a regression of known bunker capacities and DWTs:

$$K_b = 0.0238DWT + 2{,}545$$

Where K_b = bunker capacity (in barrels).

For other vessels, typical bunker capacities based on vessel size, as derived from inspection of Environmental Research Consulting (ERC) vessel databases were applied.

[85] 33 CFR 155.1020.
[86] Note that all vessels contain other oils used for lubrication and other functions on the vessel. The volumes of these are generally considerably smaller than the oil cargo tanks or bunker tanks and are not generally factored into the calculation of total capacity.
[87] Based on Etkin (1999); Etkin and Michel (2003); Etkin, et al. (2009); French-McCay, et al. (2008); State of WA JLARC (2009); Nuka, et al. (2006).
[88] Note that tones have been converted to gallons using a standard conversion of 7 bbl/tonne, which is an average for most oils. Lighter oils (e.g., diesel) will have more gallons per tonne, whereas heavier oils (e.g., Bunker C) will have fewer gallons per tonne as they are more dense.

Table 62: Estimated WCD Volumes for Vessels by Type						
Facility Type	**Largest in Category**	**Estimated WCD Volume (bbl)**	**% Oil Types[89]**			
			Distillate	**Light**	**Crude**	**Heavy**
Bulk Carrier	75,000 (DWT)[90]	44,000	0%	39.1%	0%	60.9%
Container Vessel	69,000 (DWT)	65,000	0%	8.8%	0%	91.2%
Cruise Vessel	70,000 (DWT)	28,000	1.1%	94.9%	0%	3.9%
Ferry <400GT[91]	148 (DWT)	50	0%	100%	0%	0%
Ferry >400GT	1,700 (DWT)	5,000	0.4%	99.6%	0%	0%
Fishing Vessel <400GT	450 (DWT)	200	1.7%	97.8%	0%	0.5%
Fishing Vessel >400GT	17,845 (GT)	24,000	0.7%	97.3%	0%	2.0%
Freight Barge <400GT	390 (GT)	200	0%	63.9%	0%	36.1%
Freight Barge >400GT	10,000 (GT)	3,000	0%	60.0%	0%	40.0%
General Cargo Vessel <400GT	200 (GT)	50	3.8%	73.1%	0%	23.1%
General Cargo Vessel >400GT	45,000 (DWT)	23,000	0%	44.4%	0%	55.6%
Industrial Vessel <400GT	655 (DWT)	500	7.4%	88.5%	0%	4.1%
Industrial Vessel >400GT	1,700 (DWT)	1,000	14.3%	85.7%	0%	0%
Military	2,600 (GT)	3,000	15.3%	84.1%	0%	0.6%
Mobile Offshore Drilling Unit	300 (GT)	100	0%	50%	50%	0%
Offshore Supply <400GT	300 (GT)	100	2.9%	97.1%	0%	0%
Offshore Supply >400GT	4,000 (DWT)	3,000	0%	100%	0%	0%
Oil Recovery Vessel <400GT	900 (DWT)	500	0%	100%	0%	0%
Oil Recovery Vessel >400GT	24,000 (DWT)	5,000	5.9%	94.1%	0%	0%
Passenger Vessel <400GT	400 (DWT)	50	5.2%	94.2%	0%	0.6%
Passenger Vessel >400GT	8,300 (DWT)	4,000	0%	100%	0%	0%
Recreational	400 (GT)	10	10.5%	89.3%	0%	0.2%
Research Vessel	1,300 (DWT)	800	5.9%	92.6%	0%	1.5%
Tank Barge	24,000 (DWT)	163,000	26.8%	72.7%	0%	0.5%
Tank Ship <90,000DWT	77,000 (DWT)	523,000	2.3%	58.9%	35.6%	4.1%
Tank Ship >90,000DWT	285,000 (DWT)	1,900,000	0%	37.3%	54.2%	8.5%
Towing Vessel	400 (DWT)	500	5.9%	93.1%	0%	1.0%
Vehicle Carrier	28,000 (DWT)	12,000	0%	0%	0%	100%

Table 63 shows the WCD volumes for all sources in descending order of volume. For any region, period, and oil type combination, the WCD will be the largest discharge of the sources that are likely to be present in this region, at that time period, carrying that type of oil.

Table 63: Worst-Case Discharge Volumes by Source	
Source	**WCD (bbl)**
Oil E&P Beaufort Sea	3,900,000
Oil E&P Chukchi Sea	2,200,000
Tank Ship >90,000DWT[92]	1,900,000
Tank Ship <90,000DWT	523,000
Petroleum Terminal	200,000

[89] Based on 1995 – 2012 incident data in AKRID.
[90] DWT = deadweight tonnage
[91] GT = gross tonnage
[92] DWT = deadweight tonnage

Table 63: Worst-Case Discharge Volumes by Source	
Source	**WCD (bbl)**
Refinery	200,000
Tank Barge	163,000
Container Vessel	65,000
Airport	50,000
Power Plant	50,000
Pipeline Transport	45,000
Bulk Carrier	44,000
Oil E&P Other	39,000
Fuel Terminal	30,000
Cruise Vessel	28,000
Vehicle Carrier	28,000
Fishing Vessel >400GT[93]	24,000
General Cargo Vessel >400GT	23,000
Bulk Chemical	10,000
Military Facility	10,000
Ship Terminal	10,000
Oil Recovery Vessel >400GT	5,000
Ferry >400GT	5,000
Passenger Vessel >400GT	4,000
Freight Barge >400GT	3,000
Military Vessel	3,000
Offshore Supply >400GT	3,000
Barge Terminal	1,000
Container Terminal	1,000
Cruise Ship Terminal	1,000
Drydock	1,000
Ferry Terminal	1,000
Logging	1,000
Marine Services	1,000
Municipal Fuel Storage	1,000
Offshore Services	1,000
Seafood Industry	1,000
Small Boat Harbor	1,000
Industrial Vessel >400GT	1,000
Research Vessel	800
Industrial Vessel <400GT	500
Oil Recovery Vessel <400GT	500
Towing Vessel	500
Fishing Vessel <400GT	200
Freight Barge <400GT	200
Construction	100
Mining	100
Other	100
Unknown	100
Mobile Offshore Drilling Unit	100
Offshore Supply <400GT	100
Ferry <400GT	50
General Cargo Vessel <400GT	50

[93] GT = gross tonnage

Table 63: Worst-Case Discharge Volumes by Source	
Source	**WCD (bbl)**
Passenger Vessel <400GT	50
Residential	10
Recreational	10
Vehicle	2

For each of the region-period-oil type matrix cells in Table 64 the WCD volume is shown.

Table 64: Worst-Case Discharge Spill Volumes by Region, Period, and Oil Type[94]

Region	Period	WCD Spill Volume (bbl)			
		Crude	Distillate	Heavy	Light
Aleutians	Dec-Jan	n/a	523,000	523,000	523,000
	Feb-Mar	n/a	523,000	523,000	523,000
	Apr-May	n/a	523,000	523,000	523,000
	Jun-Jul	n/a	523,000	523,000	523,000
	Aug-Sep	n/a	523,000	523,000	523,000
	Oct-Nov	n/a	523,000	523,000	523,000
Aniakchak	Dec-Jan	523,000	523,000	523,000	523,000
	Feb-Mar	523,000	523,000	523,000	523,000
	Apr-May	523,000	523,000	523,000	523,000
	Jun-Jul	523,000	523,000	523,000	523,000
	Aug-Sep	523,000	523,000	523,000	523,000
	Oct-Nov	523,000	523,000	523,000	523,000
Beaufort Sea	Dec-Jan	3,900,000	n/a	n/a	523,000
	Feb-Mar	1,900,000	n/a	n/a	523,000
	Apr-May	1,900,000	523,000	523,000	523,000
	Jun-Jul	1,900,000	523,000	523,000	523,000
	Aug-Sep	1,900,000	523,000	523,000	523,000
	Oct-Nov	1,900,000	523,000	523,000	523,000
Bristol Bay	Dec-Jan	n/a	n/a	163,000	163,000
	Feb-Mar	n/a	n/a	163,000	163,000
	Apr-May	n/a	163,000	163,000	163,000
	Jun-Jul	n/a	163,000	163,000	163,000
	Aug-Sep	n/a	163,000	163,000	163,000
	Oct-Nov	n/a	163,000	163,000	163,000
Cook Inlet	Dec-Jan	1,900,000	523,000	1,900,000	1,900,000
	Feb-Mar	1,900,000	523,000	1,900,000	1,900,000
	Apr-May	1,900,000	523,000	1,900,000	1,900,000
	Jun-Jul	1,900,000	523,000	1,900,000	1,900,000
	Aug-Sep	1,900,000	523,000	1,900,000	1,900,000
	Oct-Nov	1,900,000	523,000	1,900,000	1,900,000
Kotzebue Sound/ Hope Basin	Dec-Jan	n/a	n/a	n/a	163,000
	Feb-Mar	n/a	n/a	n/a	163,000
	Apr-May	n/a	163,000	163,000	163,000
	Jun-Jul	n/a	163,000	163,000	163,000
	Aug-Sep	n/a	163,000	163,000	163,000
	Oct-Nov	n/a	163,000	163,000	163,000
Kodiak/	Dec-Jan	1,900,000	523,000	1,900,000	1,900,000

[94] "n/a" means "not applicable" in that this type of incident is highly unlikely to occur due to the source and oil type not being present in this region in this period.

Table 64: Worst-Case Discharge Spill Volumes by Region, Period, and Oil Type[94]					
Region	**Period**	**WCD Spill Volume (bbl)**			
		Crude	**Distillate**	**Heavy**	**Light**
Shelikof Strait	**Feb-Mar**	1,900,000	523,000	1,900,000	1,900,000
	Apr-May	1,900,000	523,000	1,900,000	1,900,000
	Jun-Jul	1,900,000	523,000	1,900,000	1,900,000
	Aug-Sep	1,900,000	523,000	1,900,000	1,900,000
	Oct-Nov	1,900,000	523,000	1,900,000	1,900,000
Chukchi Sea	**Dec-Jan**	2,200,000	50,000	n/a	50,000
	Feb-Mar	2,200,000	50,000	n/a	50,000
	Apr-May	2,200,000	50,000	30,000	50,000
	Jun-Jul	2,200,000	50,000	30,000	50,000
	Aug-Sep	2,200,000	50,000	30,000	50,000
	Oct-Nov	2,200,000	50,000	30,000	50,000
Norton Sound/ St. Lawrence Island	**Dec-Jan**	n/a	163,000	n/a	163,000
	Feb-Mar	n/a	163,000	n/a	163,000
	Apr-May	n/a	163,000	163,000	163,000
	Jun-Jul	n/a	163,000	163,000	163,000
	Aug-Sep	n/a	163,000	163,000	163,000
	Oct-Nov	n/a	163,000	163,000	163,000
Off Kenai Peninsula	**Dec-Jan**	523,000	523,000	523,000	523,000
	Feb-Mar	523,000	523,000	523,000	523,000
	Apr-May	523,000	523,000	523,000	523,000
	Jun-Jul	523,000	523,000	523,000	523,000
	Aug-Sep	523,000	523,000	523,000	523,000
	Oct-Nov	523,000	523,000	523,000	523,000
South-Central Alaska	**Dec-Jan**	1,900,000	n/a	1,900,000	1,900,000
	Feb-Mar	1,900,000	n/a	1,900,000	1,900,000
	Apr-May	1,900,000	523,000	1,900,000	1,900,000
	Jun-Jul	1,900,000	523,000	1,900,000	1,900,000
	Aug-Sep	1,900,000	523,000	1,900,000	1,900,000
	Oct-Nov	1,900,000	523,000	1,900,000	1,900,000
Prince William Sound	**Dec-Jan**	1,900,000	523,000	1,900,000	1,900,000
	Feb-Mar	1,900,000	523,000	1,900,000	1,900,000
	Apr-May	1,900,000	523,000	1,900,000	1,900,000
	Jun-Jul	1,900,000	523,000	1,900,000	1,900,000
	Aug-Sep	1,900,000	523,000	1,900,000	1,900,000
	Oct-Nov	1,900,000	523,000	1,900,000	1,900,000
Southeast Alaska	**Dec-Jan**	1,900,000	523,000	1,900,000	1,900,000
	Feb-Mar	1,900,000	523,000	1,900,000	1,900,000
	Apr-May	1,900,000	523,000	1,900,000	1,900,000
	Jun-Jul	1,900,000	523,000	1,900,000	1,900,000
	Aug-Sep	1,900,000	523,000	1,900,000	1,900,000
	Oct-Nov	1,900,000	523,000	1,900,000	1,900,000
Western Alaska	**Dec-Jan**	n/a	163,000	n/a	163,000
	Feb-Mar	n/a	163,000	n/a	163,000
	Apr-May	n/a	163,000	163,000	163,000
	Jun-Jul	n/a	163,000	163,000	163,000
	Aug-Sep	n/a	163,000	163,000	163,000
	Oct-Nov	n/a	163,000	163,000	163,000

5.2 Spill Volumes for Impact Modeling – MMPDs

For the MMPDs, the US Coast Guard definitions were applied. The MMPD volumes are defined by source type as follows:

- Facility MMPD = the lesser of 1,200 bbl or 10% of the WCD;
- Vessel (<25,000 deadweight tonnage) MMPD = 10% of the WCD; and
- Vessel (≥25,000 deadweight tonnage) MMPD = 2,500 bbl.

Based on these definitions, the largest possible MMPD is 2,500 bbl. Since there is no analogous equivalent for offshore wells in BOEM or BSEE regulations, the facility MMPD of 1,200 bbl was applied to offshore wells in this analysis. MMPDs by source type are shown in Table 65 with WCDs and AMPDs for comparison.

Table 65: Maximum Most Probable Discharge Volumes by Source

Source	WCD[95] (bbl)	MMPD[96] (bbl)	AMPD[97] (bbl)
Oil Exp/Prod Facility (Beaufort)	3,900,000	1,200	50
Oil Exp/Prod Facility (Chukchi)	2,200,000	1,200	50
Tanker >90,000DWT[98]	1,900,000	2,500	50
Tanker <90,000DWT	523,000	2,500	50
Petroleum Terminal	200,000	1,200	50
Refinery	200,000	1,200	50
Tank Barge <400GT[99]	163,000	2,500	50
Tank Barge >400GT	163,000	2,500	50
Airport	50,000	1,200	50
Power Plant	50,000	1,200	50
Pipeline Facility	45,000	1,200	50
Oil Exp/Prod Facility (Cook/Kodiak/Aniakchak)	39,000	1,200	50
Fuel Terminal	30,000	1,200	50
Bulk Carrier >400GT	12,000	2,500	50
Container Ship >400GT	11,000	2,500	50
Cruise Ship >400GT	11,000	2,500	50
Bulk Chemical Facility	10,000	1,000	50
Military Facility	10,000	1,000	50
Ship Terminal	10,000	1,000	50
General Cargo Ship >400GT	8,000	2,500	50
Vehicle Carrier Ship >400GT	6,000	2,500	50
Oil Recovery Vessel >400GT	5,000	500	50
Passenger Ship >400GT	4,000	400	40
Freight Barge >400GT	3,000	300	30
Military Vessel <400GT	3,000	300	30
Military Vessel >400GT	3,000	300	30
Offshore Supply Vessel >400GT	3,000	300	30

[95] WCD = worst-case discharge
[96] MMPD = maximum most-probable discharge
[97] The "average most-probable discharge" (AMPD) is the lesser of 50 bbl or 1% WCD. This classification has been dropped from the USCG's Spill Classification Matrix as the response to such a small spill would generally be very localized. It is presented here as a comparison only.
[98] DWT = deadweight tonnage
[99] GT = gross tonnage

Table 65: Maximum Most Probable Discharge Volumes by Source			
Source	**WCD[95] (bbl)**	**MMPD[96] (bbl)**	**AMPD[97] (bbl)**
Ferry >400GT	2,500	250	25
Fishing Vessel >400GT	2,500	250	25
Barge Terminal	1,000	100	10
Container Terminal	1,000	100	10
Cruise Terminal	1,000	100	10
Drydock Facility	1,000	100	10
Ferry Terminal	1,000	100	10
Industrial Vessel >400 GT	1,000	100	10
Logging Facility	1,000	100	10
Marine Services Facility	1,000	100	10
Municipal Fuel Storage	1,000	100	10
Offshore Supply Facility	1,000	100	10
Seafood Facility	1,000	100	10
Small Boat Harbor	1,000	100	10
Research Vessel <400GT	800	80	8
Research Vessel >400GT	800	80	8
Industrial Vessel <400 GT	500	50	5
Oil Recovery Vessel <400GT	500	50	5
Towing Vessel <400GT	500	50	5
Towing Vessel >400GT	500	50	5
Fishing Vessel <400GT	200	20	2
Freight Barge <400GT	200	20	2
Construction Site	100	10	1
Mining Facility	100	10	1
MODU <400GT	100	10	1
Offshore Supply Vessel <400GT	100	10	1
Other Facility	100	10	1
Unknown Land Source	100	10	1
Ferry <400GT	50	5	0.5
General Cargo Ship <400GT	50	5	0.5
Passenger Ship <400GT	50	5	0.5
Recreational Vessel <400GT	10	1	0.1
Recreational Vessel >400GT	10	1	0.1
Residential Facility	10	1	0.1
Vehicle	2	1	0.02

For each of the risk matrix cells in Table 64, the MMPDs for all of the sources in that region/period/oil type combination were calculated to determine the *largest* MMPD. The results are shown in Table 66. Note that these volumes are based on the largest source in each matrix cell.

Table 66: MMPD Spill Volumes by Region, Period, and Oil Type					
Region	**Period**	**MMPD[100] Volume (bbl)**			
		Crude	**Distillate**	**Heavy**	**Light**
Aleutians	**Dec-Jan**	n/a	2,500	2,500	2,500
	Feb-Mar	n/a	2,500	2,500	2,500
	Apr-May	n/a	2,500	2,500	2,500
	Jun-Jul	n/a	2,500	2,500	2,500

[100] MMPD = Maximum most-probable discharge

Table 66: MMPD Spill Volumes by Region, Period, and Oil Type					
Region	**Period**	**MMPD[100] Volume (bbl)**			
		Crude	**Distillate**	**Heavy**	**Light**
	Aug-Sep	n/a	2,500	2,500	2,500
	Oct-Nov	n/a	2,500	2,500	2,500
Aniakchak	**Dec-Jan**	2,500	2,500	2,500	2,500
	Feb-Mar	2,500	2,500	2,500	2,500
	Apr-May	2,500	2,500	2,500	2,500
	Jun-Jul	2,500	2,500	2,500	2,500
	Aug-Sep	2,500	2,500	2,500	2,500
	Oct-Nov	2,500	2,500	2,500	2,500
Beaufort Sea	**Dec-Jan**	2,500	n/a	n/a	2,500
	Feb-Mar	2,500	n/a	n/a	2,500
	Apr-May	2,500	2,500	2,500	2,500
	Jun-Jul	2,500	2,500	2,500	2,500
	Aug-Sep	2,500	2,500	2,500	2,500
	Oct-Nov	2,500	2,500	2,500	2,500
Bristol Bay	**Dec-Jan**	n/a	n/a	2,500	2,500
	Feb-Mar	n/a	n/a	2,500	2,500
	Apr-May	n/a	2,500	2,500	2,500
	Jun-Jul	n/a	2,500	2,500	2,500
	Aug-Sep	n/a	2,500	2,500	2,500
	Oct-Nov	n/a	2,500	2,500	2,500
Cook Inlet	**Dec-Jan**	2,500	2,500	2,500	2,500
	Feb-Mar	2,500	2,500	2,500	2,500
	Apr-May	2,500	2,500	2,500	2,500
	Jun-Jul	2,500	2,500	2,500	2,500
	Aug-Sep	2,500	2,500	2,500	2,500
	Oct-Nov	2,500	2,500	2,500	2,500
Kotzebue Sound/ Hope Basin	**Dec-Jan**	n/a	n/a	n/a	2,500
	Feb-Mar	n/a	n/a	n/a	2,500
	Apr-May	n/a	2,500	2,500	2,500
	Jun-Jul	n/a	2,500	2,500	2,500
	Aug-Sep	n/a	2,500	2,500	2,500
	Oct-Nov	n/a	2,500	2,500	2,500
Kodiak/ Shelikof Strait	**Dec-Jan**	2,500	2,500	2,500	2,500
	Feb-Mar	2,500	2,500	2,500	2,500
	Apr-May	2,500	2,500	2,500	2,500
	Jun-Jul	2,500	2,500	2,500	2,500
	Aug-Sep	2,500	2,500	2,500	2,500
	Oct-Nov	2,500	2,500	2,500	2,500
Chukchi Sea	**Dec-Jan**	1,200	1,200	n/a	1,200
	Feb-Mar	1,200	1,200	n/a	1,200
	Apr-May	1,200	1,200	1,200	1,200
	Jun-Jul	1,200	1,200	1,200	1,200
	Aug-Sep	1,200	1,200	1,200	1,200
	Oct-Nov	1,200	1,200	1,200	1,200
Norton Sound/ St. Lawrence Island	**Dec-Jan**	n/a	2,500	n/a	2,500
	Feb-Mar	n/a	2,500	n/a	2,500
	Apr-May	n/a	2,500	2,500	2,500
	Jun-Jul	n/a	2,500	2,500	2,500
	Aug-Sep	n/a	2,500	2,500	2,500

Table 66: MMPD Spill Volumes by Region, Period, and Oil Type					
Region	**Period**	**MMPD[100] Volume (bbl)**			
		Crude	**Distillate**	**Heavy**	**Light**
	Oct-Nov	n/a	2,500	2,500	2,500
Off Kenai Peninsula	**Dec-Jan**	2,500	2,500	2,500	2,500
	Feb-Mar	2,500	2,500	2,500	2,500
	Apr-May	2,500	2,500	2,500	2,500
	Jun-Jul	2,500	2,500	2,500	2,500
	Aug-Sep	2,500	2,500	2,500	2,500
	Oct-Nov	2,500	2,500	2,500	2,500
South-Central Alaska	**Dec-Jan**	2,500	n/a	2,500	2,500
	Feb-Mar	2,500	n/a	2,500	2,500
	Apr-May	2,500	2,500	2,500	2,500
	Jun-Jul	2,500	2,500	2,500	2,500
	Aug-Sep	2,500	2,500	2,500	2,500
	Oct-Nov	2,500	2,500	2,500	2,500
Prince William Sound	**Dec-Jan**	2,500	2,500	2,500	2,500
	Feb-Mar	2,500	2,500	2,500	2,500
	Apr-May	2,500	2,500	2,500	2,500
	Jun-Jul	2,500	2,500	2,500	2,500
	Aug-Sep	2,500	2,500	2,500	2,500
	Oct-Nov	2,500	2,500	2,500	2,500
Southeast Alaska	**Dec-Jan**	2,500	2,500	2,500	2,500
	Feb-Mar	2,500	2,500	2,500	2,500
	Apr-May	2,500	2,500	2,500	2,500
	Jun-Jul	2,500	2,500	2,500	2,500
	Aug-Sep	2,500	2,500	2,500	2,500
	Oct-Nov	2,500	2,500	2,500	2,500
Western Alaska	**Dec-Jan**	n/a	2,500	n/a	2,500
	Feb-Mar	n/a	2,500	n/a	2,500
	Apr-May	n/a	2,500	2,500	2,500
	Jun-Jul	n/a	2,500	2,500	2,500
	Aug-Sep	n/a	2,500	2,500	2,500
	Oct-Nov	n/a	2,500	2,500	2,500

To provide a more likely scenario for the MMPD, the MMPD volumes for all source types were *weight-averaged* for each matrix cell so that the MMPD volumes were represented in proportion to their occurrence (incident rate) by source type (as in Table 58) and corresponding MMPD (as in Table 67). The rounded weight-averaged MMPD volumes by region, oil type, and period are shown in Table 68.

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
Aleutians	**Fishing Vessel <400GT[101]**	42.389	0.474490	20
	Fishing Vessel >400GT	14.611	0.163551	250
	Recreational Vessel <400GT	10.778	0.120646	1
	Seafood Facility	5.056	0.056595	100
	Fuel Terminal	2.111	0.023630	1,200
	Towing Vessel <400GT	1.944	0.021761	50

[101] GT = gross tonnage

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
	General Cargo Ship >400GT	1.500	0.016791	2,500
	Tank Barge >400GT	1.222	0.013679	2,500
	Container Ship >400GT	0.667	0.007466	2,500
	Military Facility	0.667	0.007466	1,000
	Tank Barge <400GT	0.667	0.007466	2,500
	Freight Barge >400GT	0.556	0.006224	300
	Research Vessel <400GT	0.556	0.006224	80
	Small Boat Harbor	0.556	0.006224	100
	Bulk Carrier >400GT	0.444	0.004970	2,500
	Passenger Ship <400GT	0.444	0.004970	5
	Towing Vessel >400GT	0.444	0.004970	50
	Ferry >400GT	0.389	0.004354	250
	Military Vessel <400GT	0.389	0.004354	300
	Municipal Fuel Storage	0.389	0.004354	100
	Offshore Supply Vessel <400GT	0.389	0.004354	10
	Container Terminal	0.333	0.003728	100
	Offshore Supply Facility	0.333	0.003728	100
	Power Plant	0.333	0.003728	1,200
	Unknown Land Source	0.333	0.003728	10
	Recreational Vessel >400GT	0.222	0.002485	1
	Tanker <90,000DWT	0.222	0.002485	2,500
	Industrial Vessel >400 GT	0.167	0.001869	50
	Industrial Vessel <400 GT	0.167	0.001869	100
	Research Vessel >400GT	0.167	0.001869	80
	Construction Site	0.111	0.001243	10
	Cruise Ship >400GT	0.111	0.001243	2,500
	MODU <400GT	0.111	0.001243	10
	Other Facility	0.111	0.001243	10
	Vehicle Carrier Ship >400GT	0.111	0.001243	2,500
	Airport	0.056	0.000627	1,200
	Drydock Facility	0.056	0.000627	100
	Freight Barge <400GT	0.056	0.000627	20
	General Cargo Ship <400GT	0.056	0.000627	2,500
	Offshore Supply Vessel >400GT	0.056	0.000627	10
	Oil Recovery Vessel <400GT	0.056	0.000627	10
Aleutians Total		**89.336**	**1.000000**	**246**
Aniakchak	**Fishing Vessel <400GT**	1.222	0.372334	20
	Seafood Facility	0.611	0.186167	100
	Fishing Vessel >400GT	0.278	0.084704	250
	Tank Barge >400GT	0.167	0.050884	2,500
	Bulk Carrier >400GT	0.111	0.033821	2,500
	Construction Site	0.111	0.033821	10
	Small Boat Harbor	0.111	0.033821	100
	Tanker <90,000DWT	0.111	0.033821	2,500
	Container Ship >400GT	0.056	0.017063	2,500
	Cruise Ship >400GT	0.056	0.017063	2,500
	General Cargo Ship >400GT	0.056	0.017063	2,500
	Municipal Fuel Storage	0.056	0.017063	100
	Oil Exp/Prod Facility	0.056	0.017063	1,200

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
	Power Plant	0.056	0.017063	1,200
	Recreational Vessel <400GT	0.056	0.017063	1
	Residential Facility	0.056	0.017063	1
	Tank Barge <400GT	0.056	0.017063	2,500
	Towing Vessel <400GT	0.056	0.017063	50
Aniakchak Total		**3.282**	**1.000000**	**561**
Beaufort Sea	**Oil Exp/Prod Facility**	81	0.983081	1,200
	Fishing Vessel <400GT	0.167	0.002027	20
	Industrial Vessel <400 GT	0.167	0.002027	50
	Passenger Ship <400GT	0.167	0.002027	5
	Freight Barge >400GT	0.111	0.001347	300
	Recreational Vessel <400GT	0.111	0.001347	1
	Municipal Fuel Storage	0.111	0.001347	100
	Fishing Vessel >400GT	0.056	0.00068	250
	Offshore Supply Vessel <400GT	0.056	0.00068	10
	Oil Recovery Vessel >400GT	0.056	0.00068	10
	Oil Recovery Vessel <400GT	0.056	0.00068	300
	Research Vessel >400GT	0.056	0.00068	80
	Tank Barge >400GT	0.056	0.00068	2,500
	Tanker <90,000DWT	0.056	0.00068	2,500
	Construction Site	0.056	0.00068	10
	Other Facility	0.056	0.00068	10
	Unknown Land Source	0.056	0.00068	10
Beaufort Sea Total		**82.394**	**1.000000**	**1,184**
Bristol Bay	**Fishing Vessel <400GT**	5.667	0.455217	20
	Recreational Vessel <400GT	1.056	0.084826	1
	Fuel Terminal	0.667	0.053579	1,200
	Seafood Facility	0.667	0.053579	100
	Fishing Vessel >400GT	0.556	0.044662	250
	Municipal Fuel Storage	0.556	0.044662	100
	Tank Barge <400GT	0.556	0.044662	2,500
	Tank Barge >400GT	0.500	0.040164	2,500
	Power Plant	0.444	0.035666	1,200
	Towing Vessel <400GT	0.389	0.031247	50
	Freight Barge <400GT	0.222	0.017833	20
	General Cargo Ship <400GT	0.222	0.017833	2,500
	Industrial Vessel <400 GT	0.222	0.017833	50
	Towing Vessel >400GT	0.222	0.017833	50
	Freight Barge >400GT	0.111	0.008916	300
	Barge Terminal	0.056	0.004498	100
	General Cargo Ship >400GT	0.056	0.004498	2,500
	Military Facility	0.056	0.004498	1,000
	Offshore Supply Vessel <400GT	0.056	0.004498	10
	Oil Recovery Vessel <400GT	0.056	0.004498	10
	Recreational Vessel >400GT	0.056	0.004498	1
	Small Boat Harbor	0.056	0.004498	100
Bristol Bay Total		**12.449**	**1.000000**	**417**
Cook Inlet	**Oil Exp/Prod Facility**	28.389	0.382179	1,200
	Fishing Vessel <400GT	11.056	0.148838	20

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
	Refinery	10.056	0.135376	1,200
	Recreational Vessel <400GT	5.944	0.080019	1
	Passenger Ship <400GT	2.111	0.028419	5
	Power Plant	1.389	0.018699	1,200
	Small Boat Harbor	1.278	0.017205	100
	Tanker <90,000DWT	1.167	0.015710	2,500
	Petroleum Terminal	1.111	0.014957	1,200
	Towing Vessel <400GT	1.111	0.014957	50
	Bulk Chemical Facility	0.944	0.012708	1,000
	Tank Barge >400GT	0.889	0.011968	2,500
	Fuel Terminal	0.833	0.011214	1,200
	Research Vessel >400GT	0.556	0.007485	80
	Ferry >400GT	0.500	0.006731	250
	General Cargo Ship >400GT	0.500	0.006731	2,500
	Tank Barge <400GT	0.500	0.006731	2,500
	Fishing Vessel >400GT	0.444	0.005977	250
	Industrial Vessel <400 GT	0.444	0.005977	50
	Unknown Land Source	0.444	0.005977	10
	Research Vessel <400GT	0.333	0.004483	80
	Container Ship >400GT	0.278	0.003742	2,500
	Offshore Supply Facility	0.278	0.003742	100
	Oil Recovery Vessel >400GT	0.278	0.003742	10
	Oil Recovery Vessel <400GT	0.278	0.003742	300
	Pipeline Facility	0.278	0.003742	1,200
	Municipal Fuel Storage	0.222	0.002989	100
	Offshore Supply Vessel <400GT	0.222	0.002989	10
	Other Facility	0.222	0.002989	10
	Construction Site	0.167	0.002248	10
	Container Terminal	0.167	0.002248	100
	Freight Barge >400GT	0.167	0.002248	300
	Military Vessel <400GT	0.167	0.002248	300
	Recreational Vessel >400GT	0.167	0.002248	1
	Seafood Facility	0.167	0.002248	100
	Towing Vessel >400GT	0.167	0.002248	50
	Airport	0.111	0.001494	1,200
	General Cargo Ship <400GT	0.111	0.001494	2,500
	Industrial Vessel >400 GT	0.111	0.001494	100
	Marine Services Facility	0.111	0.001494	100
	Military Facility	0.111	0.001494	1,000
	Tanker >90,000DWT	0.111	0.001494	2,500
	Barge Terminal	0.056	0.000754	100
	Bulk Carrier >400GT	0.056	0.000754	2,500
	Ferry Terminal	0.056	0.000754	100
	Freight Barge <400GT	0.056	0.000754	20
	Offshore Supply Vessel >400GT	0.056	0.000754	10
	Residential Facility	0.056	0.000754	1
	Ship Terminal	0.056	0.000754	1,000
Cook Inlet Total		**74.282**	**1.000000**	**832**
Kotzebue Sound/	**Power Plant**	0.556	0.222133	1,200

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
Hope Basin	**Mining Facility**	0.333	0.133040	10
	Fuel Terminal	0.222	0.088694	1,200
	Municipal Fuel Storage	0.222	0.088694	100
	Tank Barge >400GT	0.222	0.088694	2,500
	Other Facility	0.167	0.066720	10
	Freight Barge <400GT	0.111	0.044347	20
	General Cargo Ship >400GT	0.111	0.044347	2,500
	Marine Services Facility	0.111	0.044347	100
	Bulk Carrier >400GT	0.056	0.022373	2,500
	Fishing Vessel <400GT	0.056	0.022373	20
	Freight Barge >400GT	0.056	0.022373	300
	Industrial Vessel <400 GT	0.056	0.022373	50
	Residential Facility	0.056	0.022373	1
	Towing Vessel >400GT	0.056	0.022373	50
	Towing Vessel <400GT	0.056	0.022373	50
	Unknown Land Source	0.056	0.022373	10
Kotzebue/Hope Total		**2.503**	**1.000000**	**788**
Kodiak/ Shelikof Strait	**Fishing Vessel <400GT**	24.333	0.524509	20
	Recreational Vessel <400GT	9.611	0.207169	1
	Military Vessel <400GT	3.611	0.077837	300
	Towing Vessel <400GT	0.944	0.020348	50
	Small Boat Harbor	0.722	0.015563	100
	Ferry >400GT	0.667	0.014377	250
	Military Facility	0.611	0.013170	1,000
	Passenger Ship <400GT	0.611	0.013170	5
	Research Vessel <400GT	0.556	0.011985	80
	Military Vessel >400GT	0.500	0.010778	300
	Power Plant	0.500	0.010778	1,200
	Freight Barge >400GT	0.389	0.008385	300
	Fishing Vessel >400GT	0.333	0.007178	250
	Fuel Terminal	0.333	0.007178	1,200
	Container Ship >400GT	0.278	0.005992	2,500
	General Cargo Ship <400GT	0.222	0.004785	2,500
	Municipal Fuel Storage	0.222	0.004785	100
	Offshore Supply Vessel <400GT	0.222	0.004785	10
	Unknown Land Source	0.222	0.004785	10
	Tank Barge >400GT	0.167	0.003600	2,500
	Barge Terminal	0.111	0.002393	100
	Other Facility	0.111	0.002393	10
	Refinery	0.111	0.002393	1,200
	Seafood Facility	0.111	0.002393	100
	Ship Terminal	0.111	0.002393	1,000
	Towing Vessel >400GT	0.111	0.002393	50
	Bulk Carrier >400GT	0.056	0.001207	2,500
	Cruise Ship >400GT	0.056	0.001207	2,500
	Freight Barge <400GT	0.056	0.001207	20
	General Cargo Ship >400GT	0.056	0.001207	2,500
	Industrial Vessel >400 GT	0.056	0.001207	50
	Industrial Vessel <400 GT	0.056	0.001207	100

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
	Logging Facility	0.056	0.001207	100
	Oil Exp/Prod Facility	0.056	0.001207	1,200
	Oil Recovery Vessel <400GT	0.056	0.001207	10
	Tank Barge <400GT	0.056	0.001207	2,500
	Tanker <90,000DWT	0.056	0.001207	2,500
	Tanker >90,000DWT	0.056	0.001207	2,500
Kodiak/Shelikof Total		**46.392**	**1.000000**	**146**
Chukchi Sea	**Oil Exp/Prod Facility**	0.556	0.312360	1,200
	Towing Vessel >400GT	0.444	0.249438	50
	Municipal Fuel Storage	0.389	0.218539	100
	Power Plant	0.167	0.093820	1,200
	Fuel Terminal	0.056	0.031461	1,200
	Other Facility	0.056	0.031461	50
	Industrial Vessel <400 GT	0.056	0.031461	10
	Recreational Vessel >400GT	0.056	0.031461	1
Chukchi Sea Total		**1.780**	**1.000000**	**561**
Norton Sound/ St. Lawrence Island	**Municipal Fuel Storage**	1.278	0.249853	100
	Tank Barge >400GT	0.667	0.130401	2,500
	Fuel Terminal	0.444	0.086804	1,200
	Power Plant	0.389	0.076051	1,200
	Fishing Vessel <400GT	0.278	0.054350	100
	Barge Terminal	0.278	0.054350	20
	Towing Vessel <400GT	0.222	0.043402	1,000
	Military Facility	0.222	0.043402	100
	Small Boat Harbor	0.222	0.043402	50
	Freight Barge <400GT	0.167	0.032649	20
	Recreational Vessel <400GT	0.167	0.032649	10
	Other Facility	0.167	0.032649	1
	Towing Vessel >400GT	0.111	0.021701	100
	Marine Services Facility	0.111	0.021701	50
	Industrial Vessel <400 GT	0.056	0.010948	1,200
	Offshore Supply Vessel <400GT	0.056	0.010948	10
	Tank Barge <400GT	0.056	0.010948	50
	Airport	0.056	0.010948	10
	Construction Site	0.056	0.010948	100
	Seafood Facility	0.056	0.010948	2,500
	Unknown Land Source	0.056	0.010948	10
Norton/St. Law Total		**5.115**	**1.000000**	**650**
Off Kenai Peninsula	**Fishing Vessel <400GT**	4.333	0.305722	20
	Recreational Vessel <400GT	3.722	0.262612	1
	Passenger Ship <400GT	1.833	0.129330	5
	Towing Vessel <400GT	0.611	0.043110	50
	Industrial Vessel <400 GT	0.389	0.027447	50
	Military Vessel <400GT	0.389	0.027447	300
	Ferry >400GT	0.167	0.011783	250
	Cruise Ship >400GT	0.111	0.007832	2,500
	Freight Barge <400GT	0.111	0.007832	20
	Container Ship >400GT	0.056	0.003951	2,500
	Fishing Vessel >400GT	0.056	0.003951	250

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
	Freight Barge >400GT	0.056	0.003951	300
	Military Vessel >400GT	0.056	0.003951	300
	Offshore Supply Vessel <400GT	0.056	0.003951	10
	Oil Recovery Vessel >400GT	0.056	0.003951	300
	Passenger Ship >400GT	0.056	0.003951	400
	Research Vessel >400GT	0.056	0.003951	80
	Research Vessel <400GT	0.056	0.003951	80
	Tank Barge <400GT	0.056	0.003951	2,500
	Tanker <90,000DWT	0.056	0.003951	2,500
	Power Plant	0.389	0.027447	1,200
	Small Boat Harbor	0.389	0.027447	100
	Unknown Land Source	0.278	0.019615	10
	Cruise Terminal	0.167	0.011783	100
	Ship Terminal	0.167	0.011783	1,000
	Container Terminal	0.111	0.007832	100
	Fuel Terminal	0.111	0.007832	1,200
	Seafood Facility	0.111	0.007832	100
	Airport	0.056	0.003951	1,200
	Marine Services Facility	0.056	0.003951	100
	Military Facility	0.056	0.003951	1,000
Off Kenai Total		**14.173**	**1.000000**	**147**
South-Central Alaska	**Fishing Vessel <400GT**	2.222	0.388122	20
	Recreational Vessel <400GT	0.444	0.077555	1
	Tanker >90,000DWT	0.444	0.077555	2,500
	Power Plant	0.389	0.067948	1,200
	Tanker <90,000DWT	0.278	0.048559	2,500
	Towing Vessel <400GT	0.278	0.048559	50
	Bulk Carrier >400GT	0.222	0.038777	2,500
	Fishing Vessel >400GT	0.222	0.038777	250
	General Cargo Ship >400GT	0.222	0.038777	2,500
	Small Boat Harbor	0.222	0.038777	100
	Ferry >400GT	0.111	0.019389	250
	Military Vessel <400GT	0.111	0.019389	300
	Ferry Terminal	0.056	0.009782	100
	Freight Barge >400GT	0.056	0.009782	300
	Industrial Vessel <400 GT	0.056	0.009782	50
	Logging Facility	0.056	0.009782	100
	Military Vessel >400GT	0.056	0.009782	1,000
	Military Facility	0.056	0.009782	300
	Offshore Supply Vessel <400GT	0.056	0.009782	10
	Passenger Ship <400GT	0.056	0.009782	5
	Seafood Facility	0.056	0.009782	100
	Tank Barge <400GT	0.056	0.009782	2,500
South-Central Total		**5.725**	**1.000000**	**669**
Prince William Sound	**Recreational Vessel <400GT**	11.278	0.214354	1
	Fishing Vessel <400GT	9.167	0.174231	20
	Petroleum Terminal	4.389	0.083419	1,200
	Refinery	2.611	0.049626	1,200
	Towing Vessel <400GT	2.611	0.049626	50

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
	Tanker >90,000DWT	2.500	0.047516	2,500
	Industrial Vessel <400 GT	2.444	0.046452	50
	Passenger Ship <400GT	2.333	0.044342	5
	Ferry >400GT	1.944	0.036948	250
	Tanker <90,000DWT	1.944	0.036948	2,500
	Small Boat Harbor	1.611	0.030619	100
	Tank Barge >400GT	0.944	0.017942	2,500
	Fishing Vessel >400GT	0.889	0.016897	250
	Oil Recovery Vessel <400GT	0.778	0.014787	10
	Tank Barge <400GT	0.722	0.013723	2,500
	Towing Vessel >400GT	0.722	0.013723	50
	Offshore Supply Vessel <400GT	0.556	0.010568	10
	Oil Recovery Vessel >400GT	0.556	0.010568	300
	Freight Barge >400GT	0.444	0.008439	300
	Unknown Land Source	0.389	0.007393	10
	Fuel Terminal	0.333	0.006329	1,200
	Military Vessel <400GT	0.333	0.006329	300
	Research Vessel >400GT	0.333	0.006329	80
	Cruise Ship >400GT	0.278	0.005284	2,500
	Passenger Ship >400GT	0.278	0.005284	400
	Power Plant	0.278	0.005284	1,200
	Recreational Vessel >400GT	0.278	0.005284	1
	Container Terminal	0.222	0.004219	100
	Municipal Fuel Storage	0.222	0.004219	100
	Offshore Supply Vessel >400GT	0.222	0.004219	10
	Ferry Terminal	0.167	0.003174	100
	Military Facility	0.111	0.002110	1,000
	Other Facility	0.111	0.002110	10
	Barge Terminal	0.056	0.001064	100
	Ferry <400GT	0.056	0.001064	5
	Freight Barge <400GT	0.056	0.001064	20
	General Cargo Ship >400GT	0.056	0.001064	2,500
	Industrial Vessel >400 GT	0.056	0.001064	100
	Marine Services Facility	0.056	0.001064	100
	Offshore Supply Facility	0.056	0.001064	100
	Research Vessel <400GT	0.056	0.001064	80
	Residential Facility	0.056	0.001064	1
	Ship Terminal	0.056	0.001064	1,000
	Vehicle	0.056	0.001064	1
PWS Total		**52.614**	**1.000000**	**521**
Southeast Alaska	**Recreational Vessel <400GT**	71.389	0.353896	1
	Fishing Vessel <400GT	49.944	0.247587	20
	Ferry >400GT	10.722	0.053152	250
	Small Boat Harbor	10.722	0.053152	100
	Passenger Ship <400GT	10.667	0.052879	5
	Cruise Ship >400GT	9.222	0.045716	2,500
	Towing Vessel <400GT	3.944	0.019552	50
	Unknown Land Source	3.722	0.018451	10
	Military Vessel <400GT	2.944	0.014594	300

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
	Fuel Terminal	2.667	0.013221	1,200
	Industrial Vessel <400 GT	2.611	0.012943	50
	Cruise Terminal	2.111	0.010465	100
	Fishing Vessel >400GT	2.000	0.009915	250
	Recreational Vessel >400GT	1.333	0.006608	1
	Tank Barge >400GT	1.333	0.006608	2,500
	Freight Barge >400GT	1.222	0.006058	300
	Ferry <400GT	1.167	0.005785	5
	Residential Facility	0.944	0.004680	1
	Freight Barge <400GT	0.889	0.004407	20
	Research Vessel <400GT	0.889	0.004407	80
	General Cargo Ship <400GT	0.833	0.004129	2,500
	Other Facility	0.833	0.004129	10
	Logging Facility	0.778	0.003857	100
	Ferry Terminal	0.722	0.003579	100
	Passenger Ship >400GT	0.611	0.003029	400
	Airport	0.556	0.002756	1,200
	Container Ship >400GT	0.556	0.002756	2,500
	Military Facility	0.556	0.002756	1,000
	Seafood Facility	0.556	0.002756	100
	Tank Barge <400GT	0.556	0.002756	2,500
	Vehicle	0.500	0.002479	1
	Power Plant	0.444	0.002201	1,200
	General Cargo Ship >400GT	0.333	0.001651	2,500
	Industrial Vessel >400 GT	0.333	0.001651	100
	Municipal Fuel Storage	0.333	0.001651	100
	Bulk Carrier >400GT	0.278	0.001378	2,500
	Towing Vessel >400GT	0.278	0.001378	50
	Bulk Chemical Facility	0.222	0.001101	1,000
	Offshore Supply Vessel <400GT	0.222	0.001101	10
	Barge Terminal	0.167	0.000828	100
	Construction Site	0.167	0.000828	10
	Drydock Facility	0.167	0.000828	100
	Marine Services Facility	0.167	0.000828	100
	Research Vessel >400GT	0.167	0.000828	80
	Tanker <90,000DWT	0.167	0.000828	2,500
	Tanker >90,000DWT	0.167	0.000828	2,500
	Container Terminal	0.111	0.000550	100
	Military Vessel >400GT	0.111	0.000550	300
	Petroleum Terminal	0.111	0.000550	1,200
	Ship Terminal	0.111	0.000550	1,000
	Mining Facility	0.056	0.000278	10
	Offshore Supply Vessel >400GT	0.056	0.000278	10
	Oil Recovery Vessel <400GT	0.056	0.000278	10
SE Alaska Total		**201.723**	**1.000000**	**233**
Western Alaska	**Fishing Vessel <400GT**	3.333	0.179589	20
	Municipal Fuel Storage	3.333	0.179589	100
	Fishing Vessel >400GT	3.167	0.170645	250
	Power Plant	1.667	0.089822	1,200

Table 67: Proportions of Incident Types by Region				
Region	**Type**	**Annual Rate**	**Proportion in Region**	**MMPD (bbl)**
	Fuel Terminal	1.222	0.065844	1,200
	Tank Barge >400GT	1.222	0.065844	2,500
	Towing Vessel <400GT	1.056	0.056900	50
	Recreational Vessel <400GT	0.889	0.047901	1
	Tank Barge <400GT	0.333	0.017943	2,500
	Barge Terminal	0.278	0.014979	100
	Freight Barge <400GT	0.278	0.014979	20
	Construction Site	0.222	0.011962	10
	Small Boat Harbor	0.222	0.011962	100
	Freight Barge >400GT	0.167	0.008998	300
	Towing Vessel >400GT	0.167	0.008998	50
	Airport	0.111	0.005981	1,200
	General Cargo Ship >400GT	0.111	0.005981	2,500
	Marine Services Facility	0.111	0.005981	100
	Recreational Vessel >400GT	0.111	0.005981	1
	Seafood Facility	0.111	0.005981	100
	Bulk Carrier >400GT	0.056	0.003017	2,500
	Cruise Ship >400GT	0.056	0.003017	2,500
	Industrial Vessel >400 GT	0.056	0.003017	50
	Industrial Vessel <400 GT	0.056	0.003017	100
	Military Vessel <400GT	0.056	0.003017	300
	Other Facility	0.056	0.003017	10
	Research Vessel >400GT	0.056	0.003017	80
	Unknown Land Source	0.056	0.003017	10
Western Alaska Total		**18.559**	**1.000000**	**510**

Table 68: Weight-Averaged MMPD Spill Volumes by Region, Period, and Oil Type					
Region	**Period**	**MMPD Volume (bbl)**			
		Crude	**Distillate**	**Heavy**	**Light**
Aleutians	**Dec-Jan**	n/a	250	250	250
	Feb-Mar	n/a	250	250	250
	Apr-May	n/a	250	250	250
	Jun-Jul	n/a	250	250	250
	Aug-Sep	n/a	250	250	250
	Oct-Nov	n/a	250	250	250
Aniakchak	**Dec-Jan**	560	560	560	560
	Feb-Mar	560	560	560	560
	Apr-May	560	560	560	560
	Jun-Jul	560	560	560	560
	Aug-Sep	560	560	560	560
	Oct-Nov	560	560	560	560
Beaufort Sea	**Dec-Jan**	1,200	n/a	n/a	1,200
	Feb-Mar	1,200	n/a	n/a	1,200
	Apr-May	1,200	1,200	1,200	1,200
	Jun-Jul	1,200	1,200	1,200	1,200
	Aug-Sep	1,200	1,200	1,200	1,200
	Oct-Nov	1,200	1,200	1,200	1,200
Bristol Bay	**Dec-Jan**	n/a	n/a	420	420
	Feb-Mar	n/a	n/a	420	420

Table 68: Weight-Averaged MMPD Spill Volumes by Region, Period, and Oil Type					
Region	**Period**	**MMPD Volume (bbl)**			
		Crude	**Distillate**	**Heavy**	**Light**
	Apr-May	n/a	420	420	420
	Jun-Jul	n/a	420	420	420
	Aug-Sep	n/a	420	420	420
	Oct-Nov	n/a	420	420	420
Cook Inlet	**Dec-Jan**	830	830	830	830
	Feb-Mar	830	830	830	830
	Apr-May	830	830	830	830
	Jun-Jul	830	830	830	830
	Aug-Sep	830	830	830	830
	Oct-Nov	830	830	830	830
Kotzebue Sound/ Hope Basin	**Dec-Jan**	n/a	n/a	n/a	790
	Feb-Mar	n/a	n/a	n/a	790
	Apr-May	n/a	790	790	790
	Jun-Jul	n/a	790	790	790
	Aug-Sep	n/a	790	790	790
	Oct-Nov	n/a	790	790	790
Kodiak/ Shelikof Strait	**Dec-Jan**	150	150	150	150
	Feb-Mar	150	150	150	150
	Apr-May	150	150	150	150
	Jun-Jul	150	150	150	150
	Aug-Sep	150	150	150	150
	Oct-Nov	150	150	150	150
Chukchi Sea	**Dec-Jan**	560	560	560	560
	Feb-Mar	560	560	560	560
	Apr-May	560	560	560	560
	Jun-Jul	560	560	560	560
	Aug-Sep	560	560	560	560
	Oct-Nov	560	560	560	560
Norton Sound/ St. Lawrence Island	**Dec-Jan**	n/a	650	n/a	650
	Feb-Mar	n/a	650	n/a	650
	Apr-May	n/a	650	650	650
	Jun-Jul	n/a	650	650	650
	Aug-Sep	n/a	650	650	650
	Oct-Nov	n/a	650	650	650
Off Kenai Peninsula	**Dec-Jan**	150	150	150	150
	Feb-Mar	150	150	150	150
	Apr-May	150	150	150	150
	Jun-Jul	150	150	150	150
	Aug-Sep	150	150	150	150
	Oct-Nov	150	150	150	150
South-Central Alaska	**Dec-Jan**	670	670	670	670
	Feb-Mar	670	670	670	670
	Apr-May	670	670	670	670
	Jun-Jul	670	670	670	670
	Aug-Sep	670	670	670	670
	Oct-Nov	670	670	670	670
Prince William Sound	**Dec-Jan**	520	520	520	520
	Feb-Mar	520	520	520	520
	Apr-May	520	520	520	520

Table 68: Weight-Averaged MMPD Spill Volumes by Region, Period, and Oil Type					
Region	**Period**	**MMPD Volume (bbl)**			
		Crude	**Distillate**	**Heavy**	**Light**
	Jun-Jul	520	520	520	520
	Aug-Sep	520	520	520	520
	Oct-Nov	520	520	520	520
Southeast Alaska	**Dec-Jan**	230	230	230	230
	Feb-Mar	230	230	230	230
	Apr-May	230	230	230	230
	Jun-Jul	230	230	230	230
	Aug-Sep	230	230	230	230
	Oct-Nov	230	230	230	230
Western Alaska	**Dec-Jan**	n/a	510	n/a	510
	Feb-Mar	n/a	510	n/a	510
	Apr-May	n/a	510	510	510
	Jun-Jul	n/a	510	510	510
	Aug-Sep	n/a	510	510	510
	Oct-Nov	n/a	510	510	510

For comparison purposes, the WCD, maximum MMPD (Max-MMPD), and weight-averaged MMPD (WA-MMPD) for all regions are summarized in Table 69. The volumes of the three discharge types are vastly different – up to four orders of magnitude. The maximum MMPD, which is the largest volume of the MMPDs, for each region is most relevant for contingency planning purposes with respect to spill volumes, but the weight-averaged MMPD more closely reflects the expected MMPD for each region and oil type. For this reason, the weight-averaged MMPD was applied to the risk modeling.

Table 69: WCD, Maximum MMPD, Weight-Averaged MMPD Volume Summary												
Region	**Volume (bbl)**											
	Crude			**Distillate**			**Heavy**			**Light**		
	WCD[102]	**Max-MMPD[103]**	**WA-MMPD[104]**	**WCD**	**Max-MMPD**	**WA-MMPD**	**WCD**	**Max-MMPD**	**WA-MMPD**	**WCD**	**Max-MMPD**	**WA-MMPD**
Aleutian	n/a	n/a	n/a	523,000	2,500	250	523,000	2,500	250	523,000	2,500	250
Aniakchak	523,000	2,500	560	523,000	2,500	560	523,000	2,500	560	523,000	2,500	560
Beaufort	3,900,000	2,500	1,200	523,000	2,500	1,200	523,000	2,500	1,200	523,000	2,500	1,200
Bristol Bay	n/a	2,500	420	163,000	2,500	420	163,000	2,500	420	163,000	2,500	420
Cook Inlet	1,900,000	2,500	830	523,000	2,500	830	1,900,000	2,500	830	1,900,000	2,500	830
Kotzebue	n/a	n/a	n/a	163,000	2,500	790	163,000	2,500	790	163,000	2,500	790
Kodiak	1,900,000	2,500	150	523,000	2,500	150	1,900,000	2,500	150	1,900,000	2,500	150
Chukchi	2,200,000	1,200	560	50,000	1,200	560	30,000	1,200	560	50,000	1,200	560
Norton	n/a	n/a	n/a	163,000	2,500	650	163,000	2,500	650	163,000	2,500	650
Off Kenai	523,000	2,500	150	523,000	2,500	150	523,000	2,500	150	523,000	2,500	150
South-Cent	1,900,000	2,500	670	523,000	2,500	670	1,900,000	2,500	670	1,900,000	2,500	670
PWS	1,900,000	2,500	520	523,000	2,500	520	1,900,000	2,500	520	1,900,000	2,500	520
Southeast	1,900,000	2,500	230	523,000	2,500	230	1,900,000	2,500	230	1,900,000	2,500	230
Western	n/a	n/a	n/a	163,000	2,500	510	163,000	2,500	510	163,000	2,500	510

[102] WCD = worst-case discharge
[103] The maximum spill volume for the maximum most-probable discharges (MMPDs) for each region, oil type, and period.
[104] WA-MMPD = weight-averaged maximum most-probable discharge

6 "Most Likely" Spills

The analyses above calculate the WCD and MMPD scenarios, which do not reflect the *most likely* spill scenario. To provide some perspective on the probabilities of different types of events, a brief analysis of spill volumes for most likely spill scenarios was conducted.

6.1 Spills and Potential Spills

The first important point to remember in considering the likelihood of spills is that not all "incidents" result in spills. *In these analyses all incidents were considered to be potential spillage cases.*

According to the data in Tables 4 and 5, during the years 1995 – 2012, approximately 79% of incidents across all regions and source types result in spillage. For facilities, the percentage of incidents with the potential for spillage that result in spillage is approximately 92%. For vessels, the rate is lower, 73%. The reason that more reported incidents result in spillage for facilities is not that the likelihood of spillage is greater, but probably that "near-miss" incidents are less likely to be reported or noted for facilities than for vessels. An incident is most likely noted from a facility when there is an actual spill. Operators of vessels that ground, allide, collide, or have some other kind of failure generally report to the US Coast Guard and state authorities regardless of whether spillage occurs or not.

6.2 Spill Volumes

Examining the actual spill volumes over the years 1995 – 2012, the findings demonstrate that most spills are quite small. The overall distribution of spill volumes, including no-spillage, is shown in Table 70 and Figure 28. Of all spills, 85% involves less than 1 bbl. Figure 29 shows the same data as a probability distribution function.

Table 70: Distribution of Spill Volumes for Alaskan Spills 1995 – 2012

Spill Volume	Number of Incidents	Percent Total Incidents	Percent Total Spills
> 5,000 bbl	1	0.01%	0.01%
1,000 – 4,999 bbl	2	0.02%	0.02%
500 – 999 bbl	5	0.05%	0.06%
100 – 499 bbl	32	0.29%	0.37%
50 – 99 bbl	30	0.27%	0.35%
10 – 49 bbl	223	2.03%	2.57%
5 – 9 bbl	156	1.42%	1.80%
1 – 4 bbl	832	7.57%	9.60%
< 1 bbl	7,386	67.24%	85.22%
0 bbl (potential only)	2,318	21.10%	-
Total Incidents	**10,985**	**100%**	**-**
Total Spills	**8,667**	**83.38%**	**100%**

Over 99% of the spills that have occurred in Alaska during 1995 – 2012 involved less than 50 bbl, and only 0.5% involved more than 100 bbl. Clearly, the "most likely" spill volume is less than 1 bbl.

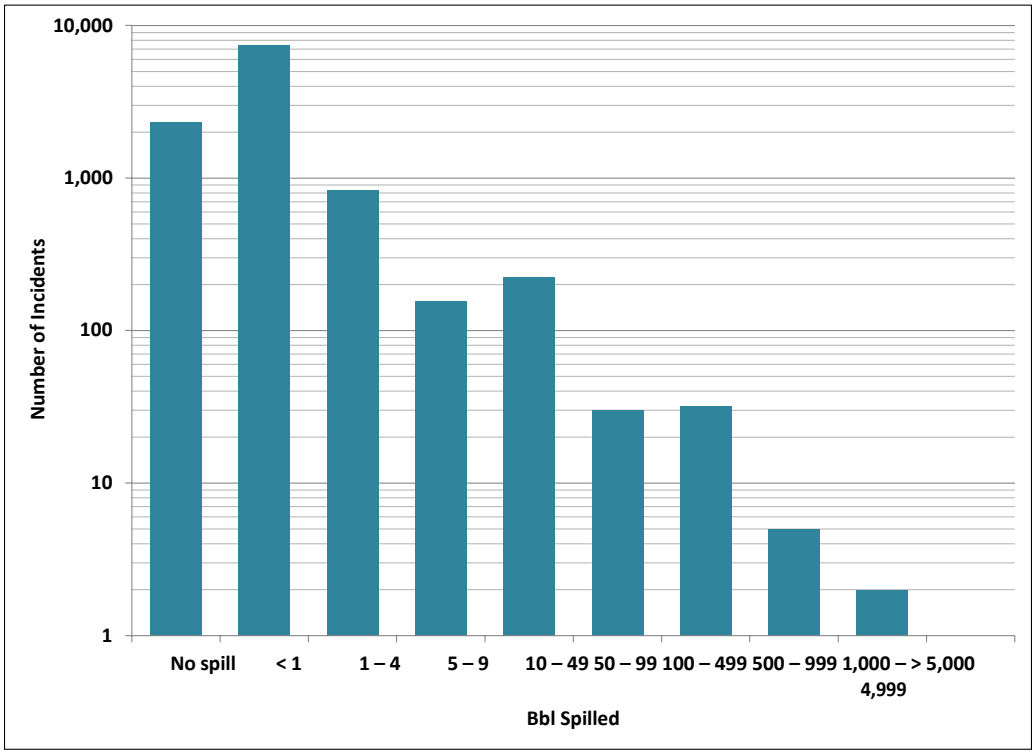

Figure 28: Distribution of Spill Volumes for Alaska 1995 – 2012[105]

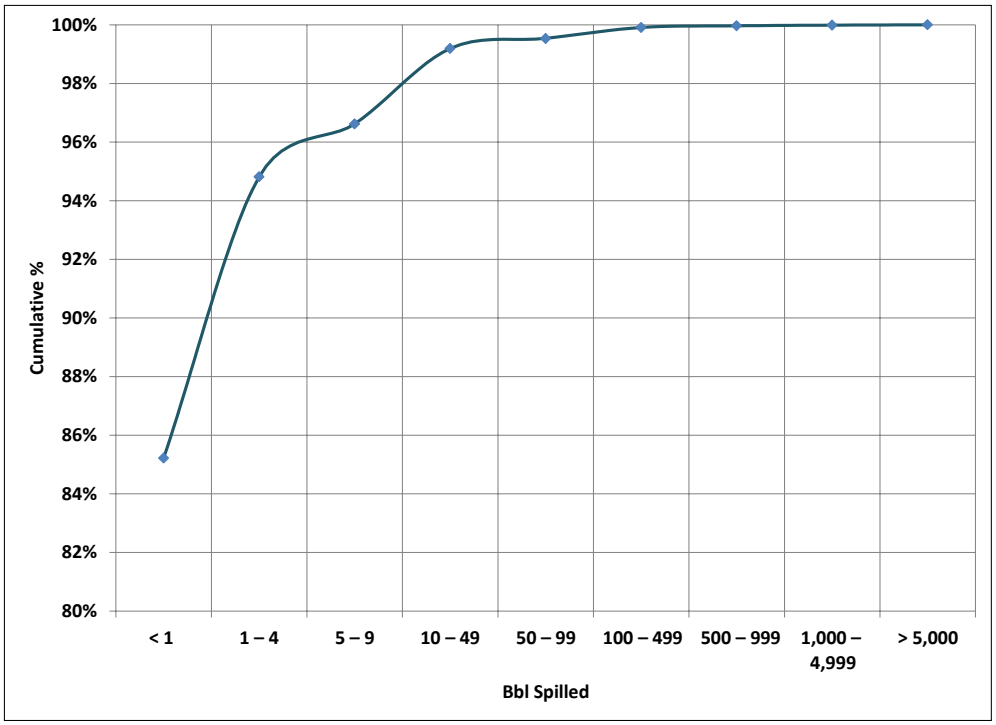

Figure 29: Probability Distribution Function of Marine Alaskan Spill Volume 1995 – 2012

[105] Note logarithmic scale for incident number.

On a national level, this general pattern holds true as well. Figure 30 shows the distribution of spill volumes for facility-sourced marine spills in US waters. Overall, nearly 92% of spills involve 2 bbl or less, but these spills only contribute 1.7% of the total volume spilled, while spills over 2,000 bbl, though rare (0.083%) make up 60% of total spillage volumes. The distribution of spill volumes varies somewhat with the source and cause of the spill.[106]

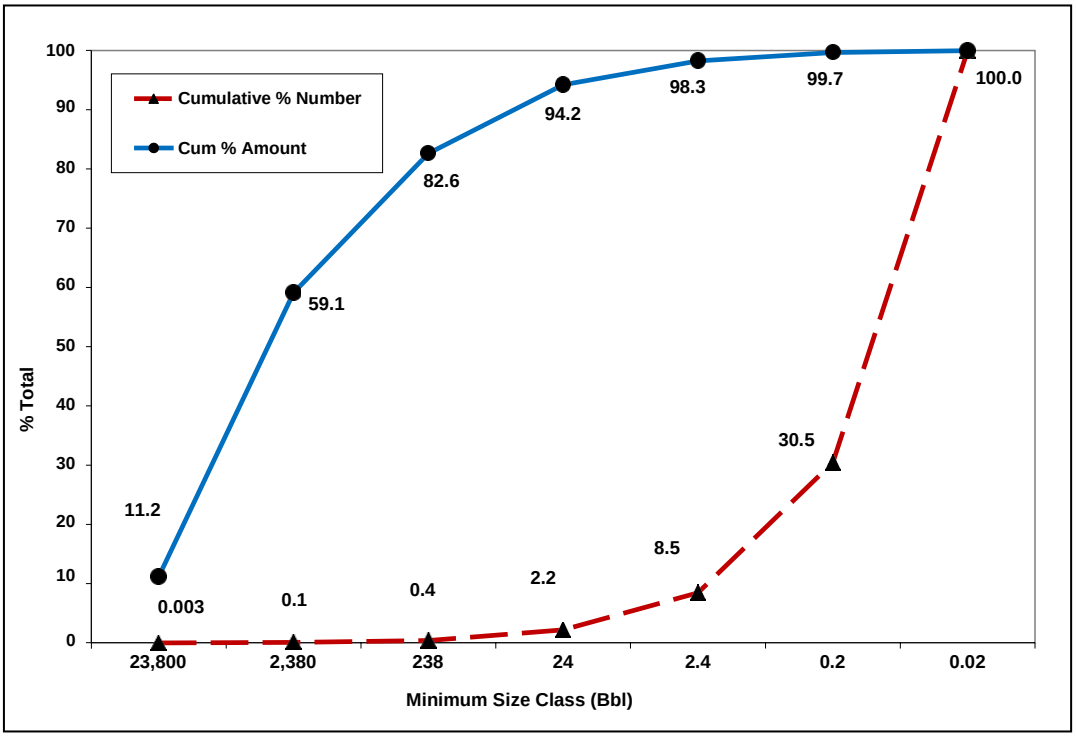

Figure 30: Distribution of Spill Volume for US Facility Marine Spills 1985 – 1999[107]

6.3 Probability of Spills and WCDs

The probability of spills of various sizes is distinct from the probability of spills occurring in the first place. The analysis of incident rates, as presented in Sections 2, 3, and 4 provides the approximation of incident rates (number of incidents per year that may result in spillage). Each of these incidents has a probability of resulting in actual spillage, and given that spillage occurs, the volume will tend to be distributed as described in Sections 6.1 and 6.2. The vast majority of spills will be relatively small.

The probability of a WCD of the magnitude shown Table 69 varies by source type and the specific conditions in each region. The calculation of these probabilities is beyond the scope of this study. However, a general conclusion on the probabilities of WCDs, as defined in this study, should take into consideration that there has never been a WCD from an oil tanker in US waters, though this type of event has happened several times internationally.[108]

[106] Etkin (2003); Wells, et al. (2007).
[107] Adapted from Wells, et al. (2007).
[108] Etkin 2009; Etkin 2001.

With respect to offshore exploration and production wells, it is more difficult to determine. By most standards, the Macondo MC-252 blowout would be considered a WCD in that it spilled about 4.2 million bbl of oil over the course of 86 days. Theoretically, in US waters, a larger WCD is possible with higher flow rates and longer durations.

The probability of a well blowout depends on the type of well, reservoir characteristics, and many other factors. But, overall, the probability of a well blowout is about 0.00031 per well, based on international data.[109] Of these blowouts, the majority (84%) bridge naturally after 0.5 to 5 days, [110] and the rest continue to flow until effective capping or relief well intervention. The volume of spillage would depend on the flow rate, which varies widely, and the duration of flow.

6.3 Incident Scenarios

Based on the analyses of historical incident data for 1995 – 2012, the most common incident scenarios[111] are as summarized in Table 68. These incident types account for 68% of all incidents that occurred during this time period. The average spill volume for these common scenarios is less than 7 bbl. The weighted average of the scenarios (i.e., the spill volume averaged in proportion to occurrence) in Table 71 is 1.6 bbl. From the comparison between average, actual maximum, AMPD, MMPD, and WCD volumes, it can be seen that the AMPD generally reflects the most likely spill event.

Table 71: Most Likely Incident Scenarios

Type	Region	Annual Rate	% Total[112]	Volume (bbl)[113]				
				Avg.	Max	AMPD[114]	MMPD[115]	WCD[116]
Oil Exp/Prod Facility[117]	**Beaufort**	81.000	13.27%	1.3	262	50	1,200	3.9 mil
Rec. Vessel <400GT[118]	**Southeast**	71.389	11.70%	0.3	24	0.1	1	10
Fishing Vessel <400GT	**Southeast**	49.944	8.18%	1.8	119	2	20	200
Fishing Vessel <400GT	**Aleutian**	42.389	6.95%	6.7	95	2	20	200
Oil Exp/Prod Facility	**Cook Inlet**	28.389	4.65%	2.1	214	50	1,200	39,000
Fishing Vessel <400GT	**Kodiak**	24.333	3.99%	0.4	7	2	20	200
Fishing Vessel >400GT	**Aleutian**	14.611	2.39%	0.1	0.5	5	50	500
Recreat. Vessel <400GT	**PWS**	11.278	1.85%	0.5	16	0.1	1	10
Fishing Vessel <400GT	**Cook Inlet**	11.056	1.81%	0.4	7.1	2	20	200
Recreat. Vessel <400GT	**Aleutian**	10.778	1.77%	0.6	14	0.1	1	10
Ferry >400GT	**Southeast**	10.722	1.76%	2.1	71	25	250	2,500
Small Boat Harbor	**Southeast**	10.722	1.76%	0.3	12	10	100	1,000
Passenger Ship <400GT	**Southeast**	10.667	1.75%	0.4	7	0.5	5	50

[109] Scandpower 2006; OGP 2010; Holand 2013.
[110] Natural bridging occurs when sediment naturally fills the well pipe or riser to such an extent that flow ceases. International analyses indicate that this occurs in 84% of well blowouts within 0.5 to 5 days (Holand 2013).
[111] A "scenario" in this case is an incident event that involves the particular combination of source type and region (e.g., a fishing vessel in the Southeast Alaska region.
[112] Percent of all incidents for all regions.
[113] Average spill volume for recorded incidents (excluding potential spills with no spillage); maximum reported spill volume in 1995 – 2012 time period; MMPD for that source type; WCD for that source type.
[114] AMPD = average most-probable discharge
[115] MMPD = maximum most-probable discharge
[116] WCD = worst-case discharge
[117] Includes all parts of the oil exploration and production facilities (wells, storage tanks, facility operations).
[118] GT = gross tonnage

Table 71: Most Likely Incident Scenarios								
Type	**Region**	**Annual Rate**	**% Total[112]**	**Volume (bbl)[113]**				
				Avg.	**Max**	**AMPD[114]**	**MMPD[115]**	**WCD[116]**
Refinery	**Cook Inlet**	10.056	1.65%	3.4	124	50	1,200	200,000
Recreat. Vessel <400GT	**Kodiak**	9.611	1.57%	0.3	10	0.1	1	10
Cruise Ship >400GT	**Southeast**	9.222	1.51%	0.1	5	50	2,500	11,000
Fishing Vessel <400GT	**PWS**	9.167	1.50%	3.2	83	2	20	200

6.4 Oil Types

The most likely scenario with regard to *oil type* is one involving a light oil, principally diesel fuel. As shown in Figure 9, 87% of all incidents involve light oils. For regions with oil exploration and production activity or other handling of crude oil, there is a higher probability of crude oil spillage, though even in these regions, light oil spillage predominates. Areas that have cargo shipping have more exposure to heavy oil spills.

The potential WCD spill volumes for crude oil are much higher than for the other oil types, because the two largest sources – oil exploration and production facilities (wells) and crude oil tankers, have the largest capacities. The WCD for the largest crude oil tanker is 1.9 million barrels, and the estimated WCD for an oil well is 3.9 million gallons. These volumes are about seven times and 15 times the volume of the 1989 Exxon Valdez spill, respectively.

The relative incident rates by oil type and weight-averaged MMPD and actual WCD are shown in Table 72. The relative incident rates in descending order of frequency are shown in Table 73. The most frequent incident is one involving light oil (diesel) spilling from a recreational vessel in the Southeast region during the June – July time period.

Table 72: Relative Frequency of Incidents by Season, Oil Type, and Region													
Region	**Period**	**Volume (bbl)**											
		Crude			**Distillate**			**Heavy**			**Light**		
		Rel. Freq.	**WCD[119]**	**WA-MMPD[120]**	**Rel. Freq.**	**WCD**	**WA-MMPD**	**Rel. Freq.**	**WCD**	**WA-MMPD**	**Rel. Freq.**	**WCD**	**WA-MMPD**
Aleutians	**Dec-Jan**	0.0000	n/a	n/a	0.0027	523,000	250	0.0126	523,000	250	0.2547	523,000	250
	Feb-Mar	0.0000	n/a	n/a	0.0088	523,000	560	0.0113	523,000	560	0.4467	523,000	560
	Apr-May	0.0000	n/a	n/a	0.0063	523,000	560	0.0050	523,000	560	0.2809	523,000	560
	Jun-Jul	0.0000	n/a	n/a	0.0113	523,000	560	0.0088	523,000	560	0.3037	523,000	560
	Aug-Sep	0.0000	n/a	n/a	0.0063	523,000	560	0.0151	523,000	560	0.3713	523,000	560
	Oct-Nov	0.0000	n/a	n/a	0.0050	523,000	560	0.0099	523,000	560	0.2559	523,000	560
Aniakchak	**Dec-Jan**	0.0005	523,000	560	0.0007	523,000	560	0.0009	523,000	560	0.0025	523,000	560
	Feb-Mar	0.0005	523,000	150	0.0007	523,000	150	0.0009	523,000	150	0.0176	523,000	150
	Apr-May	0.0005	523,000	150	0.0007	523,000	150	0.0009	523,000	150	0.0088	523,000	150
	Jun-Jul	0.0005	523,000	150	0.0007	523,000	150	0.0009	523,000	150	0.0138	523,000	150
	Aug-Sep	0.0005	523,000	150	0.0007	523,000	150	0.0009	523,000	150	0.0138	523,000	150
	Oct-Nov	0.0005	523,000	150	0.0007	523,000	150	0.0009	523,000	150	0.0063	523,000	150
Beaufort Sea	**Dec-Jan**	0.0413	3,9 mil	1,200	0.0000	523,000	1,200	0.0000	523,000	1,200	0.2410	523,000	1,200
	Feb-Mar	0.0741	1.9 mil	830	0.0000	523,000	830	0.0000	1.9 mil	830	0.3049	1.9 mil	830
	Apr-May	0.0840	1.9 mil	830	0.0014	523,000	830	0.0016	1.9 mil	830	0.2710	1.9 mil	830
	Jun-Jul	0.1041	1.9 mil	830	0.0014	523,000	830	0.0016	1.9 mil	830	0.2234	1.9 mil	830
	Aug-Sep	0.0653	1.9 mil	830	0.0014	523,000	830	0.0016	1.9 mil	830	0.2107	1.9 mil	830
	Oct-Nov	0.0540	1.9 mil	830	0.0014	523,000	830	0.0016	1.9 mil	830	0.1743	1.9 mil	830
Bristol Bay	**Dec-Jan**	0.0000	n/a	n/a	0.0000	163,000	420	0.0009	163,000	420	0.0063	163,000	420
	Feb-Mar	0.0000	n/a	n/a	0.0000	523,000	150	0.0009	1.9 mil	150	0.0126	1.9 mil	150
	Apr-May	0.0000	n/a	n/a	0.0099	523,000	150	0.0014	1.9 mil	150	0.0465	1.9 mil	150
	Jun-Jul	0.0000	n/a	n/a	0.0077	523,000	150	0.0063	1.9 mil	150	0.1457	1.9 mil	150
	Aug-Sep	0.0000	n/a	n/a	0.0038	523,000	150	0.0025	1.9 mil	150	0.0276	1.9 mil	150
	Oct-Nov	0.0000	n/a	n/a	0.0027	523,000	150	0.0009	1.9 mil	150	0.0088	1.9 mil	150
Cook Inlet	**Dec-Jan**	0.0300	1.9 mil	830	0.0088	523,000	830	0.0063	1.9 mil	830	0.1531	1.9 mil	830
	Feb-Mar	0.0388	1.9 mil	670	0.0113	523,000	670	0.0063	1.9 mil	670	0.1719	1.9 mil	670
	Apr-May	0.0650	1.9 mil	670	0.0251	523,000	670	0.0088	1.9 mil	670	0.2234	1.9 mil	670
	Jun-Jul	0.0477	1.9 mil	670	0.0163	523,000	670	0.0113	1.9 mil	670	0.2886	1.9 mil	670
	Aug-Sep	0.0664	1.9 mil	670	0.0187	523,000	670	0.0151	1.9 mil	670	0.2572	1.9 mil	670

[119] WCD = worst-case discharge
[120] WA-MMPD = weight-averaged maximum most-probable discharge

Table 72: Relative Frequency of Incidents by Season, Oil Type, and Region													
Region	**Period**	**Volume (bbl)**											
		Crude			**Distillate**			**Heavy**			**Light**		
		Rel. Freq.	**WCD[119]**	**WA-MMPD[120]**	**Rel. Freq.**	**WCD**	**WA-MMPD**	**Rel. Freq.**	**WCD**	**WA-MMPD**	**Rel. Freq.**	**WCD**	**WA-MMPD**
	Oct-Nov	0.0300	1.9 mil	670	0.0088	523,000	670	0.0088	1.9 mil	670	0.1594	1.9 mil	670
Kotzebue Sound/ Hope Basin	**Dec-Jan**	0.0000	n/a	n/a	0.0000	163,000	790	0.0000	163,000	790	0.0025	163,000	790
	Feb-Mar	0.0000	n/a	n/a	0.0000	523,000	520	0.0000	1.9 mil	520	0.0063	1.9 mil	520
	Apr-May	0.0000	n/a	n/a	0.0014	523,000	520	0.0007	1.9 mil	520	0.0038	1.9 mil	520
	Jun-Jul	0.0000	n/a	n/a	0.0027	523,000	520	0.0007	1.9 mil	520	0.0163	1.9 mil	520
	Aug-Sep	0.0000	n/a	n/a	0.0025	523,000	520	0.0007	1.9 mil	520	0.0075	1.9 mil	520
	Oct-Nov	0.0000	n/a	n/a	0.0014	523,000	520	0.0007	1.9 mil	520	0.0099	1.9 mil	520
Kodiak/ Shelikof Strait	**Dec-Jan**	0.0011	1.9 mil	150	0.0075	523,000	150	0.0038	1.9 mil	150	0.1581	1.9 mil	150
	Feb-Mar	0.0011	1.9 mil	230	0.0025	523,000	230	0.0025	1.9 mil	230	0.1682	1.9 mil	230
	Apr-May	0.0011	1.9 mil	230	0.0088	523,000	230	0.0038	1.9 mil	230	0.1644	1.9 mil	230
	Jun-Jul	0.0011	1.9 mil	230	0.0063	523,000	230	0.0014	1.9 mil	230	0.2071	1.9 mil	230
	Aug-Sep	0.0011	1.9 mil	230	0.0025	523,000	230	0.0038	1.9 mil	230	0.1556	1.9 mil	230
	Oct-Nov	0.0011	1.9 mil	230	0.0052	523,000	230	0.0063	1.9 mil	230	0.1355	1.9 mil	230
Chukchi Sea	**Dec-Jan**	0.0002	2.2 mil	560	0.0016	50,000	560	0.0000	30,000	560	0.0050	50,000	560
	Feb-Mar	0.0002	2.2 mil	1,200	0.0016	523,000	1,200	0.0000	523,000	1,200	0.0025	523,000	1,200
	Apr-May	0.0002	2.2 mil	1,200	0.0016	523,000	1,200	0.0005	523,000	1,200	0.0025	523,000	1,200
	Jun-Jul	0.0002	2.2 mil	1,200	0.0016	523,000	1,200	0.0005	523,000	1,200	0.0025	523,000	1,200
	Aug-Sep	0.0002	2.2 mil	1,200	0.0016	523,000	1,200	0.0005	523,000	1,200	0.0138	523,000	1,200
	Oct-Nov	0.0002	2.2 mil	1,200	0.0016	523,000	1,200	0.0005	523,000	1,200	0.0014	523,000	1,200
Norton Sound/ St. Lawrence Island	**Dec-Jan**	0.0000	n/a	n/a	0.0027	163,000	650	0.0000	163,000	650	0.0063	163,000	650
	Feb-Mar	0.0000	n/a	n/a	0.0025	50,000	560	0.0000	30,000	560	0.0088	50,000	560
	Apr-May	0.0000	n/a	n/a	0.0014	50,000	560	0.0009	30,000	560	0.0075	50,000	560
	Jun-Jul	0.0000	n/a	n/a	0.0041	50,000	560	0.0011	30,000	560	0.0339	50,000	560
	Aug-Sep	0.0000	n/a	n/a	0.0038	50,000	560	0.0009	30,000	560	0.0239	50,000	560
	Oct-Nov	0.0000	n/a	n/a	0.0014	50,000	560	0.0009	30,000	560	0.0163	50,000	560
Off Kenai Peninsula	**Dec-Jan**	0.0002	523,000	150	0.0025	523,000	150	0.0025	523,000	150	0.0289	523,000	150
	Feb-Mar	0.0002	523,000	150	0.0025	523,000	250	0.0025	523,000	250	0.0477	523,000	250
	Apr-May	0.0002	523,000	150	0.0038	523,000	250	0.0007	523,000	250	0.0589	523,000	250
	Jun-Jul	0.0002	523,000	150	0.0025	523,000	250	0.0007	523,000	250	0.0678	523,000	250
	Aug-Sep	0.0002	523,000	150	0.0075	523,000	250	0.0007	523,000	250	0.0501	523,000	250
	Oct-Nov	0.0002	523,000	150	0.0014	523,000	250	0.0007	523,000	250	0.0377	523,000	250
South-Central	**Dec-Jan**	0.0025	1.9 mil	670	0.0000	523,000	670	0.0011	1.9 mil	670	0.0088	1.9 mil	670

Table 72: Relative Frequency of Incidents by Season, Oil Type, and Region

Region	Period	Volume (bbl)											
		Crude			Distillate			Heavy			Light		
		Rel. Freq.	WCD[119]	WA-MMPD[120]	Rel. Freq.	WCD	WA-MMPD	Rel. Freq.	WCD	WA-MMPD	Rel. Freq.	WCD	WA-MMPD
Alaska	**Feb-Mar**	0.0025	1.9 mil	420	0.0000	163,000	420	0.0025	163,000	420	0.0187	163,000	420
	Apr-May	0.0011	1.9 mil	420	0.0050	163,000	420	0.0025	163,000	420	0.0251	163,000	420
	Jun-Jul	0.0009	1.9 mil	420	0.0025	163,000	420	0.0009	163,000	420	0.0176	163,000	420
	Aug-Sep	0.0009	1.9 mil	420	0.0025	163,000	420	0.0009	163,000	420	0.0212	163,000	420
	Oct-Nov	0.0011	1.9 mil	420	0.0000	163,000	420	0.0011	163,000	420	0.0099	163,000	420
Prince William Sound	**Dec-Jan**	0.0187	1.9 mil	520	0.0088	523,000	520	0.0014	1.9 mil	520	0.1280	1.9 mil	520
	Feb-Mar	0.0138	1.9 mil	520	0.0088	163,000	790	0.0014	163,000	790	0.1405	163,000	790
	Apr-May	0.0113	1.9 mil	520	0.0176	163,000	790	0.0014	163,000	790	0.1707	163,000	790
	Jun-Jul	0.0151	1.9 mil	520	0.0190	163,000	790	0.0063	163,000	790	0.2748	163,000	790
	Aug-Sep	0.0063	1.9 mil	520	0.0063	163,000	790	0.0014	163,000	790	0.1920	163,000	790
	Oct-Nov	0.0126	1.9 mil	520	0.0165	163,000	790	0.0038	163,000	790	0.1129	163,000	790
Southeast Alaska	**Dec-Jan**	0.0007	1.9 mil	230	0.0477	523,000	230	0.0088	1.9 mil	230	0.4555	1.9 mil	230
	Feb-Mar	0.0007	1.9 mil	230	0.0364	163,000	650	0.0075	163,000	650	0.6224	163,000	650
	Apr-May	0.0007	1.9 mil	230	0.0388	163,000	650	0.0075	163,000	650	0.5836	163,000	650
	Jun-Jul	0.0007	1.9 mil	230	0.0840	163,000	650	0.0113	163,000	650	1.0000	163,000	650
	Aug-Sep	0.0007	1.9 mil	230	0.0815	163,000	650	0.0151	163,000	650	0.8796	163,000	650
	Oct-Nov	0.0007	1.9 mil	230	0.0639	163,000	650	0.0176	163,000	650	0.5910	163,000	650
Western Alaska	**Dec-Jan**	0.0000	n/a	n/a	0.0050	163,000	510	0.0000	163,000	510	0.0289	163,000	510
	Feb-Mar	0.0000	n/a	n/a	0.0025	163,000	510	0.0000	163,000	510	0.0377	163,000	510
	Apr-May	0.0000	n/a	n/a	0.0052	163,000	510	0.0016	163,000	510	0.0653	163,000	510
	Jun-Jul	0.0000	n/a	n/a	0.0163	163,000	510	0.0016	163,000	510	0.0903	163,000	510
	Aug-Sep	0.0000	n/a	n/a	0.0113	163,000	510	0.0016	163,000	510	0.0991	163,000	510
	Oct-Nov	0.0000	n/a	n/a	0.0113	163,000	510	0.0016	163,000	510	0.0388	163,000	510

Table 73: Relative Frequencies of Spill Incidents by Region, Oil Type, and Period							
Region	**Period**	**Oil Type**	**Relative Frequency**	**Annual Frequency**	**Return Years**	**WCD[121] (bbl)**	**WA-MMPD[122] (bbl)**
Southeast Alaska	**Jun-Jul**	**Light**	1.0000	44.28	0.02	163,000	650
Southeast Alaska	**Aug-Sep**	**Light**	0.8796	38.95	0.03	163,000	650
Southeast Alaska	**Feb-Mar**	**Light**	0.6224	27.56	0.04	163,000	650
Southeast Alaska	**Oct-Nov**	**Light**	0.5910	26.17	0.04	163,000	650
Southeast Alaska	**Apr-May**	**Light**	0.5836	25.84	0.04	163,000	650
Southeast Alaska	**Dec-Jan**	**Light**	0.4555	20.17	0.05	1,900,000	230
Aleutians	**Feb-Mar**	**Light**	0.4467	19.78	0.05	523,000	560
Aleutians	**Aug-Sep**	**Light**	0.3713	16.44	0.06	523,000	560
Beaufort	**Feb-Mar**	**Light**	0.3049	13.50	0.07	1,900,000	830
Aleutians	**Jun-Jul**	**Light**	0.3037	13.45	0.07	523,000	560
Cook Inlet	**Jun-Jul**	**Light**	0.2886	12.78	0.08	1,900,000	670
Aleutians	**Apr-May**	**Light**	0.2809	12.44	0.08	523,000	560
Prince William Sound	**Jun-Jul**	**Light**	0.2748	12.17	0.08	163,000	790
Beaufort	**Apr-May**	**Light**	0.2710	12.00	0.08	1,900,000	830
Cook Inlet	**Aug-Sep**	**Light**	0.2572	11.39	0.09	1,900,000	670
Aleutians	**Oct-Nov**	**Light**	0.2559	11.33	0.09	523,000	560
Aleutians	**Dec-Jan**	**Light**	0.2547	11.28	0.09	523,000	250
Beaufort	**Dec-Jan**	**Light**	0.2410	10.67	0.09	523,000	1,200
Beaufort	**Jun-Jul**	**Light**	0.2234	9.89	0.10	1,900,000	830
Cook Inlet	**Apr-May**	**Light**	0.2234	9.89	0.10	1,900,000	670
Beaufort	**Aug-Sep**	**Light**	0.2107	9.33	0.11	1,900,000	830
Kodiak	**Jun-Jul**	**Light**	0.2071	9.17	0.11	1,900,000	230
Prince William Sound	**Aug-Sep**	**Light**	0.1920	8.50	0.12	163,000	790
Beaufort	**Oct-Nov**	**Light**	0.1743	7.72	0.13	1,900,000	830
Cook Inlet	**Feb-Mar**	**Light**	0.1719	7.61	0.13	1,900,000	670
Prince William Sound	**Apr-May**	**Light**	0.1707	7.56	0.13	163,000	790
Kodiak	**Feb-Mar**	**Light**	0.1682	7.45	0.13	1,900,000	230
Kodiak	**Apr-May**	**Light**	0.1644	7.28	0.14	1,900,000	230
Cook Inlet	**Oct-Nov**	**Light**	0.1594	7.06	0.14	1,900,000	670
Kodiak	**Dec-Jan**	**Light**	0.1581	7.00	0.14	1,900,000	150
Kodiak	**Aug-Sep**	**Light**	0.1556	6.89	0.15	1,900,000	230
Cook Inlet	**Dec-Jan**	**Light**	0.1531	6.78	0.15	1,900,000	830
Bristol Bay	**Jun-Jul**	**Light**	0.1457	6.45	0.16	1,900,000	150
Prince William Sound	**Feb-Mar**	**Light**	0.1405	6.22	0.16	163,000	790
Kodiak	**Oct-Nov**	**Light**	0.1355	6.00	0.17	1,900,000	230
Prince William Sound	**Dec-Jan**	**Light**	0.1280	5.67	0.18	1,900,000	520
Prince William Sound	**Oct-Nov**	**Light**	0.1129	5.00	0.20	163,000	790
Beaufort	**Jun-Jul**	**Crude**	0.1041	4.61	0.22	1,900,000	830
Western	**Aug-Sep**	**Light**	0.0991	4.39	0.23	163,000	510
Western	**Jun-Jul**	**Light**	0.0903	4.00	0.25	163,000	510
Beaufort	**Apr-May**	**Crude**	0.0840	3.72	0.27	1,900,000	830
Southeast Alaska	**Jun-Jul**	**Distillate**	0.0840	3.72	0.27	163,000	650
Southeast Alaska	**Aug-Sep**	**Distillate**	0.0815	3.61	0.28	163,000	650
Beaufort	**Feb-Mar**	**Crude**	0.0741	3.28	0.30	1,900,000	830
Off Kenai	**Jun-Jul**	**Light**	0.0678	3.00	0.33	523,000	250

[121] WCD = worst-case discharge
[122] WA-MMPD = weight-averaged maximum most-probable discharge

Table 73: Relative Frequencies of Spill Incidents by Region, Oil Type, and Period							
Region	**Period**	**Oil Type**	**Relative Frequency**	**Annual Frequency**	**Return Years**	**WCD[121] (bbl)**	**WA-MMPD[122] (bbl)**
Cook Inlet	**Aug-Sep**	**Crude**	0.0664	2.94	0.34	1,900,000	670
Beaufort	**Aug-Sep**	**Crude**	0.0653	2.89	0.35	1,900,000	830
Western	**Apr-May**	**Light**	0.0653	2.89	0.35	163,000	510
Cook Inlet	**Apr-May**	**Crude**	0.0650	2.88	0.35	1,900,000	670
Southeast Alaska	**Oct-Nov**	**Distillate**	0.0639	2.83	0.35	163,000	650
Off Kenai	**Apr-May**	**Light**	0.0589	2.61	0.38	523,000	250
Beaufort	**Oct-Nov**	**Crude**	0.0540	2.39	0.42	1,900,000	830
Off Kenai	**Aug-Sep**	**Light**	0.0501	2.22	0.45	523,000	250
Cook Inlet	**Jun-Jul**	**Crude**	0.0477	2.11	0.47	1,900,000	670
Southeast Alaska	**Dec-Jan**	**Distillate**	0.0477	2.11	0.47	523,000	230
Off Kenai	**Feb-Mar**	**Light**	0.0477	2.11	0.47	523,000	250
Bristol Bay	**Apr-May**	**Light**	0.0465	2.06	0.49	1,900,000	150
Beaufort	**Dec-Jan**	**Crude**	0.0413	1.83	0.55	3,900,000	1,200
Cook Inlet	**Feb-Mar**	**Crude**	0.0388	1.72	0.58	1,900,000	670
Southeast Alaska	**Apr-May**	**Distillate**	0.0388	1.72	0.58	163,000	650
Western	**Oct-Nov**	**Light**	0.0388	1.72	0.58	163,000	510
Off Kenai	**Oct-Nov**	**Light**	0.0377	1.67	0.60	523,000	250
Western	**Feb-Mar**	**Light**	0.0377	1.67	0.60	163,000	510
Southeast Alaska	**Feb-Mar**	**Distillate**	0.0364	1.61	0.62	163,000	650
Norton/St. Lawrence	**Jun-Jul**	**Light**	0.0339	1.50	0.67	50,000	560
Cook Inlet	**Dec-Jan**	**Crude**	0.0300	1.33	0.75	1,900,000	830
Cook Inlet	**Oct-Nov**	**Crude**	0.0300	1.33	0.75	1,900,000	670
Off Kenai	**Dec-Jan**	**Light**	0.0289	1.28	0.78	523,000	150
Western	**Dec-Jan**	**Light**	0.0289	1.28	0.78	163,000	510
Bristol Bay	**Aug-Sep**	**Light**	0.0276	1.22	0.82	1,900,000	150
Cook Inlet	**Apr-May**	**Distillate**	0.0251	1.11	0.90	523,000	670
South-Central	**Apr-May**	**Light**	0.0251	1.11	0.90	163,000	420
Norton/St. Lawrence	**Aug-Sep**	**Light**	0.0239	1.06	0.94	50,000	560
South-Central	**Aug-Sep**	**Light**	0.0212	0.94	1.07	163,000	420
Prince William Sound	**Jun-Jul**	**Distillate**	0.0190	0.84	1.19	163,000	790
Prince William Sound	**Dec-Jan**	**Crude**	0.0187	0.83	1.21	1,900,000	520
Cook Inlet	**Aug-Sep**	**Distillate**	0.0187	0.83	1.21	523,000	670
South-Central	**Feb-Mar**	**Light**	0.0187	0.83	1.21	163,000	420
Prince William Sound	**Apr-May**	**Distillate**	0.0176	0.78	1.28	163,000	790
Southeast Alaska	**Oct-Nov**	**Heavy**	0.0176	0.78	1.28	163,000	650
Aniakchak	**Feb-Mar**	**Light**	0.0176	0.78	1.28	523,000	150
South-Central	**Jun-Jul**	**Light**	0.0176	0.78	1.28	163,000	420
Prince William Sound	**Oct-Nov**	**Distillate**	0.0165	0.73	1.37	163,000	790
Cook Inlet	**Jun-Jul**	**Distillate**	0.0163	0.72	1.39	523,000	670
Western	**Jun-Jul**	**Distillate**	0.0163	0.72	1.39	163,000	510
Kotzebue/Hope	**Jun-Jul**	**Light**	0.0163	0.72	1.39	1,900,000	520
Norton/St. Lawrence	**Oct-Nov**	**Light**	0.0163	0.72	1.39	50,000	560
Prince William Sound	**Jun-Jul**	**Crude**	0.0151	0.67	1.50	1,900,000	520
Aleutians	**Aug-Sep**	**Heavy**	0.0151	0.67	1.50	523,000	560
Cook Inlet	**Aug-Sep**	**Heavy**	0.0151	0.67	1.50	1,900,000	670
Southeast Alaska	**Aug-Sep**	**Heavy**	0.0151	0.67	1.50	163,000	650
Prince William Sound	**Feb-Mar**	**Crude**	0.0138	0.61	1.64	1,900,000	520
Aniakchak	**Jun-Jul**	**Light**	0.0138	0.61	1.64	523,000	150

Table 73: Relative Frequencies of Spill Incidents by Region, Oil Type, and Period							
Region	**Period**	**Oil Type**	**Relative Frequency**	**Annual Frequency**	**Return Years**	**WCD[121] (bbl)**	**WA-MMPD[122] (bbl)**
Aniakchak	**Aug-Sep**	**Light**	0.0138	0.61	1.64	523,000	150
Chukchi	**Aug-Sep**	**Light**	0.0138	0.61	1.64	523,000	1,200
Prince William Sound	**Oct-Nov**	**Crude**	0.0126	0.56	1.79	1,900,000	520
Aleutians	**Dec-Jan**	**Heavy**	0.0126	0.56	1.79	523,000	250
Bristol Bay	**Feb-Mar**	**Light**	0.0126	0.56	1.79	1,900,000	150
Prince William Sound	**Apr-May**	**Crude**	0.0113	0.50	2.00	1,900,000	520
Aleutians	**Jun-Jul**	**Distillate**	0.0113	0.50	2.00	523,000	560
Cook Inlet	**Feb-Mar**	**Distillate**	0.0113	0.50	2.00	523,000	670
Western	**Aug-Sep**	**Distillate**	0.0113	0.50	2.00	163,000	510
Western	**Oct-Nov**	**Distillate**	0.0113	0.50	2.00	163,000	510
Aleutians	**Feb-Mar**	**Heavy**	0.0113	0.50	2.00	523,000	560
Cook Inlet	**Jun-Jul**	**Heavy**	0.0113	0.50	2.00	1,900,000	670
Southeast Alaska	**Jun-Jul**	**Heavy**	0.0113	0.50	2.00	163,000	650
Bristol Bay	**Apr-May**	**Distillate**	0.0099	0.44	2.28	523,000	150
Aleutians	**Oct-Nov**	**Heavy**	0.0099	0.44	2.28	523,000	560
Kotzebue/Hope	**Oct-Nov**	**Light**	0.0099	0.44	2.28	1,900,000	520
South-Central	**Oct-Nov**	**Light**	0.0099	0.44	2.28	163,000	420
Aleutians	**Feb-Mar**	**Distillate**	0.0088	0.39	2.57	523,000	560
Cook Inlet	**Dec-Jan**	**Distillate**	0.0088	0.39	2.57	523,000	830
Cook Inlet	**Oct-Nov**	**Distillate**	0.0088	0.39	2.57	523,000	670
Kodiak	**Apr-May**	**Distillate**	0.0088	0.39	2.57	523,000	230
Prince William Sound	**Dec-Jan**	**Distillate**	0.0088	0.39	2.57	523,000	520
Prince William Sound	**Feb-Mar**	**Distillate**	0.0088	0.39	2.57	163,000	790
Aleutians	**Jun-Jul**	**Heavy**	0.0088	0.39	2.57	523,000	560
Cook Inlet	**Apr-May**	**Heavy**	0.0088	0.39	2.57	1,900,000	670
Cook Inlet	**Oct-Nov**	**Heavy**	0.0088	0.39	2.57	1,900,000	670
Southeast Alaska	**Dec-Jan**	**Heavy**	0.0088	0.39	2.57	1,900,000	230
Aniakchak	**Apr-May**	**Light**	0.0088	0.39	2.57	523,000	150
Bristol Bay	**Oct-Nov**	**Light**	0.0088	0.39	2.57	1,900,000	150
Norton/St. Lawrence	**Feb-Mar**	**Light**	0.0088	0.39	2.57	50,000	560
South-Central	**Dec-Jan**	**Light**	0.0088	0.39	2.57	1,900,000	670
Bristol Bay	**Jun-Jul**	**Distillate**	0.0077	0.34	2.93	523,000	150
Kodiak	**Dec-Jan**	**Distillate**	0.0075	0.33	3.01	523,000	150
Off Kenai	**Aug-Sep**	**Distillate**	0.0075	0.33	3.01	523,000	250
Southeast Alaska	**Feb-Mar**	**Heavy**	0.0075	0.33	3.01	163,000	650
Southeast Alaska	**Apr-May**	**Heavy**	0.0075	0.33	3.01	163,000	650
Kotzebue/Hope	**Aug-Sep**	**Light**	0.0075	0.33	3.01	1,900,000	520
Norton/St. Lawrence	**Apr-May**	**Light**	0.0075	0.33	3.01	50,000	560
Prince William Sound	**Aug-Sep**	**Crude**	0.0063	0.28	3.58	1,900,000	520
Aleutians	**Apr-May**	**Distillate**	0.0063	0.28	3.58	523,000	560
Aleutians	**Aug-Sep**	**Distillate**	0.0063	0.28	3.58	523,000	560
Kodiak	**Jun-Jul**	**Distillate**	0.0063	0.28	3.58	523,000	230
Prince William Sound	**Aug-Sep**	**Distillate**	0.0063	0.28	3.58	163,000	790
Bristol Bay	**Jun-Jul**	**Heavy**	0.0063	0.28	3.58	1,900,000	150
Cook Inlet	**Dec-Jan**	**Heavy**	0.0063	0.28	3.58	1,900,000	830
Cook Inlet	**Feb-Mar**	**Heavy**	0.0063	0.28	3.58	1,900,000	670
Kodiak	**Oct-Nov**	**Heavy**	0.0063	0.28	3.58	1,900,000	230
Prince William Sound	**Jun-Jul**	**Heavy**	0.0063	0.28	3.58	163,000	790

Table 73: Relative Frequencies of Spill Incidents by Region, Oil Type, and Period							
Region	**Period**	**Oil Type**	**Relative Frequency**	**Annual Frequency**	**Return Years**	**WCD[121] (bbl)**	**WA-MMPD[122] (bbl)**
Aniakchak	**Oct-Nov**	**Light**	0.0063	0.28	3.58	523,000	150
Bristol Bay	**Dec-Jan**	**Light**	0.0063	0.28	3.58	163,000	420
Kotzebue/Hope	**Feb-Mar**	**Light**	0.0063	0.28	3.58	1,900,000	520
Norton/St. Lawrence	**Dec-Jan**	**Light**	0.0063	0.28	3.58	163,000	650
Kodiak	**Oct-Nov**	**Distillate**	0.0052	0.23	4.34	523,000	230
Western	**Apr-May**	**Distillate**	0.0052	0.23	4.34	163,000	510
Aleutians	**Oct-Nov**	**Distillate**	0.0050	0.22	4.52	523,000	560
South-Central	**Apr-May**	**Distillate**	0.0050	0.22	4.52	163,000	420
Western	**Dec-Jan**	**Distillate**	0.0050	0.22	4.52	163,000	510
Aleutians	**Apr-May**	**Heavy**	0.0050	0.22	4.52	523,000	560
Chukchi	**Dec-Jan**	**Light**	0.0050	0.22	4.52	50,000	560
Norton/St. Lawrence	**Jun-Jul**	**Distillate**	0.0041	0.18	5.51	50,000	560
Bristol Bay	**Aug-Sep**	**Distillate**	0.0038	0.17	5.94	523,000	150
Norton/St. Lawrence	**Aug-Sep**	**Distillate**	0.0038	0.17	5.94	50,000	560
Off Kenai	**Apr-May**	**Distillate**	0.0038	0.17	5.94	523,000	250
Kodiak	**Dec-Jan**	**Heavy**	0.0038	0.17	5.94	1,900,000	150
Kodiak	**Apr-May**	**Heavy**	0.0038	0.17	5.94	1,900,000	230
Kodiak	**Aug-Sep**	**Heavy**	0.0038	0.17	5.94	1,900,000	230
Prince William Sound	**Oct-Nov**	**Heavy**	0.0038	0.17	5.94	163,000	790
Kotzebue/Hope	**Apr-May**	**Light**	0.0038	0.17	5.94	1,900,000	520
Aleutians	**Dec-Jan**	**Distillate**	0.0027	0.12	8.36	523,000	250
Bristol Bay	**Oct-Nov**	**Distillate**	0.0027	0.12	8.36	523,000	150
Kotzebue/Hope	**Jun-Jul**	**Distillate**	0.0027	0.12	8.36	523,000	520
Norton/St. Lawrence	**Dec-Jan**	**Distillate**	0.0027	0.12	8.36	163,000	650
South-Central	**Dec-Jan**	**Crude**	0.0025	0.11	9.03	1,900,000	670
South-Central	**Feb-Mar**	**Crude**	0.0025	0.11	9.03	1,900,000	520
Kotzebue/Hope	**Aug-Sep**	**Distillate**	0.0025	0.11	9.03	523,000	520
Kodiak	**Feb-Mar**	**Distillate**	0.0025	0.11	9.03	523,000	230
Kodiak	**Aug-Sep**	**Distillate**	0.0025	0.11	9.03	523,000	230
Norton/St. Lawrence	**Feb-Mar**	**Distillate**	0.0025	0.11	9.03	50,000	560
Off Kenai	**Dec-Jan**	**Distillate**	0.0025	0.11	9.03	523,000	150
Off Kenai	**Feb-Mar**	**Distillate**	0.0025	0.11	9.03	523,000	250
Off Kenai	**Jun-Jul**	**Distillate**	0.0025	0.11	9.03	523,000	250
South-Central	**Jun-Jul**	**Distillate**	0.0025	0.11	9.03	163,000	420
South-Central	**Aug-Sep**	**Distillate**	0.0025	0.11	9.03	163,000	420
Western	**Feb-Mar**	**Distillate**	0.0025	0.11	9.03	163,000	510
Bristol Bay	**Aug-Sep**	**Heavy**	0.0025	0.11	9.03	1,900,000	150
Kodiak	**Feb-Mar**	**Heavy**	0.0025	0.11	9.03	1,900,000	230
Off Kenai	**Dec-Jan**	**Heavy**	0.0025	0.11	9.03	523,000	150
Off Kenai	**Feb-Mar**	**Heavy**	0.0025	0.11	9.03	523,000	250
South-Central	**Feb-Mar**	**Heavy**	0.0025	0.11	9.03	163,000	420
South-Central	**Apr-May**	**Heavy**	0.0025	0.11	9.03	163,000	420
Aniakchak	**Dec-Jan**	**Light**	0.0025	0.11	9.03	523,000	560
Kotzebue/Hope	**Dec-Jan**	**Light**	0.0025	0.11	9.03	163,000	790
Chukchi	**Feb-Mar**	**Light**	0.0025	0.11	9.03	523,000	1,200
Chukchi	**Apr-May**	**Light**	0.0025	0.11	9.03	523,000	1,200
Chukchi	**Jun-Jul**	**Light**	0.0025	0.11	9.03	523,000	1,200
Chukchi	**Dec-Jan**	**Distillate**	0.0016	0.07	14.12	50,000	560

Table 73: Relative Frequencies of Spill Incidents by Region, Oil Type, and Period							
Region	**Period**	**Oil Type**	**Relative Frequency**	**Annual Frequency**	**Return Years**	**WCD[121] (bbl)**	**WA-MMPD[122] (bbl)**
Chukchi	**Feb-Mar**	**Distillate**	0.0016	0.07	14.12	523,000	1,200
Chukchi	**Apr-May**	**Distillate**	0.0016	0.07	14.12	523,000	1,200
Chukchi	**Jun-Jul**	**Distillate**	0.0016	0.07	14.12	523,000	1,200
Chukchi	**Aug-Sep**	**Distillate**	0.0016	0.07	14.12	523,000	1,200
Chukchi	**Oct-Nov**	**Distillate**	0.0016	0.07	14.12	523,000	1,200
Beaufort	**Apr-May**	**Heavy**	0.0016	0.07	14.12	1,900,000	830
Beaufort	**Jun-Jul**	**Heavy**	0.0016	0.07	14.12	1,900,000	830
Beaufort	**Aug-Sep**	**Heavy**	0.0016	0.07	14.12	1,900,000	830
Beaufort	**Oct-Nov**	**Heavy**	0.0016	0.07	14.12	1,900,000	830
Western	**Apr-May**	**Heavy**	0.0016	0.07	14.12	163,000	510
Western	**Jun-Jul**	**Heavy**	0.0016	0.07	14.12	163,000	510
Western	**Aug-Sep**	**Heavy**	0.0016	0.07	14.12	163,000	510
Western	**Oct-Nov**	**Heavy**	0.0016	0.07	14.12	163,000	510
Beaufort	**Apr-May**	**Distillate**	0.0014	0.06	16.13	523,000	830
Beaufort	**Jun-Jul**	**Distillate**	0.0014	0.06	16.13	523,000	830
Beaufort	**Aug-Sep**	**Distillate**	0.0014	0.06	16.13	523,000	830
Beaufort	**Oct-Nov**	**Distillate**	0.0014	0.06	16.13	523,000	830
Kotzebue/Hope	**Apr-May**	**Distillate**	0.0014	0.06	16.13	523,000	520
Kotzebue/Hope	**Oct-Nov**	**Distillate**	0.0014	0.06	16.13	523,000	520
Norton/St. Lawrence	**Apr-May**	**Distillate**	0.0014	0.06	16.13	50,000	560
Norton/St. Lawrence	**Oct-Nov**	**Distillate**	0.0014	0.06	16.13	50,000	560
Off Kenai	**Oct-Nov**	**Distillate**	0.0014	0.06	16.13	523,000	250
Bristol Bay	**Apr-May**	**Heavy**	0.0014	0.06	16.13	1,900,000	150
Kodiak	**Jun-Jul**	**Heavy**	0.0014	0.06	16.13	1,900,000	230
Prince William Sound	**Dec-Jan**	**Heavy**	0.0014	0.06	16.13	1,900,000	520
Prince William Sound	**Feb-Mar**	**Heavy**	0.0014	0.06	16.13	163,000	790
Prince William Sound	**Apr-May**	**Heavy**	0.0014	0.06	16.13	163,000	790
Prince William Sound	**Aug-Sep**	**Heavy**	0.0014	0.06	16.13	163,000	790
Chukchi	**Oct-Nov**	**Light**	0.0014	0.06	16.13	523,000	1,200
Kodiak	**Dec-Jan**	**Crude**	0.0011	0.05	20.53	1,900,000	150
Kodiak	**Feb-Mar**	**Crude**	0.0011	0.05	20.53	1,900,000	230
Kodiak	**Apr-May**	**Crude**	0.0011	0.05	20.53	1,900,000	230
Kodiak	**Jun-Jul**	**Crude**	0.0011	0.05	20.53	1,900,000	230
Kodiak	**Aug-Sep**	**Crude**	0.0011	0.05	20.53	1,900,000	230
Kodiak	**Oct-Nov**	**Crude**	0.0011	0.05	20.53	1,900,000	230
South-Central	**Apr-May**	**Crude**	0.0011	0.05	20.53	1,900,000	420
South-Central	**Oct-Nov**	**Crude**	0.0011	0.05	20.53	1,900,000	420
Norton/St. Lawrence	**Jun-Jul**	**Heavy**	0.0011	0.05	20.53	30,000	560
South-Central	**Dec-Jan**	**Heavy**	0.0011	0.05	20.53	1,900,000	670
South-Central	**Oct-Nov**	**Heavy**	0.0011	0.05	20.53	163,000	420
South-Central	**Jun-Jul**	**Crude**	0.0009	0.04	25.09	1,900,000	420
South-Central	**Aug-Sep**	**Crude**	0.0009	0.04	25.09	1,900,000	420
Aniakchak	**Dec-Jan**	**Heavy**	0.0009	0.04	25.09	523,000	560
Aniakchak	**Feb-Mar**	**Heavy**	0.0009	0.04	25.09	523,000	150
Aniakchak	**Apr-May**	**Heavy**	0.0009	0.04	25.09	523,000	150
Aniakchak	**Jun-Jul**	**Heavy**	0.0009	0.04	25.09	523,000	150
Aniakchak	**Aug-Sep**	**Heavy**	0.0009	0.04	25.09	523,000	150
Aniakchak	**Oct-Nov**	**Heavy**	0.0009	0.04	25.09	523,000	150

Table 73: Relative Frequencies of Spill Incidents by Region, Oil Type, and Period							
Region	**Period**	**Oil Type**	**Relative Frequency**	**Annual Frequency**	**Return Years**	**WCD[121] (bbl)**	**WA-MMPD[122] (bbl)**
Bristol Bay	**Dec-Jan**	**Heavy**	0.0009	0.04	25.09	163,000	420
Bristol Bay	**Feb-Mar**	**Heavy**	0.0009	0.04	25.09	1,900,000	150
Bristol Bay	**Oct-Nov**	**Heavy**	0.0009	0.04	25.09	1,900,000	150
Norton/St. Lawrence	**Apr-May**	**Heavy**	0.0009	0.04	25.09	30,000	560
Norton/St. Lawrence	**Aug-Sep**	**Heavy**	0.0009	0.04	25.09	30,000	560
Norton/St. Lawrence	**Oct-Nov**	**Heavy**	0.0009	0.04	25.09	30,000	560
South-Central	**Jun-Jul**	**Heavy**	0.0009	0.04	25.09	163,000	420
South-Central	**Aug-Sep**	**Heavy**	0.0009	0.04	25.09	163,000	420
Southeast Alaska	**Dec-Jan**	**Crude**	0.0007	0.03	32.26	1,900,000	230
Southeast Alaska	**Feb-Mar**	**Crude**	0.0007	0.03	32.26	1,900,000	230
Southeast Alaska	**Apr-May**	**Crude**	0.0007	0.03	32.26	1,900,000	230
Southeast Alaska	**Jun-Jul**	**Crude**	0.0007	0.03	32.26	1,900,000	230
Southeast Alaska	**Aug-Sep**	**Crude**	0.0007	0.03	32.26	1,900,000	230
Southeast Alaska	**Oct-Nov**	**Crude**	0.0007	0.03	32.26	1,900,000	230
Aniakchak	**Dec-Jan**	**Distillate**	0.0007	0.03	32.26	523,000	560
Aniakchak	**Feb-Mar**	**Distillate**	0.0007	0.03	32.26	523,000	150
Aniakchak	**Apr-May**	**Distillate**	0.0007	0.03	32.26	523,000	150
Aniakchak	**Jun-Jul**	**Distillate**	0.0007	0.03	32.26	523,000	150
Aniakchak	**Aug-Sep**	**Distillate**	0.0007	0.03	32.26	523,000	150
Aniakchak	**Oct-Nov**	**Distillate**	0.0007	0.03	32.26	523,000	150
Kotzebue/Hope	**Apr-May**	**Heavy**	0.0007	0.03	32.26	1,900,000	520
Kotzebue/Hope	**Jun-Jul**	**Heavy**	0.0007	0.03	32.26	1,900,000	520
Kotzebue/Hope	**Aug-Sep**	**Heavy**	0.0007	0.03	32.26	1,900,000	520
Kotzebue/Hope	**Oct-Nov**	**Heavy**	0.0007	0.03	32.26	1,900,000	520
Off Kenai	**Apr-May**	**Heavy**	0.0007	0.03	32.26	523,000	250
Off Kenai	**Jun-Jul**	**Heavy**	0.0007	0.03	32.26	523,000	250
Off Kenai	**Aug-Sep**	**Heavy**	0.0007	0.03	32.26	523,000	250
Off Kenai	**Oct-Nov**	**Heavy**	0.0007	0.03	32.26	523,000	250
Aniakchak	**Dec-Jan**	**Crude**	0.0005	0.02	45.17	523,000	560
Aniakchak	**Feb-Mar**	**Crude**	0.0005	0.02	45.17	523,000	150
Aniakchak	**Apr-May**	**Crude**	0.0005	0.02	45.17	523,000	150
Aniakchak	**Jun-Jul**	**Crude**	0.0005	0.02	45.17	523,000	150
Aniakchak	**Aug-Sep**	**Crude**	0.0005	0.02	45.17	523,000	150
Aniakchak	**Oct-Nov**	**Crude**	0.0005	0.02	45.17	523,000	150
Chukchi	**Apr-May**	**Heavy**	0.0005	0.02	45.17	523,000	1,200
Chukchi	**Jun-Jul**	**Heavy**	0.0005	0.02	45.17	523,000	1,200
Chukchi	**Aug-Sep**	**Heavy**	0.0005	0.02	45.17	523,000	1,200
Chukchi	**Oct-Nov**	**Heavy**	0.0005	0.02	45.17	523,000	1,200
Chukchi	**Dec-Jan**	**Crude**	0.0002	0.01	112.92	2,200,000	560
Chukchi	**Feb-Mar**	**Crude**	0.0002	0.01	112.92	2,200,000	1,200
Chukchi	**Apr-May**	**Crude**	0.0002	0.01	112.92	2,200,000	1,200
Chukchi	**Jun-Jul**	**Crude**	0.0002	0.01	112.92	2,200,000	1,200
Chukchi	**Aug-Sep**	**Crude**	0.0002	0.01	112.92	2,200,000	1,200
Chukchi	**Oct-Nov**	**Crude**	0.0002	0.01	112.92	2,200,000	1,200
Off Kenai	**Dec-Jan**	**Crude**	0.0002	0.01	112.92	523,000	150
Off Kenai	**Feb-Mar**	**Crude**	0.0002	0.01	112.92	523,000	150
Off Kenai	**Apr-May**	**Crude**	0.0002	0.01	112.92	523,000	150
Off Kenai	**Jun-Jul**	**Crude**	0.0002	0.01	112.92	523,000	150

Table 73: Relative Frequencies of Spill Incidents by Region, Oil Type, and Period							
Region	**Period**	**Oil Type**	**Relative Frequency**	**Annual Frequency**	**Return Years**	**WCD[121] (bbl)**	**WA-MMPD[122] (bbl)**
Off Kenai	**Aug-Sep**	**Crude**	0.0002	0.01	112.92	523,000	150
Off Kenai	**Oct-Nov**	**Crude**	0.0002	0.01	112.92	523,000	150

6.5 Source Types with Highest WCDs and Incident Rates

Across the entire state waters (i.e., all marine regions), the AMPD, MMPD, and WCD volumes by source types along with the actual recorded spill volumes are shown in Table 74. Table 75 shows the sources with the highest incident rates across all regions. Overall, the results show that the actual spill volumes during 1995 – 2012 were usually much smaller than the MMPD and WCD volumes. It is important to note also that not all incidents resulted in actual spillage.

Table 74: Source Types in Descending Order of WCD Volumes (All Regions)							
Source	**Annual Incident Number**	**Actual Spillage (bbl) (All Zones)**			**USCG Discharge Scenarios (bbl)**		
		% No Spill[123]	**Average[124]**	**Max.**	**AMPD[125]**	**MMPD[126]**	**WCD[127]**
Oil Exp/Prod (Beaufort)	81.556	1.0%	1.4	262	50	1,200	3,900,000
Oil Exp/Prod (Chukchi)	0.556	40.0%	9.2	39	50	1,200	2,200,000
Tanker >90,000DWT[128]	3.278	45.8%	0.3	5	50	2,500	1,900,000
Tanker <90,000DWT	4.056	42.5%	0.4	10	50	2,500	523,000
Petroleum Terminal	5.611	34.7%	1.6	90	50	1,200	200,000
Refinery	12.779	1.3%	4.2	200	50	1,200	200,000
Tank Barge >400GT[129]	7.389	29.3%	1.7	62	50	2,500	163,000
Tank Barge <400GT	3.611	50.8%	0.8	12	50	2,500	163,000
Airport	0.944	23.5%	165	2,009	50	1,200	50,000
Power Plant	7.000	4.0%	7.9	238	50	1,200	50,000
Pipeline Facility	0.278	40.0%	0.02	0.02	50	1,200	45,000
Oil Exp/Prod (Other)	28.500	17.9%	2.1	214	50	1,200	39,000
Fuel Terminal	9.000	11.1%	4.1	128	50	1,200	30,000
Bulk Carrier >400GT	1.222	72.7%	1,139	7,944[130]	50	2,500	12,000
Container Ship >400GT	1.889	88.2%	0.6	1	50	2,500	11,000
Cruise Ship >400GT	9.778	46.6%	0.3	19	50	2,500	11,000
Bulk Chemical Facility	1.167	9.5%	0.3	2	50	1,000	10,000
Military Facility	2.444	22.7%	26.4	619	50	1,000	10,000
Ship Terminal	0.500	22.2%	0.08	0.4	50	1,000	10,000

[123] Percent of incidents (across all zones) in the category that resulted in no spillage (i.e., only potential spill).
[124] Only includes incidents with actual spillage. For each category, there are incidents that involved no spillage.
[125] The "average most-probable discharge" (AMPD) is the lesser of 50 bbl or 1% WCD. This classification has been dropped from the USCG's Spill Classification Matrix as the response to such a small spill would generally be very localized. It is presented here as a comparison only.
[126] MMPD = maximum most-probable discharge
[127] WCD = worst-case discharge. The WCD in each category is determined by the typical size of the source type for the purpose of estimating WCD volumes across all regions. In some cases an actual spill event may have exceeded the WCD as estimated across all regions because the particular source (usually a vessel) was unusually large or had an unusually high volume of fuel on board.
[128] DWT = deadweight tonnage
[129] GT = gross tonnage
[130] Selendang Ayu incident.

Table 74: Source Types in Descending Order of WCD Volumes (All Regions)							
Source	**Annual Incident Number**	**Actual Spillage (bbl) (All Zones)**			**USCG Discharge Scenarios (bbl)**		
		% No Spill[123]	**Average [124]**	**Max.**	**AMPD [125]**	**MMPD [126]**	**WCD[127]**
General Cargo Ship >400GT	3.000	46.3%	37.5	929	50	2,500	8,000
Vehicle Carrier Ship >400GT	0.111	100%	0	0	50	2,500	6,000
Oil Recovery Vessel >400GT	0.833	26.7%	0.7	7	50	500	5,000
Passenger Ship >400GT	0.944	41.2%	0.2	2	40	400	4,000
Freight Barge >400GT	3.333	53.3%	0.7	7	30	300	3,000
Military Vessel <400GT	0.611	27.3%	2.6	24	30	300	3,000
Military Vessel >400GT	8.000	4.9%	0.5	18	30	300	3,000
Offshore Supply Vessel >400GT	0.056	42.9%	0.04	0.1	30	300	3,000
Ferry >400GT	14.222	82.0%	1.6	71	25	250	2,500
Fishing Vessel >400GT	22.611	50.9%	11.5	833	25	250	2,500
Barge Terminal	1.000	5.6%	2.2	24	10	100	1,000
Container Terminal	0.944	11.8%	0.7	3	10	100	1,000
Cruise Terminal	2.278	12.2%	0.03	0.4	10	100	1,000
Drydock Facility	0.222	25.0%	0.5	1	10	100	1,000
Ferry Terminal	1.000	5.6%	0.3	2	10	100	1,000
Industrial Vessel >400 GT	0.778	0%	1.0	5	10	100	1,000
Logging Facility	0.889	47.1%	0.2	1	10	100	1,000
Marine Services Facility	0.813	0%	1.8	14	10	100	1,000
Municipal Fuel Storage	7.333	4.5%	5.9	119	10	100	1,000
Offshore Supply Facility	0.667	0%	0.2	1	10	100	1,000
Seafood Facility	7.500	8.9%	16.8	1,637	10	100	1,000
Small Boat Harbor	16.111	10.0%	0.4	14	10	100	1,000
Research Vessel <400GT	1.389	52.0%	0.1	0.5	8	80	800
Industrial Vessel <400 GT	6.778	13.9%	1.8	143	5	50	500
Oil Recovery Vessel <400GT	1.333	20.8%	0.1	0.6	5	50	500
Towing Vessel >400GT	2.722	8.2%	0.6	7	5	50	500
Towing Vessel <400GT	13.222	42.9%	5.3	357	5	50	500
Fishing Vessel <400GT	154.167	40.4%	3.7	731	2	20	200
Freight Barge <400GT	2.000	44.4%	1.4	16	2	20	200
Construction Site	0.889	25.0%	1.0	6	1	10	100
Mining Facility	0.389	14.3%	0.4	1	1	10	100
MODU <400GT	0.111	50.0%	0.002	0.002	1	10	100
Offshore Supply Vessel <400GT	1.889	26.5%	6.2	143	1	10	100
Other Facility	1.889	26.5%	8.3	167	1	10	100
Unknown Land Source	5.611	36.6%	6.1	238	1	10	100
Ferry <400GT	1.222	86.4%	0.2	0.5	0.5	5	50
General Cargo Ship <400GT	1.389	24.0%	7.6	71	0.5	5	50
Passenger Ship <400GT	18.222	62.5%	0.6	12	0.5	5	50
Recreational Vessel <400GT	117.89	11.1%	0.5	143	0.1	1	10
Recreational Vessel >400GT	2.222	7.5%	1.1	18	0.1	1	10
Residential Facility	1.167	71.4%	1.3	4	0.1	1	10
Vehicle	0.556	50.0%	0.1	0.2	0.02	1	2

Table 75: Source Types in Descending Order of Incident Numbers (All Regions)							
Source	**Annual Incident Number**	**Actual Spillage (bbl) (All Zones)**			**USCG Discharge Scenarios (bbl)**		
		% No Spill[131]	**Average[132]**	**Max.**	**AMPD[133]**	**MMPD[134]**	**WCD[135]**
Fishing Vessel <400GT	154.167	40.40%	3.7	731	2	20	200
Recreational Vessel <400GT	117.890	11.10%	0.5	143	0.1	1	10
Oil Exp/Prod (Beaufort)	81.556	1.00%	1.4	262	50	1,200	3,900,000
Oil Exp/Prod Facility (Other)	28.500	17.90%	2.1	214	50	1,200	39,000
Fishing Vessel >400GT	22.611	50.90%	11.5	833	25	250	2,500
Passenger Ship <400GT	18.222	62.50%	0.6	12	0.5	5	50
Small Boat Harbor	16.111	10.00%	0.4	14	10	100	1,000
Ferry >400GT	14.222	82.00%	1.6	71	25	250	2,500
Towing Vessel <400GT	13.222	42.90%	5.3	357	5	50	500
Refinery	12.779	1.30%	4.2	200	50	1,200	200,000
Cruise Ship >400GT	9.778	46.60%	0.3	19	50	2,500	11,000
Fuel Terminal	9.000	11.10%	4.1	128	50	1,200	30,000
Military Vessel >400GT	8.000	4.90%	0.5	18	30	300	3,000
Seafood Facility	7.500	8.90%	16.8	1,637	10	100	1,000
Tank Barge >400GT[136]	7.389	29.30%	1.7	62	50	2,500	163,000
Municipal Fuel Storage	7.333	4.50%	5.9	119	10	100	1,000
Power Plant	7.000	4.00%	7.9	238	50	1,200	50,000
Industrial Vessel <400 GT	6.778	13.90%	1.8	143	5	50	500
Petroleum Terminal	5.611	34.70%	1.6	90	50	1,200	200,000
Unknown Land Source	5.611	36.60%	6.1	238	1	10	100
Tanker <90,000DWT	4.056	42.50%	0.4	10	50	2,500	523,000
Tank Barge <400GT	3.611	50.80%	0.8	12	50	2,500	163,000
Freight Barge >400GT	3.333	53.30%	0.7	7	30	300	3,000
Tanker >90,000DWT[137]	3.278	45.80%	0.3	5	50	2,500	1,900,000
General Cargo Ship >400GT	3.000	46.30%	37.5	929	50	2,500	8,000
Towing Vessel >400GT	2.722	8.20%	0.6	7	5	50	500
Military Facility	2.444	22.70%	26.4	619	50	1,000	10,000
Cruise Terminal	2.278	12.20%	0.03	0.4	10	100	1,000
Recreational Vessel >400GT	2.222	7.50%	1.1	18	0.1	1	10
Freight Barge <400GT	2.000	44.40%	1.4	16	2	20	200
Container Ship >400GT	1.889	88.20%	0.6	1	50	2,500	11,000
Offshore Supply Vessel <400GT	1.889	26.50%	6.2	143	1	10	100
Other Facility	1.889	26.50%	8.3	167	1	10	100
Research Vessel <400GT	1.389	52.00%	0.1	0.5	8	80	800

[131] Percent of incidents (across all zones) in the category that resulted in no spillage (i.e., only potential spill).
[132] Only includes incidents with actual spillage. For each category, there are incidents that involved no spillage.
[133] The "average most-probable discharge" (AMPD) is the lesser of 50 bbl or 1% WCD. This classification has been dropped from the USCG's Spill Classification Matrix as the response to such a small spill would generally be very localized. It is presented here as a comparison only.
[134] MMPD = maximum most-probable discharge
[135] WCD = worst-case discharge. The WCD in each category is determined by the typical size of the source type for the purpose of estimating WCD volumes across all regions. In some cases an actual spill event may have exceeded the WCD as estimated across all regions because the particular source (usually a vessel) was unusually large or had an unusually high volume of fuel on board.
[136] GT = gross tonnage
[137] DWT = deadweight tonnage

Table 75: Source Types in Descending Order of Incident Numbers (All Regions)							
Source	Annual Incident Number	Actual Spillage (bbl) (All Zones)			USCG Discharge Scenarios (bbl)		
		% No Spill[131]	Average[132]	Max.	AMPD[133]	MMPD[134]	WCD[135]
General Cargo Ship <400GT	1.389	24.00%	7.6	71	0.5	5	50
Oil Recovery Vessel <400GT	1.333	20.80%	0.1	0.6	5	50	500
Bulk Carrier >400GT	1.222	72.70%	1,139	7,944[138]	50	2,500	12,000
Ferry <400GT	1.222	86.40%	0.2	0.5	0.5	5	50
Bulk Chemical Facility	1.167	9.50%	0.3	2	50	1,000	10,000
Residential Facility	1.167	71.40%	1.3	4	0.1	1	10
Barge Terminal	1.000	5.60%	2.2	24	10	100	1,000
Ferry Terminal	1.000	5.60%	0.3	2	10	100	1,000
Airport	0.944	23.50%	165	2,009	50	1,200	50,000
Passenger Ship >400GT	0.944	41.20%	0.2	2	40	400	4,000
Container Terminal	0.944	11.80%	0.7	3	10	100	1,000
Logging Facility	0.889	47.10%	0.2	1	10	100	1,000
Construction Site	0.889	25.00%	1	6	1	10	100
Oil Recovery Vessel >400GT	0.833	26.70%	0.7	7	50	500	5,000
Marine Services Facility	0.813	0%	1.8	14	10	100	1,000
Industrial Vessel >400 GT	0.778	0%	1	5	10	100	1,000
Offshore Supply Facility	0.667	0%	0.2	1	10	100	1,000
Military Vessel <400GT	0.611	27.30%	2.6	24	30	300	3,000
Vehicle	0.556	50.00%	0.1	0.2	0.02	1	2
Oil Exp/Prod (Chukchi)	0.556	40.0%	9.2	39	50	1,200	2,200,000
Ship Terminal	0.500	22.20%	0.08	0.4	50	1,000	10,000
Mining Facility	0.389	14.30%	0.4	1	1	10	100
Pipeline Facility	0.278	40.00%	0.02	0.02	50	1,200	45,000
Drydock Facility	0.222	25.00%	0.5	1	10	100	1,000
Vehicle Carrier Ship >400GT	0.111	100%	0	0	50	2,500	6,000
MODU <400GT	0.111	50.00%	0.002	0.002	1	10	100
Offshore Supply Vessel >400GT	0.056	42.90%	0.04	0.1	30	300	3,000

Tables 76 and 77 show the source types with the highest incident numbers and WCD volumes by region.

Table 76: Source Types with Highest Incident Numbers by Region								
Region	Source Type	Annual Incident Number	Actual Spillage (bbl) (All Zones)			USCG Discharge Scenarios (bbl)		
			% No Spill	Average	Max.	AMPD	MMPD	WCD
Aleutians	**Fishing Vessel <400GT**	42.389	64.6%	6.7	476	2	20	200
	Fishing Vessel >400GT	14.611	43.8%	6.7	731	25	250	2,500
	Recreational Vessel <400GT	10.778	5.3%	0.7	14	0.1	1	10
	Seafood Facility	5.056	5.5%	20.9	1,637	10	100	1,000
	Fuel Terminal	2.111	2.6%	1.6	14	50	1,200	30,000
Aniak-chak	**Fishing Vessel <400GT**	1.222	86.4%	12.2	48	2	20	200
	Seafood Facility	0.611	9.1%	12.6	100	10	100	1,000
	Fishing Vessel >400GT	0.278	100%	0	0	25	250	2,500

[138] Selendang Ayu incident.

Table 76: Source Types with Highest Incident Numbers by Region								
Region	Source Type	Annual Incident Number	Actual Spillage (bbl) (All Zones)			USCG Discharge Scenarios (bbl)		
			% No Spill	Average	Max.	AMPD	MMPD	WCD
	Tank Barge >400GT	0.167	25%	0.3	1	50	2,500	163,000
	Bulk Carrier >400GT	0.111	100%	0	0	50	2,500	12,000
Beaufort Sea	Oil Exp/Prod Facility	81.000	0.3%	1.4	262	50	1,200	3,900,000
	Fishing Vessel <400GT	0.167	0%	0.4	1	2	20	200
	Industrial Vessel <400 GT	0.167	66.7%	0.4	0.4	5	50	500
	Passenger Ship <400GT	0.167	100%	0	0	0.5	5	50
	Freight Barge >400GT	0.111	50.0%	0.02	0.02	30	300	3,000
Bristol Bay	Fishing Vessel <400GT	5.667	60.8%	0.8	6	2	20	200
	Recreational Vessel <400GT	1.056	15.5%	0.7	6	0.1	1	10
	Fuel Terminal	0.667	16.7%	3.9	24	50	1,200	30,000
	Seafood Facility	0.667	16.7%	9.2	67	10	100	1,000
	Fishing Vessel >400GT	0.556	60.0%	18.5	67	25	250	2,500
Chukchi Sea	Oil Exp/Prod Facility	0.556	40%	9.2	39	50	1,200	2,200,000
	Towing Vessel >400GT	0.444	0%	1.4	7	5	50	500
	Municipal Fuel Storage	0.389	14.3%	1.4	6	10	100	1,000
	Power Plant	0.167	0%	1.2	2	50	1,200	50,000
	Industrial Vessel <400 GT	0.056	100%	0	0	5	50	500
Cook Inlet	Oil Exp/Prod Facility	28.389	18.0%	2.1	214	50	1,200	39,000
	Fishing Vessel <400GT	11.056	24.6%	0.4	7	2	20	200
	Refinery	10.056	1.1%	3.4	124	50	1,200	200,000
	Recreational Vessel <400GT	5.944	10.8%	0.4	10	0.1	1	10
	Passenger Ship <400GT	2.111	52.6%	1.0	7	0.5	5	50
Kodiak/ Shelikof	Fishing Vessel <400GT	24.333	45.2%	6.1	192	2	20	200
	Recreational Vessel <400GT	9.611	11.5%	0.3	10	0.1	1	10
	Military Vessel <400GT	3.611	1.4%	0.9	24	30	300	3,000
	Towing Vessel <400GT	0.944	42.1%	6.4	36	5	50	500
	Small Boat Harbor	0.722	0%	0.7	5	10	100	1,000
Kotzebue/ Hope	Power Plant	0.556	0%	2.9	14	50	1,200	50,000
	Mining Facility	0.333	0%	0.4	1	1	10	100
	Fuel Terminal	0.222	0%	33.2	128	50	1,200	30,000
	Municipal Fuel Storage	0.222	0%	13.2	48	10	100	1,000
	Tank Barge >400GT	0.222	25.0%	0.02	0.02	50	2,500	163,000
Norton S/ St. Lawrence	Municipal Fuel Storage	1.278	0%	2.9	12	10	100	1,000
	Tank Barge >400GT	0.667	46.2%	3.8	11	50	2,500	163,000
	Fuel Terminal	0.444	25.0%	27.1	119	50	1,200	30,000
	Power Plant	0.389	0%	38.4	238	50	1,200	50,000
	Fishing Vessel <400GT	0.278	80.0%	0.02	0.02	2	20	200
Off Kenai Peninsula	Fishing Vessel <400GT	4.333	43.6%	1.5	19	2	20	200
	Recreational Vessel <400GT	3.722	20.6%	0.2	4	0.1	1	10
	Passenger Ship <400GT	1.833	67.6%	0.1	0.2	0.5	5	50
	Towing Vessel <400GT	0.611	45.5%	0.3	1	5	50	500
	Industrial Vessel <400 GT	0.389	28.6%	0.3	1	5	50	500
Prince William	Recreational Vessel <400GT	11.278	10.0%	1.1	143	0.1	1	10
	Fishing Vessel <400GT	9.167	33.9%	3.2	83	2	20	200

Table 76: Source Types with Highest Incident Numbers by Region								
Region	Source Type	Annual Incident Number	Actual Spillage (bbl) (All Zones)			USCG Discharge Scenarios (bbl)		
			% No Spill	Average	Max.	AMPD	MMPD	WCD
Sound	Petroleum Terminal	4.389	38.0%	0.2	3	50	1,200	200,000
	Refinery	2.611	2.1%	7.3	200	50	1,200	200,000
	Towing Vessel <400GT	2.611	31.7%	4.5	153	5	50	500
South-Central	Fishing Vessel <400GT	2.222	52.5%	6.0	49	2	20	200
	Recreational Vessel <400GT	0.444	37.5%	1.3	4	0.1	1	10
	Tanker >90,000DWT	0.444	50.0%	0.2	1	50	2,500	1,900,000
	Power Plant	0.389	0%	8.6	36	50	1,200	50,000
	Tanker <90,000DWT	0.278	100%	0	0	50	2,500	523,000
Southeast Alaska	Recreational Vessel <400GT	71.389	6.0%	0.3	24	0.1	1	10
	Fishing Vessel <400GT	49.944	34.7%	1.8	119	2	20	200
	Ferry >400GT	10.722	80.3%	2.1	71	25	250	2,500
	Small Boat Harbor	10.722	8.3%	0.3	12	10	100	1,000
	Passenger Ship <400GT	10.667	66.5%	0.4	7	0.5	5	50
Western Alaska	Fishing Vessel <400GT	3.333	55.0%	1.6	12	2	20	200
	Municipal Fuel Storage	3.333	3.3%	3.4	36	10	100	1,000
	Fishing Vessel >400GT	3.167	87.7%	0.4	1	25	250	2,500
	Power Plant	1.667	6.7%	12.2	190	50	1,200	50,000
	Fuel Terminal	1.222	0%	5.1	76	50	1,200	30,000

Table 77: Source with Largest WCD Volume by Region								
Region	Source Type	Annual Incident Number	Actual Spillage (bbl) (All Zones)			USCG Discharge Scenarios (bbl)		
			% No Spill	Average	Maximum	AMPD	MMPD	WCD
Aleutians	Tanker <90,000DWT	0.222	75.0%	0.1	0.1	50	2,500	523,000
Aniakchak	Tanker <90,000DWT	0.111	50.0%	0.02	0.02	50	2,500	523,000
Beaufort Sea	Oil Exp/Prod Facility	81.000	0.3%	1.4	262	50	1,200	3,900,000
Bristol Bay	Tank Barge >400GT	1.056	21.1%	1.5	12	50	2,500	163,000
Chukchi Sea	Oil Exp/Prod Facility	0.556	40.0%	9.2	39	50	1,200	2,200,000
Cook Inlet	Tanker >90,000DWT	0.111	50.0%	0.6	1	50	2,500	1,900,000
Kodiak/Shelikof	Tanker >90,000DWT	0.056	100%	0	0	50	2,500	1,900,000
Kotzebue/Hope	Tank Barge >400GT	0.222	25.0%	0.02	0.02	50	2,500	163,000
Norton S	Tank Barge >400GT	0.722	46.2%	3.8	11	50	2,500	163,000
Off Kenai	Tanker <90,000DWT	0.056	100%	0	0	50	2,500	523,000
Prince William	Tanker >90,000DWT	2.500	42.2%	0.3	5	50	2,500	1,900,000
South-Central	Tanker >90,000DWT	0.444	50.0%	0.2	1	50	2,500	1,900,000
Southeast	Tanker >90,000DWT	0.167	66.7%	0.01	0.01	50	2,500	1,900,000
Western	Tank Barge >400GT	1.556	25.0%	0.6	3	50	2,500	163,000

7 Future Spillage Risk – Review of Past Studies

The incident rates and spill volumes shown in Tables 43 and 44 and Table 70 are based on analyses of historical data from the years 1995 through 2012. Patterns of incidents (region, oil type, and period) may change in the future (defined in this project as the year 2025) based on different patterns of oil usage, vessel traffic, vessel size, oil exploration and production activities, effectiveness of spill prevention and risk mitigation measures, and many other complex economic and social factors. Spill volumes could also change in the future based on changing patterns of oil production, transport, and handling.

Past studies on spill risk in Alaska and the Arctic were reviewed to derive any relevant perspectives or data that could be applied to forecasting future spill risk in the region. Applying past risk studies, especially those with recommendations for risk mitigation measures, to forecasting requires:

- An assessment of the degree to which the risk mitigation has been implemented and the risk may have decreased; and
- An assessment of the factors that were attributed to risk may have changed (increased or decreased) or will change over time.

7.1 Arctic Tanker Risk Analysis Project

The Arctic Tanker Risk Analysis (ATRA) Project conducted in 1995,[139] concluded that in the eastern Canadian Arctic oil tankers were 11 times as likely to have a severe casualty per shipping mile as similar vessels transiting European waters. The highest potential for spillage was at terminals and in the High Arctic (Tables 78 and 79).

Table 78: Vessel Casualties and Ship-Miles, East Canadian Arctic 1977 – 1991[140]

Vessel Type	Total Casualties	Severe Casualties	Total Ship-Miles	Severe Casualties Per 10^6 Ship-Mile
Ore Bulk Oil Carrier (OBO)	8	3	235,000	12.8
Oil Tanker	9	7	348,000	20.1
Bulk Carrier	20	13	525,000	24.8
General Cargo Vessel	20	10	409,500	24.4
Ice-Breaker	19	4	883,500	4.5

Table 79: Severe Casualty Rates in East Canadian Arctic vs. Europe 1977 – 1991[141]

Vessel Type	Severe Casualties per 10^6 Ship-Miles		Arctic Rate Compared with European Rate[142]
	East Canada Arctic Summer	Europe Annual	
Ore Bulk Oil Carrier (OBO)	12.8	2.8	5
Oil Tanker	20.1	1.8	11
Bulk Carrier	24.8	0.9	28
General Cargo Vessel	24.4	1.2	20
Ice-Breaker	4.5	n/a	n/a
Container Vessel	n/a	0.5	n/a
Passenger Vessel	n/a	0.7	n/a

[139] Loughnane, et al. (1995); Dickins (1992).
[140] Based on Loughnane, et al. (1995)
[141] Based on Loughnane, et al. (1995)
[142] e.g., OBO carriers had five times the casualties per ship-mile in Arctic waters compared with European waters.

While this study was conducted specifically on eastern Canada, there is relevance to risk for the Alaska Arctic and sub-Arctic area. In the study, 44 of the specific hazards identified with events leading to vessel collisions, groundings, and explosions were considerably less likely to occur but had more dire consequences than more-likely events with lesser consequences. The navigation tasks that required the highest demands on bridge officers and crews for perception, attention, problem-solving, and team organization that are relevant to Alaskan waters as well included:

- Moving in shallow-restricted waters;
- Moving through pack ice;
- Moving through glacial ice; and
- Moving through other traffic.

Multi-year ice and difficulties in radar navigation due to the presence of land-fast ice were found to increase ship-handling and navigation-workload in the High Arctic. The presence of glacial ice was found to increase the demands of collision-avoidance and ship-handling tasks. Vessel collisions were, of course, more likely to occur in areas with greater vessel traffic due to higher encounter rates combined with reduced visibility or the use of radar, which is partially degraded by sea state.

7.2 Prince William Sound Steering Committee Risk Assessment 1996

After the 1989 Exxon Valdez spill in Prince William Sound, stakeholders and interested parties were concerned about the effectiveness of various spill prevention measures. They formed a steering committee of industry, government, and citizen representatives to work with a consultant team to create a detailed model[143] of the Prince William Sound system that could be used to assess current risk of oil tanker spills in the sound and to evaluate spill prevention measures. The Prince William Sound Steering Committee (1996)[144] showed that actions taken prior to the study had reduced the risk of an oil spill by 75 percent. The committee also identified measures that would reduce the risk of spillage by an additional 68 percent, including:

- Long-term plans for improvement of oil company safety-management systems;
- Stationing an enhanced-capability tugs[145] to escort oil-laden tankers through at Hinchinbrook Entrance;
- Improvements on the tug escort scheme that minimizes interactions between oil tankers and escort tugs while maintaining the ability to save disabled tankers;
- US Coast Guard Vessel Traffic System management of interactions between fishing vessels and tankers;
- Increases in the minimum required bridge crew on board escort tugs by the ship/escort response vessel system (SERVS) from one to two to add additional error-capture capability; and
- Approval by International Maritime Organization of changes to the tanker route through Prince William Sound to reduce the number of course changes required.

[143] The risk assessment model is further described in Harrald, et al. (1997).
[144] Harrald, et al. 1996. The Prince William Sound Risk Assessment was further described in Merrick, et al. (2002) and Grabowski (2005).
[145] This tug was later replaced by new azimuthing stern-driven escort vessels designed for higher transit speed and open-water assist scenarios that include the Hinchinbrook Entrance transit.

The risk assessment study was critically reviewed by the National Research Council Marine Board (1998b), which concluded that while the study was an "important step forward in using probabilistic risk assessment methods to assess the safety of transporting oil in large tankers in Prince William Sound"[146], the board cited several significant weaknesses in the study:

- Lack of an overarching framework to ensure the consistency and logic of the analyses;
- Lack of a clear description of how the models were implemented, the probabilities calculated, and the results reached;
- Inaccessibility of the proprietary data on which the results are based;
- Treatment of human and organizational error; and
- Appearance that the conclusions were precise and logical, when, in fact, they are neither.

The board stated that the Prince William Sound study was "an ambitious effort to combine several modeling approaches and site-specific data with international data to estimate risks and recommend measures for mitigating risks". Because of the close interaction with the nongovernmental citizens' group, Prince William Sound Regional Citizens Advisory Council (RCAC), the board concluded that the study is "less an independent analysis of risk than a mutually agreed upon description of issues and recommendations for mitigating risk".

The NRC Marine Board noted that the study was extremely ambitious with its consensus approach with the RCAC. They pointed to a limiting feature of the study as being the rare events that were being assessed. The database of actual events included one grounding and one ice collision. The limited data shed doubt on the validity and robustness of the analytic results. The board also expressed concern that the approach would not be transferrable to other locations. Finally, the board questioned the use of "expert judgments" in that community bias or viewpoint, and consistency could significantly affect the results and that sophisticated statistical techniques would tend to "mask" these problems. In addition, the use of "worst-case" scenarios together with probabilities made interpretation of the results extremely difficult, they concluded.

7.3 Copper River Delta Spill Risk Analysis 1996

Christensen, et al. (1996) conducted a risk analysis study of the likelihood of spills in the shipping lane to Valdez reaching the Copper River Delta. As part of that study "likely" spill sites, as identified by the Alaska Department of Environmental Conservation were selected for trajectory, fate, and effects modeling simulations. The two locations selected were:

- In the southbound shipping lane of Prince William Sound at 60 degrees 40 minutes North latitude (approximately 147 degrees West longitude); and
- In the Safety Fairway due south of Cape Hinchinbrook at 60 degrees 11 minutes North latitude (approximately 147 degrees West longitude).

[146] The NRC committee identified strengths in the study as the use of probabilistic methods at the basic modeling level (fault tree logic diagrams and the marine accident risk calculation system), data searches, and presentation of the results in a variety of formats, and involvement of the stakeholders.

The 300,000-barrel (12.6 million gallon) hypothetical spills were meant to simulate an Exxon Valdez-sized spill over 200 stochastic variations in wind and current patterns. The stochastic simulations were found to indicate that, notwithstanding isolated observations of small scale or short duration oil flow events moving from the vicinity of Hinchinbrook Entrance toward the Copper River Delta, there was a very low likelihood of spills in the Prince William Sound shipping lanes, even of this magnitude, reaching the Copper River Delta.

7.4 Nuka Research-Cape International Aleutian Vessel Traffic Study 2004

In the aftermath of the 2004 M/V Selendang Ayu oil spill[147] at Unalaska Island, the Alaska Department of Environmental Conservation focused attention on the risk of spills posed by vessels transiting the North Pacific great circle route from the west coast of North America to Asia. Vessels transiting between northern Pacific ports pass through the Aleutians (Figures 31 – 35), which are home to the largest and most valuable fishing grounds in the US, as well as to the Alaska Maritime National Wildlife Refuge.

Nuka Research Planning and Cape International (2006) analyzed available data on vessel traffic and casualties within and through the Aleutians for the time period October 2005 through June 2006. Their analyses showed that there are approximately 3,100 vessels passing through the Aleutians each year in primarily westbound innocent passage trans-Pacific voyages. A breakdown of these 3,100 vessels is shown in Table 80. A total of over three billion gallons of oil (the equivalent of over 280 Exxon Valdez spills) is transported through the Aleutian Islands each year.

Table 80: Annual Vessel Transits through Aleutian Islands[148]

Vessel Type	Annual Transits	%	Median Capacity (bbl)	Oil Type	Annual bbl
Container Ship	1,200	38.7%	1.6 million	bunker	46 million
Bulk Carrier/General Cargo	1,300	41.9%	470,000	bunker	15 million
Motor Vehicle Carrier	265	8.5%	500,000	bunker	3 million
Refrigerated Cargo Ship	110	3.5%	317,000	bunker	830,000
Tank ship	22	0.7%	18 million	refined	10 million
Other Vessel	203	6.5%	varies	varies	-
Total	**3,100**	**100.0%**			**74 million**

Other observations from the Nuka Research Planning and Cape International (2006) study include:

- Approximately 400 port calls were made to Aleutian ports each year, including 130 container ships, 108 refrigerated cargo ships, and 162 tugs towing barges);
- Few passenger ships operated in or pass through the Aleutians; and
- About 400 fishing vessels (with an average fuel capacity of 30,000 gallons of diesel) operate in the fishing areas surrounding the Aleutians.
- There were 486 casualties affecting seaworthiness on US vessels and 48 casualties[149] on foreign vessels during the 15½ year time period of January 1990 and July 2006.[150] Most of the US

[147] The bulk carrier Selendang Ayu grounded and broke up in a storm near Unimak Island. 336,000 gallons of heavy fuel oil spilled. The accident also caused the death of six crew members when a US Coast Guard rescue helicopter crashed.
[148] Based on Nuka Research Planning and Cape International (2006).
[149] The researchers believed that the foreign casualties were under-reported.

casualties affected fishing vessels. The study noted 43 oil spills "of note" from vessels during 1981 through July 2006, totaling one million gallons. Sixty-two percent of the spills involved non-persistent oil, while 38 percent involved persistent oil.

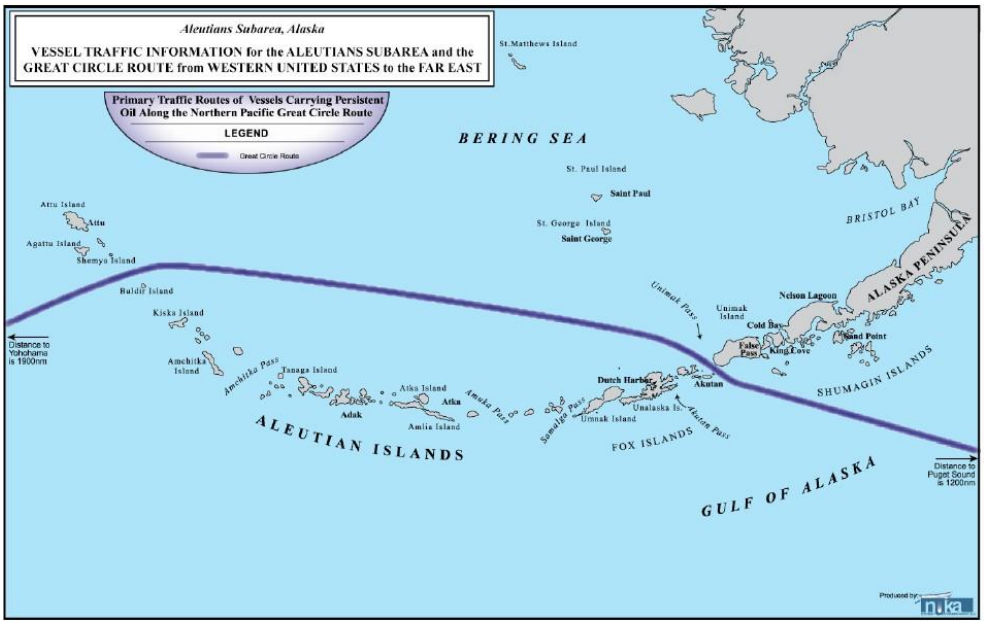

Figure 31: West US-Asia Vessel Traffic Route through the Aleutian Islands[151]

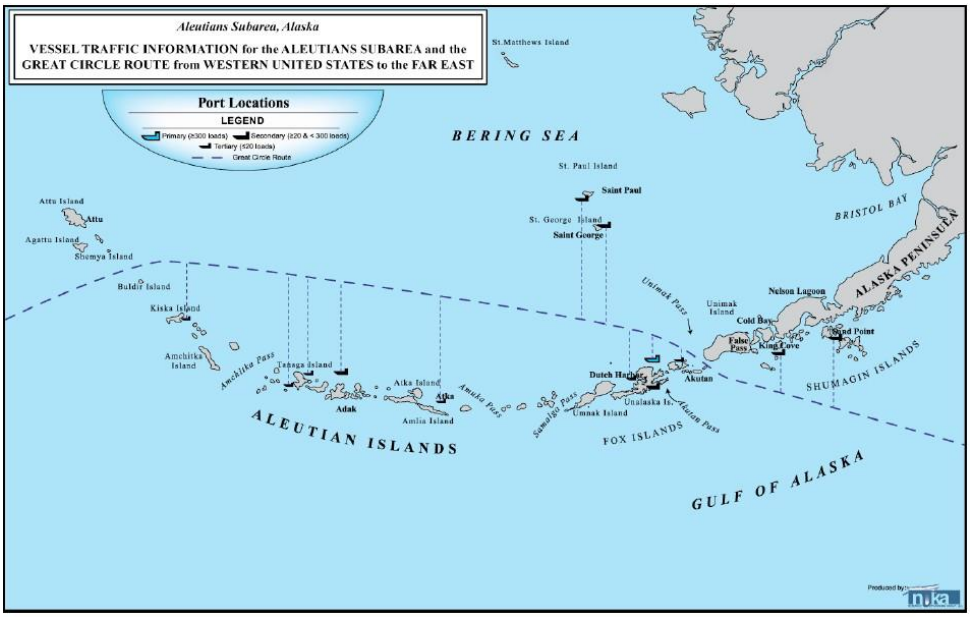

Figure 32: West US-Asia Vessel Traffic Route with Port Calls in the Aleutian Islands

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[150] The dates in Nuka's analyses differ because of the use of different US Coast Guard databases for different aspects of the analyses.

[151] From Nuka Research Planning and Cape International (2006).

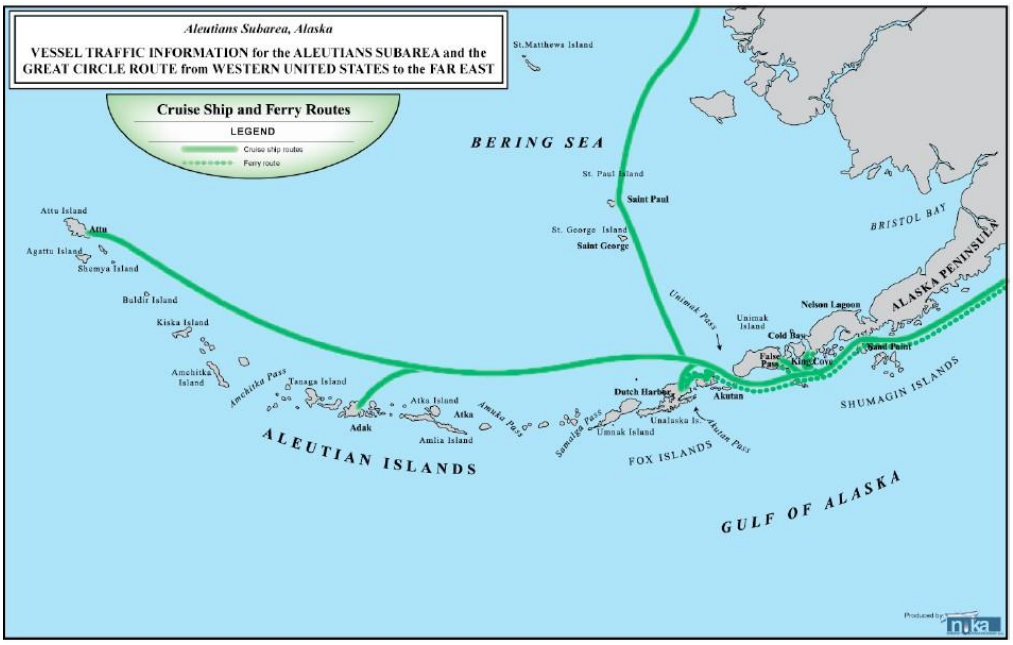


Figure 33: Cruise Ship and Ferry Boat Routes in the Aleutian Islands

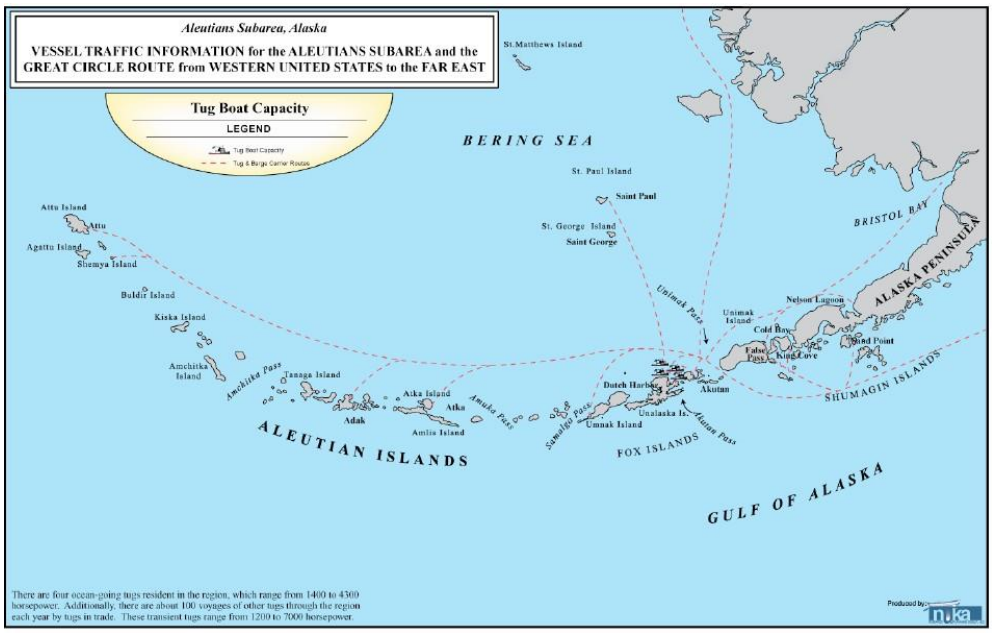


Figure 34: Tugboat Traffic through the Aleutian Islands

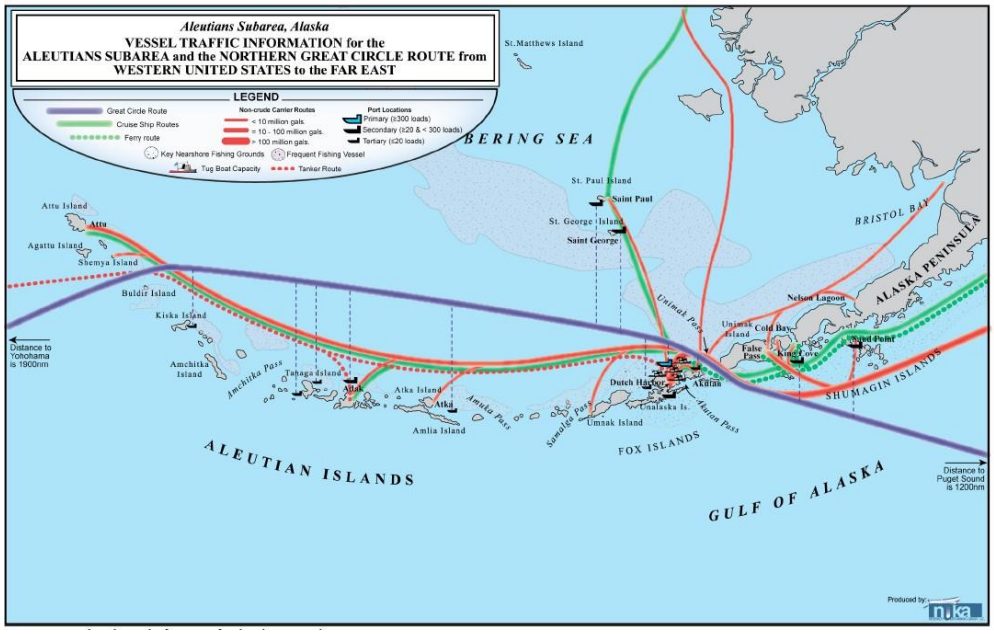


Figure 35: Combined Vessel Traffic Information for the Aleutian Islands

7.5 Ports and Waterways Safety Assessment (PAWSA) Workshop 2006

The Ports and Waterways Safety Assessment (PAWSA) Workshop (2006) used a structured approach for obtaining expert judgments assembled by the US Coast Guard and Alaska Department of Environmental Conservation on the level of risk in the Aleutian Islands for the waterways risk model factors shown in Table 81.

Table 81: PAWSA Waterway Risk Model Factors[152]

Vessel Conditions	Traffic Conditions	Navigational Conditions	Waterway Conditions	Immediate Consequences	Subsequent Consequences
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental Impacts
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Material Release	Aquatic Resources
Small Craft Vessel Quality	Traffic Congestion	Obstructions	Configuration	Mobility	Economic Impacts

As a first step, the expert panel assessed their own expertise with respect to the risk categories in the model. Those assessments were used to weight the inputs of the participants for each of the risk factors. The second step involved the participants providing input for the rating scales used to assess the baseline risk levels using pre-defined qualitative risk descriptions. The fourth step involved the evaluation of risk reduction effectiveness of existing mitigation strategies, and discussion of additional intervention actions to reduce risk.

[152] The Ports and Waterways Safety Assessment (PAWSA) Workshop (2006)

The expert panel noted a concentration of risks in Dutch Harbor, Unimak Pass, and north of Akun Island. The panel found that further risk reduction actions were needed with respect to 14 of the 24 risk factors in the Waterways Risk Model, as shown in Table 82.

Table 82: PAWSA 2006 Aleutian Islands Risk Panel Recommended Risk Reduction Strategies

Risk Factor	General Strategy	Specific Action
Small Craft Quality	Rules and Procedures	License boat operators
Petroleum Discharge	Coordination/Planning	Update Subarea Contingency Plan (SCP) Logistics Section
Water Movement	Navigation/Hydrographic Info	Enhanced vessel reporting system Wind/water circulation study
Aquatic Resources	Coordination/Planning	Develop additional Geographic Response Strategies (GRS)
Bottom Type	Navigation/Hydrographic Info	Update charts and Coast Pilot
Winds	Navigation/Hydrographic Info	Put more wind sensors in passes
Visibility Restrictions	Navigation/Hydrographic Info	Require AIS on all commercial vessels >26 ft.
Hazardous Materials Release	Coordination/Planning	USCG receive all dangerous cargo manifests
Environmental	Coordination/Planning	Include biological release (non-indigenous species in SCP)
Mobility	Coordination/Planning	Better coordination during response
Commercial Fishing Vessel Quality	Rules and Procedures	Mandatory inspections for fishing vessels >26 ft.
Deep Draft Vessel Quality	Active Traffic Management	Establish VTIS for Unimak Pass
Shallow Draft Vessel Quality	Rules and Procedures	Require double hulls on all tank barges Put look-ahead sonar on all cruise vessels
Health and Safety	Coordination/Planning	Continue emergency response drills/planning

7.6 PWS RCAC Human Factors in Oil Spills 2006

DeCola and Fletcher (2006) conducted a study on the role of human factors in oil spills from vessels for Prince William Sound Regional Citizens' Advisory Council (PWSRCAC). Human factors – either individual or organizational – had been identified as the cause of 80% of vessel casualties.[153] The study recommended measures that might effectively target human factors with regard to tanker spills:

- Improve and standardize data collection methods to recognize human factors in accident causality and to access marine insurance claim data;
- Recognize the relative contributions of individuals, groups, and organizations in assessing human factors;
- Create a mandatory near-miss reporting system for the US maritime industry and analyze near-miss data for lessons learned;
- Promote and apply best industry practices that have been recognized to reduce accident and spill risks from human factors
- Incorporate human factors analyses into risk assessments for oil spills from vessels;
- Focus on crew endurance management and other practices to reduce fatigue;
- Integrate human factors considerations into systems engineering;
- Promote a safety culture across the marine oil transportation industry; and
- Measure the effectiveness of prevention programs and safety initiatives that target human factors.

[153] Hee, et al. (1999) and Rothblum (2006)

7.7 NRC Aleutian Islands Risk Assessment 2008

The December 2004 grounding and breakup of the bulk carrier Selendang Ayu focused public attention on the oil spill risks of vessels transiting the Aleutian Islands. The court settlement following the accident specified that funds be allocated for a comprehensive risk assessment of ship accidents and spills in the Aleutians and for conduct of projects identified by the risk assessment.

The National Research Council Transportation Research Board (2008) conducted a study to provide guidance for the conduct of that assessment with regard to identifying available data and evidence of spill risk for vessels transiting the Aleutians, determining the information needed for a comprehensive risk assessments, recommending a framework for the most appropriate and scientifically-sound approach given available data and modeling capability, and identifying the logical sequence of steps for the assessment. The committee recommended that the risk assessment include quantitative fate and effects consequence analyses to yield an understanding of the damage to natural resources and socioeconomic impacts associated with different hazards, spill volumes, and accident locations.

A two-phase assessment was recommended –a preliminary risk assessment and a focused risk assessment. The preliminary risk assessment should begin with semi-quantitative studies aimed at traffic characterization and projections, spill estimates, and the identification of the highest risks. This information should then be used for a qualitative assessment and prioritization of risk reduction options. The second phase should entail a detailed, in-depth assessment of individual risk reduction options.

As of the writing of this report, the Aleutian Islands Risk Assessment project, as administered by the National Fish and Wildlife Foundation and the State of Alaska, has not yet commenced.

7.8 Coastal Response Research Center Workshop 2009

Coastal Response Research Center (2009) conducted a workshop "Opening Arctic Seas: Envisioning Disasters and Framing Solutions" in March 2008. The participants discussed five plausible marine incident scenarios that involved cruise ships, drill ships, and fishing vessels. The key workshop findings and recommendations were as follows:

- Designate potential ports of refuge in the Arctic and develop guidelines for their use;
- Control and track vessel movements;
- Institute mandatory safety regulations for vessels and crews for Arctic operations;
- Strengthen multinational contingency plans and agreements or create one Arctic agreement for all types of responses;
- Conduct comprehensive environmental risk assessments and impact assessments for the Arctic;
- Increase emergency response assets, equipment, and supplies in the Arctic, placing emphasis on regions of active development;
- Improve knowledge for Arctic incident response through training and engagement of the local community, responders, and the shipping industry;
- Consider alternative countermeasures for oil spill cleanup (e.g., dispersants, chemical herders, sinking agents, in situ burning);
- Expand communications capabilities throughout the Arctic;
- Improve logistical support capabilities for responders;

- Involve indigenous people and local communities in planning, response, recovery, and restoration decisions and operations;
- Conduct outreach to the local community and keep stakeholders informed;
- Establish an international Arctic response fund; and
- Increase penalties and insurance requirements for ships operating in the Arctic.

The workshop participants identified three research needs:

- Update weather data and navigational charts for the Arctic;
- Study the behavior of oil in cold water and technologies for spill response; and
- Improve baseline information for Arctic resources that could be affected by potential incidents.

7.9 Arctic Marine Shipping Assessment (AMSA) 2009

In meetings in 2004, the Arctic Council[154] called for the Council's Protection of the Marine Environment (PAME) working group to "conduct a comprehensive Arctic [current and future] marine shipping assessment as outlined under the Arctic Marine Strategic Plan under the guidance of Canada, Finland, and the US. PAME released the Arctic Marine Shipping Assessment (AMSA) in 2009.

The major findings of AMSA (2009) with regard to Arctic marine geography, climate, and sea ice were:

- Arctic sea ice has been decreasing since the second half of the 20th century;
- Global climate models show continuing retreat of sea ice, but winter sea ice cover will remain;
- There may be short periods of ice-free periods in summers beginning as early as 2015;
- There will likely be greater marine access and longer navigation seasons, though difficult ice conditions will continue for marine operations;
- The last regions in the Arctic with sea ice coverage in the summer months will be in the northern waterways of the Canadian Archipelago and along the northern Greenland coast; and
- Year-round navigation in ice-covered western regions of the Northern Sea Route has been maintained since the 1978 – 1979 season.

Because of these changes in Arctic operating conditions, future Arctic navigation and all marine activity will depend on more frequent, reliable, and near real-time sea ice thickness measurements. AMSA (2009) recommended research into ice forecasting models and updating of bathymetric charts for the Arctic.

The United Nations Convention on the Law of the Sea (UNCLOS)[155] provides the fundamental framework for governance of Arctic marine navigation. UNCLOS Article 234 allows coastal states the right to adopt and enforce regulations for the prevention, reduction, and control of marine pollution from

[154] The Ottawa Declaration of 1996 formally established the Arctic Council as a high-level intergovernmental forum to provide a means of cooperation, coordination, and interaction between the Arctic states, especially with regard to sustainable development and environmental protection. Members include: Canada, Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, the Russian Federation, Sweden, and the US. There are also a number of indigenous organizations that participate, including Aleut International Association, Arctic Athabaskan Council, Gwich'in Council International, Inuit Circumpolar Council, Saami Council, and Russian Arctic Indigenous Peoples of the North.

[155] The US is not a party to UNCLOS at this date.

vessels in ice-covered waters. The International Maritime Organization (IMO) has been proactively developing and modifying voluntary Guidelines for Ships Operating in Arctic Ice-Covered Waters. However, there are no uniform standards for ice navigation or safety in Arctic waters.

There are 6,000 individual vessels that make multiple voyages in the Arctic region, half of them operating in the Great Circle Route of the North Pacific that crosses the Aleutian Islands (Figure 36). Nearly 27 percent of these vessels are fishing vessels. The regions of the highest concentration of Arctic marine activity are along the northwestern Russian coast, and ice-free waters off Norway, Iceland, Greenland, and the US.

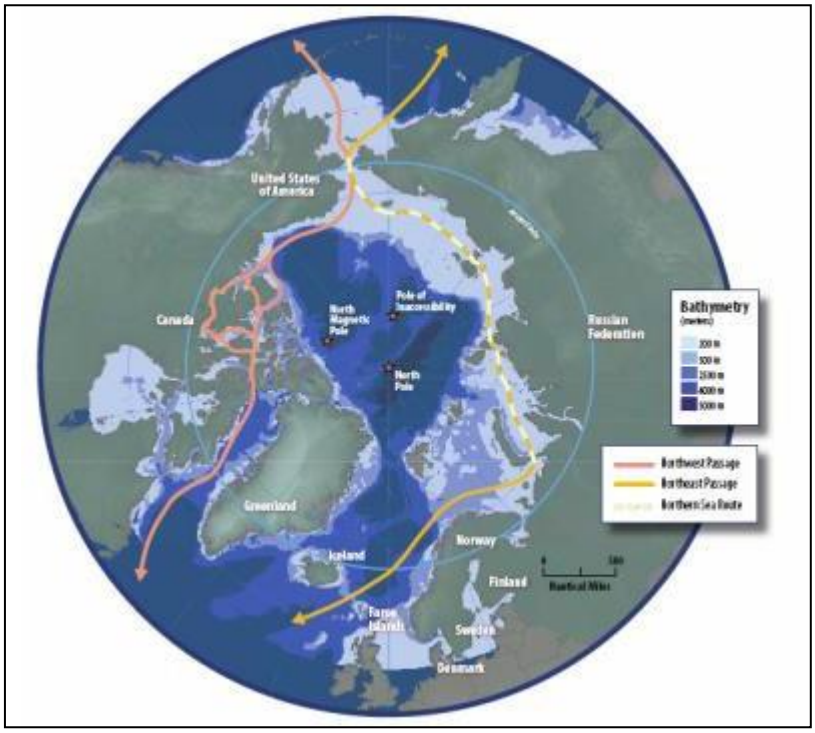


Figure 36: Arctic Marine Shipping Routes[156]

Specific recommendations with regard to Arctic marine shipping in the AMSA (2009) report included:

- Better information on marine weather;
- Studies and monitoring of changes in waves with the reduction in sea ice to dampen waves;
- Better integration of marine aids to navigation in the form of fixed and floating aids, long-range aids (shore-based electronic and satellite-based), and safety and navigation information broadcasts;
- Better coverage of marine communications[157] in some areas;

[156] AMSA (2009)

[157] US marine communications infrastructure in Alaska was noted as being excellent with very high frequency (VHF) coverage throughout southeast Alaska and into portions of the Bering Sea north to St. Paul and Bristol Bay. North of this area there are local coverages in Nome, Kotzebue, and Barrow. Outside of VHF coverage, the US Coast Guard relies on high-frequency or satellite communications.

- Personnel and maritime training for the challenges of Arctic navigation especially with increases in Arctic shipping and changes in sea ice conditions.

Other significant findings on maritime activities included:

- Safe navigation in the Arctic is often dependent on the skills of a limited and diminishing number of seasoned northern mariners;
- There is currently no universal or mandatory education, training, and certification for Arctic mariners;
- Significant portions of primary Arctic shipping routes do not have adequate hydrographic data and charts to support safe navigation;
- Expansion of current routes is required to allow alternate courses during hazardous ice conditions, or for entry into points of refuge;
- Electronic Chart Display and Information Systems (ECDIS) when coupled with digital Global Position Systems could improve navigational safety; and
- There are too few systems to monitor and control Arctic ship movements in ice covered waters to reduce the risk of incidents.

Increased shipping activity will likely lead to increased marine pollution incidents occurring in the Arctic. The AMSA study concluded that with few some exceptions, there are few Arctic-based resources to address oil spills, "especially the ability to recover trapped oil in hulls and compartment in both shallow and deep water". The use of alternative spill response measures, such as chemical dispersants and herding agents, as well as in situ burning should be further investigated.

7.10 Arctic Monitoring and Assessment Programme 1997

The Arctic Monitoring and Assessment Programme (AMAP) 1997 report estimated oil spillage rates over the estimated production period of specific Arctic petroleum reserves in the Beaufort and Chukchi Seas to be between one and eight spills of 1,000 barrels or larger, based on data from the 1980s through 1995. The probability of one or more spills of 1,000 barrels or larger was estimated to be between 58 and 99 percent. The number of spills exceeding 10,000 barrels was estimated to be 0.3 and 2.5 with a probability of one or more of these large spills of between 24 and 92 percent. The most likely source of spillage was predicted to be pipelines, followed by tankers and platforms.

These estimates were based on spillage rates from areas outside of the Arctic and did not take into consideration the special conditions in the Arctic. "In reality, pressure ridges in the ice or icebergs scouring the bottom could increase the risk for damage to any installation on the sea floor. Arctic conditions may also affect the size of the spill because of difficulties in recovering oil and in drilling relief wells," the report concluded.

7.11 MMS Cook Inlet OCS Risk Analysis 2002

Johnson, et al. (2002) conducted an oil spill risk analysis for the Cook Inlet Outer Continental Shelf (OCS) area. Based on previous studies[158], the researchers applied spill rates of 0.13 spills of at least 1,000 barrels per billion barrels of oil produced by OCS platforms, and 1.38 spills of at least 1,000 barrels per

[158] Anderson and LaBelle (1994; 2000); LaBelle and Johnson (1993).

billion barrels of oil transported by OCS pipelines. The total spill rate was 1.51 spills of at least 1,000 barrels per billion barrels of oil produced or transported. Spills smaller than 1,000 barrels were not addressed, because those spills were assumed not to persist long enough to be simulated by trajectory modeling inherent in the consequences side of the risk analysis.

7.12 NRC 2003 Cumulative Environmental Effects of Oil and Gas Activities

A comprehensive 2003 study by the National Research Council Polar Research Board (2003) evaluated the environmental impacts of oil and gas activities on Alaska's North Slope, including not oil spill impacts but also environmental and social impacts of oil exploration and production infrastructure and activities.

The study found that no major oil spills (of 1,000 bbl or more) had occurred on the North Slope or adjacent oceans to date as a result of the oil exploration and production activities. The committee noted three major crude oil spills from the Trans-Alaska Pipeline (TAPS) and numerous smaller terrestrial spills that affected mostly gravel. The study concluded: "The threat of a large oil spill – especially offshore – is a major concern among North Slope residents. This continuing concern is an accumulating effect. The effects of a large oil spill at sea, especially in broken ice, would likely be substantial and accumulate because of the fluid movement and inadequacy of current methods to remove more than a small fraction of spilled oil."

7.13 Offshore Arctic Pipeline Spill Risk Assessment 2004

Dinovitzer, et al. (2004) conducted a spill risk assessment for the proposed Liberty Pipeline to be constructed to transport oil onshore from a production site in the Alaskan Beaufort Sea. The analyses involved evaluating the relative risks in different pipe designs, as shown in Table 83. The results indicated that the steel pipe-in-pipe design had the lowest risk of the alternative designs, due primarily to the effects of secondary containment. The water depth at which the failure occurred also affected the risk as it would control total oil drainage.

Table 83: Oil Spill Risk and Sensitivity Analysis Summary for Liberty Pipeline Designs[159]

Case	Predicted Barrels of Oil Lost over 20-Year Pipeline Life		
	Single Steel Pipe	Steel Pipe-in-Pipe	Pipe in HDPE[160]
Best case[161]	28	8 – 13	24
Failure by rupture	153	39 - 75	154
Oil flow through maximum stable crack	109	28 – 54	110
Seepage through pinholes	8.7	2.2 – 4.4	8.8
Worst operational & 3rd party failure case	69	18 – 22	65
No secondary containment	28	28	28
Expected worst-case monitoring performance	51	14 – 26	51
Worst-case water depth for each hazard	35	9 - 15	31

7.14 North Slope Spills Analysis 2010

A study conducted by Nuka Research and Planning Group[162] on spillage in the North Slope focused primarily on onshore spillage rather than marine spills. A major finding of the report that may have

[159] From Dinovitzer, et al. (2004.)
[160] High-density polyethylene.
[161] Best estimate for all inputs

implications for marine spillage in the region was that valve/seal failure was the most frequent cause of spills in oil exploration and production infrastructure and facilities, but that corrosion was the most frequent cause of spills over 10,000 gallons (238 bbl). Their model predicted, for example, that a five-year-old pipeline had a 3.3% probability of having a spill, whereas a 30-year-old pipeline had a 31% probability of having a spill. The relationship between pipeline age and the frequency and severity of spills has been a major concern in Alaska.

7.15 Cook Inlet Risk Assessment 2012

A risk assessment for vessel accidents and spills was conducted for Cook Inlet for the years 2010 through 2025.[163] The Cook Inlet Risk Assessment was based on an analysis of vessel traffic data (Figure 37),[164] including future projections, incident data on vessel casualties and spills, and an evaluation of impacts of spills by oil type, location type, and season.

The factors identified that could affect future vessel traffic (in 2025) include:

- Planned and proposed changes to major marine facilities;
- Port expansion projects;
- Changes in import/export activities;
- New projects (e.g., mining);
- Changes to transportation infrastructure;
- Changes to commodity transportation modes;
- Changes to oil and gas production;
- Population growth; and
- US and international regulatory changes.

The vessel traffic study concludes:

> Over the 10-year time period from 2011-2025, it is reasonable to forecast that vessel traffic remains flat or shows moderate increases (1.5-2.5% annually), due to population growth and post-recession improvements to the economy. While it is likely that flat or moderate increases will occur over the ten-year forecast period, there are a few possible scenarios that could cause dramatic increases to the volume and composition of Cook Inlet vessel traffic, including:
>
> - Increased global demand for Alaska coal, oil, gas and minerals coupled with fully developed facilities at Port MacKenzie and Ladd's Landing could increase Cook Inlet bulk carrier ship traffic considerably, by up to 200 vessels per year.
> - Depending on the route of the Alaska gas pipeline, construction materials for this project could attract 25 – 50 cargo ship calls to the Port of Anchorage or Port MacKenzie.

[162] Robertson, et al. (2010).
[163] Kirtley, et al. (2012).
[164] Eley (2012).

- The reported recent discovery of additional gas reserves in Cook Inlet, coupled with potential increased demand, could lead to the reopening of the Nikiski LNG facility and add 36 or more gas ship calls at Cook Inlet.

Vessel-sourced spill rates would generally follow increases in vessel traffic, although changes in operational standards for vessels, as well as the implementation of some regulatory changes, most notably double-hulls on tankers and bunker fuel tanks in non-tank vessels, would affect the frequency and nature (volume) of spills in the future.[165]

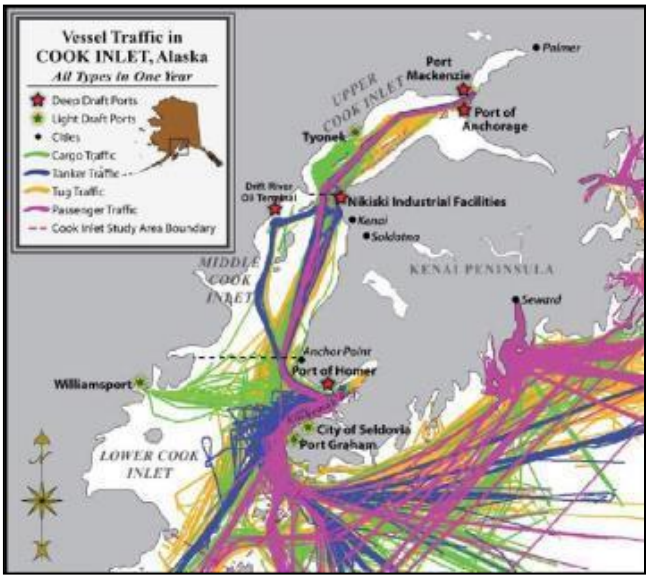


Figure 37: Cook Inlet Vessel Traffic (2010)[166]

Double hulls on tankers will be fully implemented by 2015, which not only reduces likelihood of spillage given an impact accident, but also reduces oil outflow by 50% for the largest spills. For double-hulled bunker tanks, the probability of spillage is reduced, though volume is not affected (Tables 84 – 85). The estimated probability that a non-tank vessel will have double-hulled bunker tanks is shown in Figure 38. Double hulls will only be mandated on larger ships and not smaller vessels (e.g., small fishing vessels)

Table 84: Influence of Double Hulls on Future Spill Risks[167]

Vessel Tank Type	Influence of Double Hulls		
	Spill Probability Grounding/Collision/Allision	Small to Median Spill Volume Scenario	Largest Spill Volume Scenario
Tanker Cargo	Reduced [see Table 78]	No effect	Reduce volume by 50 – 70%
Vessel Bunker	Reduced by 52%[168]	No effect	No effect

[165] Kirtley, et al. 2012.
[166] Eley 2012.
[167] As in Kirtley, et al. 2012, based on Etkin 2002 with modifications for findings in Yip, et al. 2011 and National Research Council 1991.
[168] Based on Michel and Winslow 1999 and Rawson 1998.

Table 85: Double-Hull vs. Single-Hull Tank Vessel Spillage Probabilities[169]						
Vessel Type	**Side Impact**		**Bottom Impact**		**Side and Bottom Impact**	
	SH	**DH**	**SH**	**DH**	**SH**	**DH**
Tanker 80,000-100,000 DWT[170]	0.68	0.15	0.91	0.18	0.81	0.17
Tanker 135,000-160,000 DWT	0.65	0.19	0.92	0.18	0.79	0.18
Tanker 265,000-300,000 DWT	0.81	0.19	0.93	0.20	0.88	0.20
Tank Barge 5,500 DWT	0.76	0.13	0.76	0.22	0.76	0.19

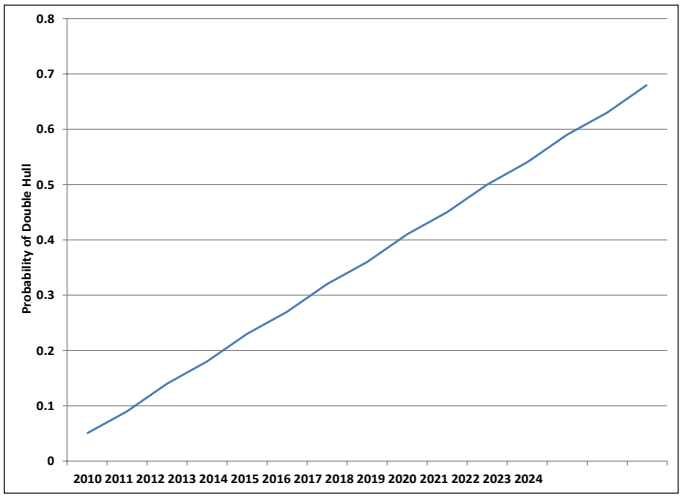


Figure 38: Probability of Presence of Double Hull on Bunker Tanks for Non-Tank Vessels[171]

7.16 Aleutian Islands Risk Assessment 2010

An assessment of oil spill risk from vessel traffic in the Aleutian Islands forecasted vessel traffic by vessel type for the years through 2035 as summarized in Tables 86 and 87.[172] Overall, there is a projected increase of 28% in vessel traffic through 2025 and an 82% increase by 2035. The increase in vessel traffic will be seen mostly in product tankers, LNG/gas carriers, and general cargo vessels.

Table 86: Projected Vessel Traffic through Aleutian Islands[173]							
Route	**Vessel Type**	**Annual Transits**					
		2010	**2015**	**2025**	**2025**	**2030**	**2035**
Westbound Traffic	**Container <4,500 TEUs[174]**	480	500	520	560	580	600
	Container >4,500 TEUs	1,020	1,180	1,240	1,400	1,580	1,780
	Bulk Carrier >60,000 DWT	580	600	610	620	630	640
	Bulk Carrier <60,000 DWT	780	790	800	805	810	820
	RoRo	180	220	240	300	380	400
	General Cargo	180	220	240	300	380	400
	Chemical Carrier	500	600	680	780	840	1,020
	Crude Tanker	0	0	0	0	0	0
	Product Tanker	20	40	60	80	100	110
	LNG and Gas Carrier	10	30	50	70	80	90

[169] Probability that an accident will result in oil spillage of any volume. Based on National Research Council 1998.
[170] DWT = deadweight tonnage
[171] Based on Etkin (2013).
[172] Det Norske Veritas & ERM-West, Inc. (2010a; 2010b)
[173] Based on Det Norske Veritas & ERM-West, Inc. (2010a). (Data visually extrapolated from figures.)
[174] TEU = twenty-foot equivalent units.

Table 86: Projected Vessel Traffic through Aleutian Islands[173]							
Route	**Vessel Type**	**Annual Transits**					
		2010	**2015**	**2025**	**2025**	**2030**	**2035**
	Total	**3,750**	**4,180**	**4,440**	**4,915**	**5,380**	**5,860**
Eastbound Traffic	**Container <4,500 TEUs**	190	200	220	240	280	340
	Container >4,500 TEUs	320	390	440	580	640	820
	Bulk Carrier >60,000 DWT	0	0	0	0	0	0
	Bulk Carrier <60,000 DWT	220	240	260	280	300	340
	RoRo	40	100	160	200	260	340
	General Cargo	40	100	160	200	260	340
	Chemical Carrier	620	740	820	960	1,100	1,280
	Crude Tanker	0	0	0	0	0	0
	Product Tanker	10	10	10	10	10	10
	LNG and Gas Carrier	20	40	60	80	100	140
	Total	**1,460**	**1,820**	**2,130**	**2,550**	**2,950**	**3,610**
Total	**Container <4,500 TEUs**	670	700	740	800	860	940
	Container >4,500 TEUs	1,340	1,570	1,680	1,980	2,220	2,600
	Bulk Carrier >60,000 DWT	580	600	610	620	630	640
	Bulk Carrier <60,000 DWT	1,000	1,030	1,060	1,085	1,110	1,160
	RoRo	220	320	400	500	640	740
	General Cargo	220	320	400	500	640	740
	Chemical Carrier	1,120	1,340	1,500	1,740	1,940	2,300
	Crude Tanker	0	0	0	0	0	0
	Product Tanker	30	50	70	90	110	120
	LNG and Gas Carrier	30	70	110	150	180	230
	Total	**5,210**	**6,000**	**6,570**	**7,465**	**8,330**	**9,470**

Table 87: Percentage Increases in Projected Vessel Traffic through Aleutian Islands							
Route	**Vessel Type**	**Percent Increase in Annual Transits from 2010**					
		2010	**2015**	**2025**	**2025**	**2030**	**2035**
Westbound	**Container <4,500 TEUs**	-	4%	8%	17%	21%	25%
	Container >4,500 TEUs	-	16%	22%	37%	55%	75%
	Bulk Carrier >60,000 DWT	-	3%	5%	7%	9%	10%
	Bulk Carrier <60,000 DWT	-	1%	3%	3%	4%	5%
	RoRo	-	22%	33%	67%	111%	122%
	General Cargo	-	22%	33%	67%	111%	122%
	Chemical Carrier	-	20%	36%	56%	68%	104%
	Crude Tanker	-	-	-	-	-	-
	Product Tanker	-	100%	200%	300%	400%	450%
	LNG and Gas Carrier	-	200%	400%	600%	700%	800%
	Total	**-**	**11%**	**18%**	**31%**	**43%**	**56%**
Eastbound	**Container <4,500 TEUs**	-	5%	16%	26%	47%	79%
	Container >4,500 TEUs	-	22%	38%	81%	100%	156%
	Bulk Carrier >60,000 DWT	-	-	-	-	-	-
	Bulk Carrier <60,000 DWT	-	9%	18%	27%	36%	55%
	RoRo	-	150%	300%	400%	550%	750%
	General Cargo	-	150%	300%	400%	550%	750%
	Chemical Carrier	-	19%	32%	55%	77%	106%
	Crude Tanker	-	-	-	-	-	-
	Product Tanker	-	0%	0%	0%	0%	0%
	LNG and Gas Carrier	-	100%	200%	300%	400%	600%
	Total	**-**	**25%**	**46%**	**75%**	**102%**	**147%**

Table 87: Percentage Increases in Projected Vessel Traffic through Aleutian Islands							
Route	**Vessel Type**	**Percent Increase in Annual Transits from 2010**					
		2010	**2015**	**2025**	**2025**	**2030**	**2035**
Total	**Container <4,500 TEUs**	-	4%	10%	19%	28%	40%
	Container >4,500 TEUs	-	17%	25%	48%	66%	94%
	Bulk Carrier >60,000 DWT	-	3%	5%	7%	9%	10%
	Bulk Carrier <60,000 DWT	-	3%	6%	9%	11%	16%
	RoRo	-	45%	82%	127%	191%	236%
	General Cargo	-	45%	82%	127%	191%	236%
	Chemical Carrier	-	20%	34%	55%	73%	105%
	Crude Tanker	-	-	-	-	-	-
	Product Tanker	-	67%	133%	200%	267%	300%
	LNG and Gas Carrier	-	133%	267%	400%	500%	667%
	Total	**-**	**15%**	**26%**	**43%**	**60%**	**82%**

7.17 Bercha Group Chukchi and Beaufort Seas Spill Risk Study 2011

A 2011 study[175] conducted for the Bureau of Ocean Energy Management Regulation and Enforcement (BOEMRE), developed probabilistic estimates of oil spill occurrences in the US Chukchi and Beaufort Seas based on hypothetical oil and gas development. This study was an update of a similar one published in 2002 and was based on more recent data.[176]

For the Beaufort Sea, the study concluded that spill rates for oil exploration and production activities might be estimated as shown in Figure 39. Similar estimates for the Chukchi Sea are shown in Figure 40. The maximized expected rate of increase in spills for the year 2026 is about 13 times the current rate for the Beaufort Sea and about 10 times the current rate for the Chukchi Sea.

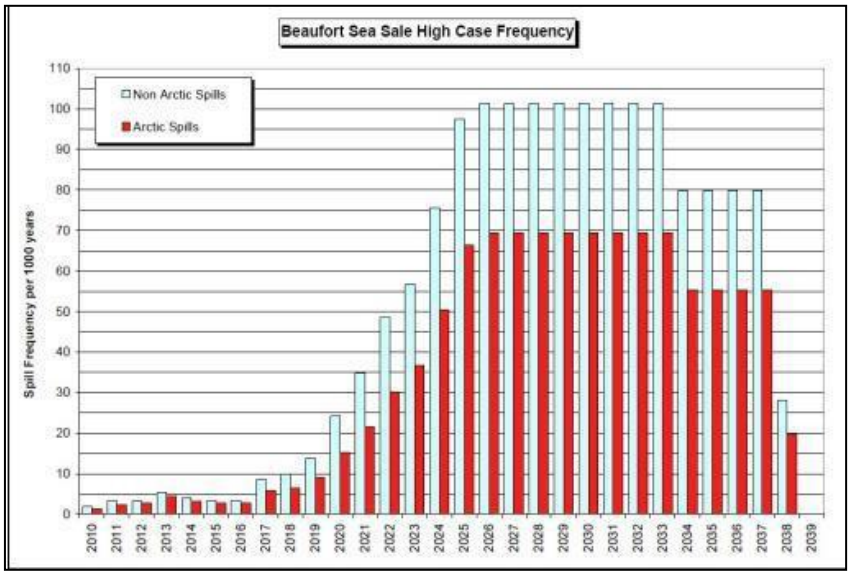


Figure 39: Forecasted Beaufort Sea High Case Frequency Spill Rate[177]

[175] Bercha (2011).
[176] Bercha (2002).
[177] Bercha 2011. Note that the "non-Arctic" spills are shown as a reference to document that spill rates in other areas of the US would likely be higher than for the Arctic.

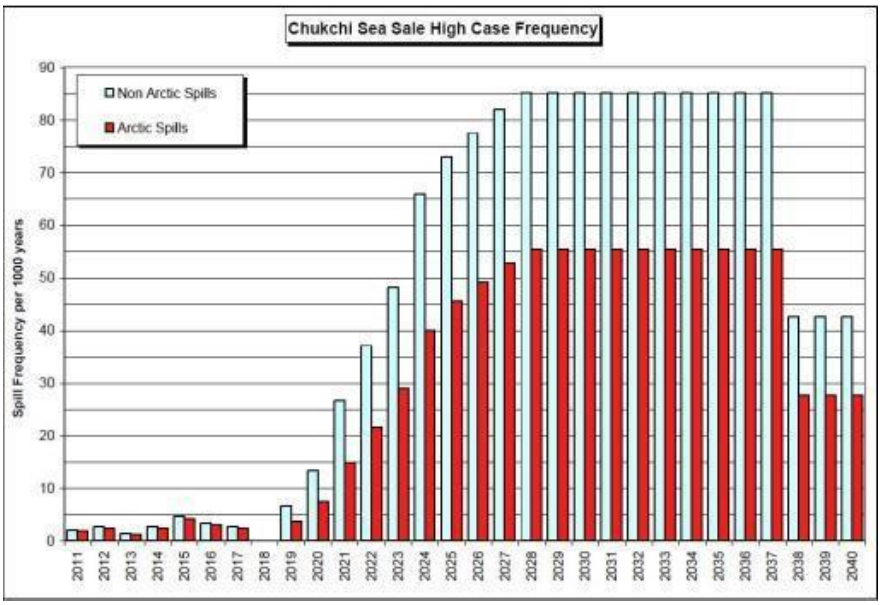


Figure 40: Forecasted Chukchi Sea High Case Frequency Spill Rate

7.18 NOAA Arctic Report Card 2012

Changes in the levels of sea ice will have a significant impact on the potential for vessel traffic in the Arctic waters of Alaska.

According to one study[178] conducted in 2012:

- Record minimum Arctic sea ice extent occurred in September 2012;
- The lowest observed during the satellite record (1979-present) and 49% below the 1979-2000 average minimum;
- 2012 had the largest loss of ice between the March maximum and September minimum extents during the satellite record (Figure 41);
- The extent of multi-year ice continued to decrease; and
- A severe storm in August accelerated ice loss in the Pacific Arctic.

[178] Perovich, et al. (2012).

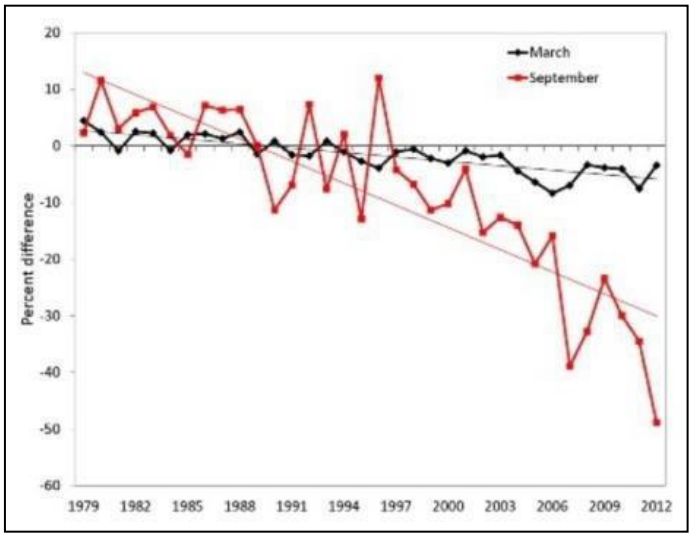


Figure 41: Time Series of Ice Extent Anomalies in March (Max) and September (Min) [179]

7.19 Coordination of Domestic Energy Development & Permitting in Alaska

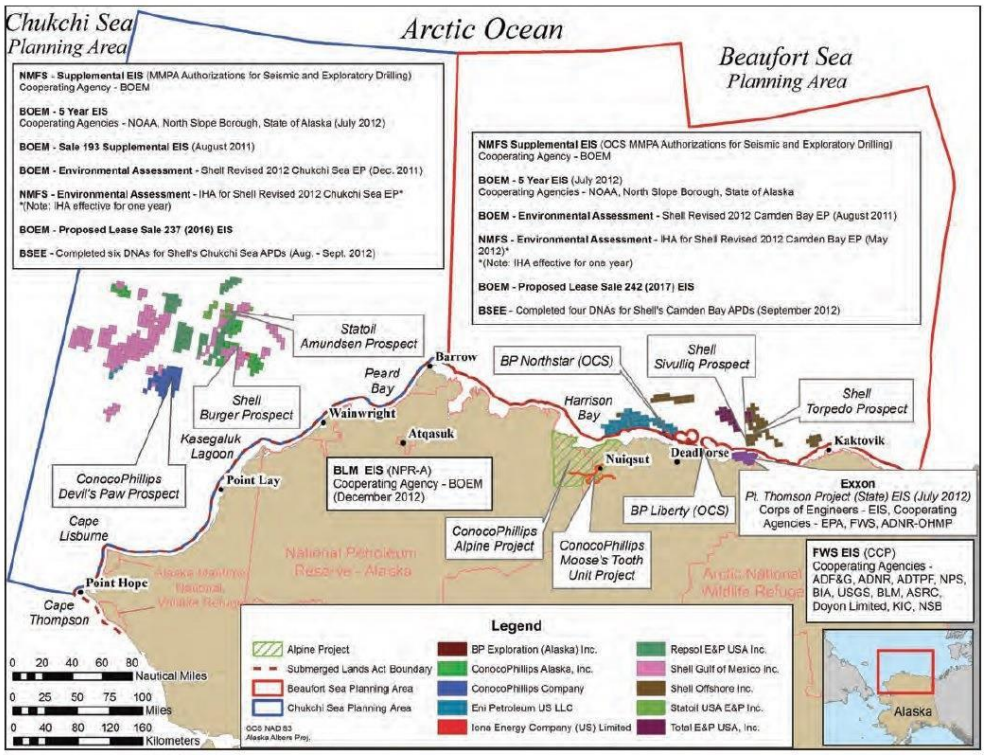
An interagency working group (Department of Interior, NOAA, and White House Office of Science and Technology Policy) prepared a report[180] that outlined the issues related to energy development and permitting in Alaska, as well as other environmental and economic issues facing the state of Alaska. Key findings in the report that relate to the future potential trends for oil spillage were summarized as follows:

> ***Sea Ice***: Seasonal patterns of Arctic sea ice are important drivers of change for marine ecosystems and global climate.[181] The observed loss of summer sea ice has been more extreme than climate models had predicted, and this loss has been accompanied by decreases in both ice thickness and the presence of multi-year ice.[182] Observational data and models forecast a nearly ice-free Arctic Ocean before mid-century, and possibly before 2030.[183]
>
> The summer ice-free region in the US Arctic has increased from about 30 to 300 miles away from shore, but satellite data do not account for the presence of small remnants of pack ice; in the summer of 2012, such ice delayed oil exploration in the Chukchi Sea. Sea ice extent is likely to fluctuate significantly from year to year, but an overall downward trend is consistently predicted by climate models.
>
> For the entire circumpolar Arctic, summer sea ice only covers half the area that it did at the end of the 20th Century. In each of the last six years, Arctic sea ice extent in September was lower than in any other year since the start of the satellite record in 1979. In September 2012, Arctic sea ice

[179] The anomaly value for each year is the difference (in%) in ice extent relative to the mean values for the period 1979-2000. The thin black and red lines are least squares linear regression lines with slopes indicating ice losses of -2.6% and -13.0% per decade in March and September, respectively. (Perovich, et al. 2012.)
[180] Clement, et al. (2013).
[181] Francis and Vavrus (2012).
[182] Wang and Overland (2012).
[183] Wang and Overland (2012); Maslowski, et al. (2012); Stroeve, et al. (2012).

extent was 49% below the average. Prior to 2005, most of the Arctic Ocean was covered by thick, multi-year ice (i.e., had survived one or more summers of melting). Multi-year ice stabilized the ice pack, but its 50% decline since 2005 has made the ice far more susceptible to melting.[184]

Offshore Resources: Over 23 billion barrels of technically recoverable oil and 108 trillion cubic feet of technically recoverable gas are estimated to lie in the Outer Continental Shelf (OCS) of the Beaufort and Chukchi Seas. That represents over 89% of all oil and 82% of all natural gas estimated for all of Alaska's OCS.[185] Shell Oil Company conducted limited preparatory activities for exploratory drilling in the Beaufort and Chukchi Seas in 2012, although ice encroachment and the failure to obtain certification of a required spill containment vessel precluded drilling into hydrocarbon zones. Shell Oil Company has elected not to continue exploration activities in the 2013 season. If Shell Oil Company is able to provide federal authorities with assurances that required safety and environmental safeguards are in place and functional, the company hopes to continue exploration activities in 2014 and beyond. ConocoPhillips and Statoil also hold leases in the Chukchi Sea; ConocoPhillips intends to begin exploratory drilling as soon as 2014. Several other companies also hold offshore leases in the region and seek permission to conduct seismic testing. The 2012 to 2017 OCS Oil and Gas Leasing Program anticipates that additional lease sales could occur in 2016 in the Chukchi Sea and in 2017 in the Beaufort Sea (Figure 42).

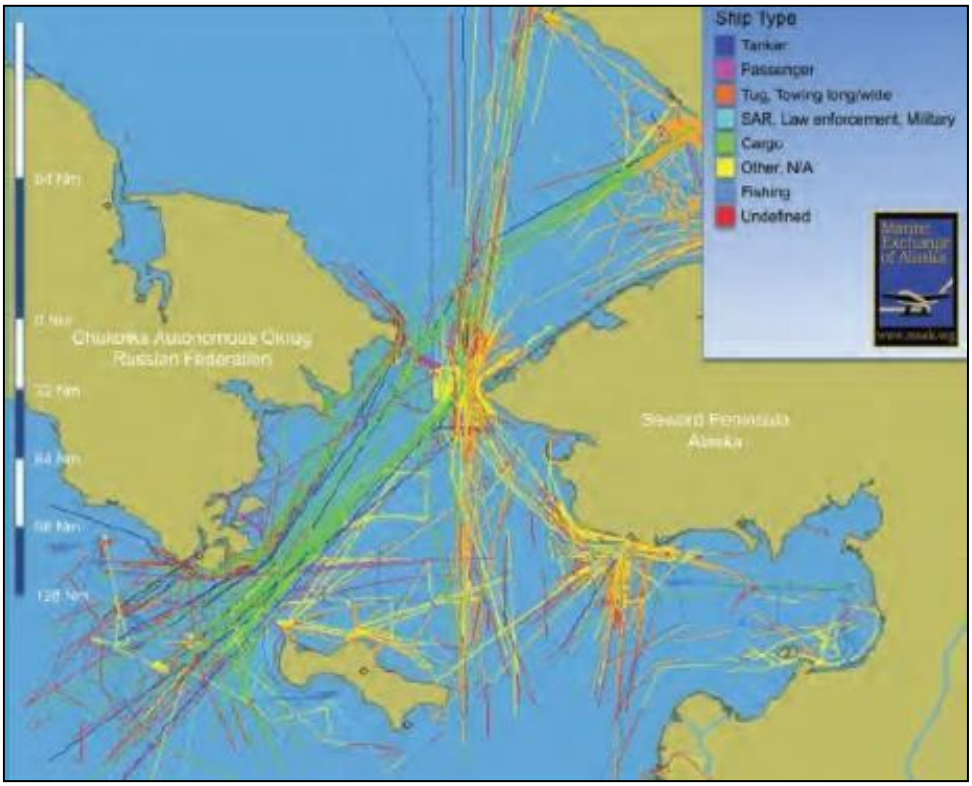


[184] Kwok and Untersteiner 2011.
[185] MMS 2006.

Figure 42: Multiple Environmental Evaluations of Proposed Oil and Gas Activities[186]

Commercial Shipping: Current shipping activity in the US Arctic is mostly regional and centered on the export of resources and the resupply of communities and facilities extracting natural resources. Most shipping is done with tugs and barges due to the absence of deep-water ports in the US Arctic. Oil and gas exploration and development continue to be the primary drivers for commercial maritime traffic in the region. Successful offshore oil and gas exploration and extraction ventures will depend heavily on safe marine transportation.

Diminishing Arctic sea ice is likely to encourage growth of commercial shipping via international trans-Arctic routes, though the time horizon for such an expansion is unclear. These routes may reduce transit distances between Europe and Asia by as much as 5,200 miles.[187] The Marine Exchange of Alaska reports that commercial traffic through the US Arctic increased by 30% from 2008 to 2010, though total number of transits remains small relative to other routes. Transits through the Bering Strait also increased 25% during the same 2-year period. As recorded by the Exchange's Automatic Identification System, there were 300 and 333 commercial-vessel transits of the Bering Strait in Arctic waters in 2011 and 2012, respectively, with many other vessels transiting west of the maritime boundary with Russia (Figure 43 shows transits for 2011). Increased traffic in the Arctic is leading to a growing use of the Bering Strait and Arctic waters, along with a dependency on the currently limited US Arctic support infrastructure.



[186] Bureau of Ocean Energy Management as in Clement, et al. 2013.
[187] Humpert (2011).

Figure 43: 2011 Vessel Traffic in Bering Strait[188]

7.20 US Coast Guard Arctic Strategy Report 2013

The US Coast Guard in its evaluation of its Arctic Strategy,[189] made the following observations:

- There was a 118% increase in maritime transit through the Bering Strait from 2008 through 2012;
- An estimated 4.57 million square miles of Arctic sea ice melted between March and September 2012;
- Oceanic transit between Europe and Asia is cut by 5,000 miles through the use of the Northern Sea Route; and
- Traffic through the Northern Sea Route has increased with 4 vessels taking this route in 2010, 34 vessels in 2011, and 46 vessels transiting the route in 2012, including an LNG vessel (Figure 44).

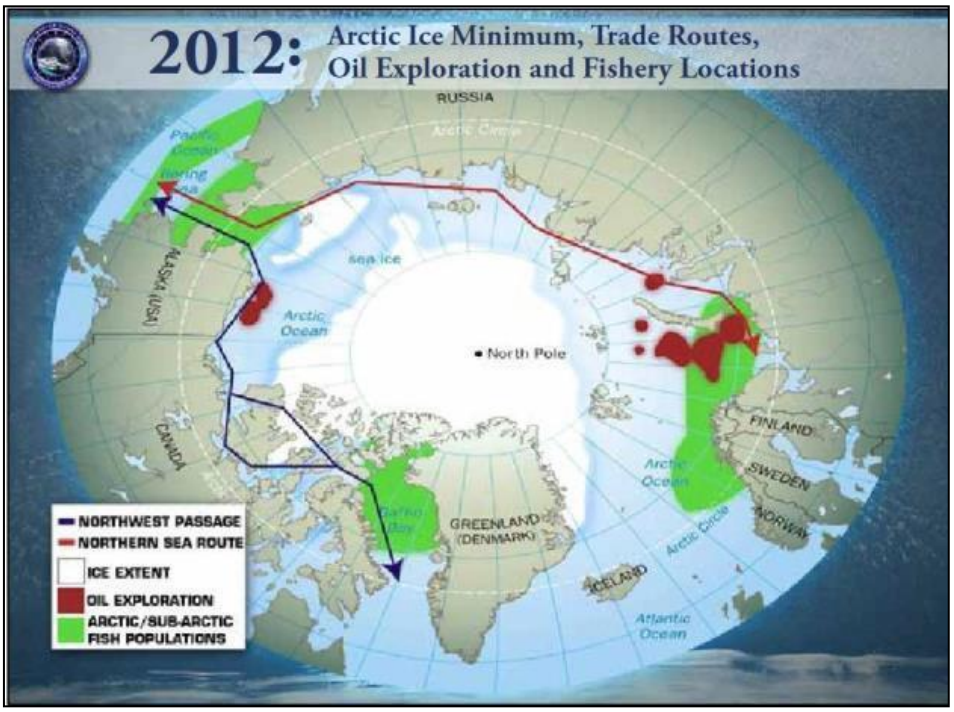


Figure 44: Arctic Ice Minimum, Trade Routes, Oil Exploration and Fishery Locations[190]

7.21 US EIA Forecasts for Future Oil Production in Alaska

The US Energy Information Administration (EIA)[191] has made various predictions for future oil production in Alaska. The assumptions applied to EIA's forecast cases are:[192]

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[188] Marine Exchange of Alaska as in Clement, et al. (2013).
[189] USCG (2013).
[190] USCG (2013).
[191] http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2011&subject=0-AEO2011&table=14-AEO2011&region=0-0&cases=ref2011-d020911a
[192] There are a total of 47 scenarios examined by EIA based on a variety of factors related to economic growth, oil prices, technologies for various energy sectors, and regulatory issues.

- Reference Case: 2.7% per year annual economic growth for the years 2009 – 2035 for world oil prices and technology;
- Annual Energy Outlook (AEO) 2010: 2.4% per year annual economic growth for years 2008 – 2035 with mid-range world oil prices and technology;
- High Economic Growth: 3.2% per year annual economic growth;
- Low Economic Growth: 2.1% per year annual economic growth;
- No Greenhouse Gas Concern: No greenhouse gas emission policy enacted and market decisions not altered;
- Extended Policies: Policies on greenhouse gas emissions and other environmental concerns enacted, such as vehicle efficiency standards;
- Lower Renewable Energy Reliance: Capital costs, operating and maintenance costs, and performance levels for wind, biomass, and geothermal resources do not improve from 2011 levels;
- Higher Renewable Energy Reliance: Levelized costs of energy resources for non-hydropower renewable generating technologies decline and biomass fuel supplies are less expensive;
- High OCS Resource: Oil reserves in undeveloped OCS areas[193] are three times higher than assumed in the reference case; and
- Reduced OCS Access: No new leases in undeveloped areas of OCS through 2035.

The results of the forecasts are shown in Figure 45.

[193] Eastern Gulf of Mexico, Pacific, and Atlantic regions.

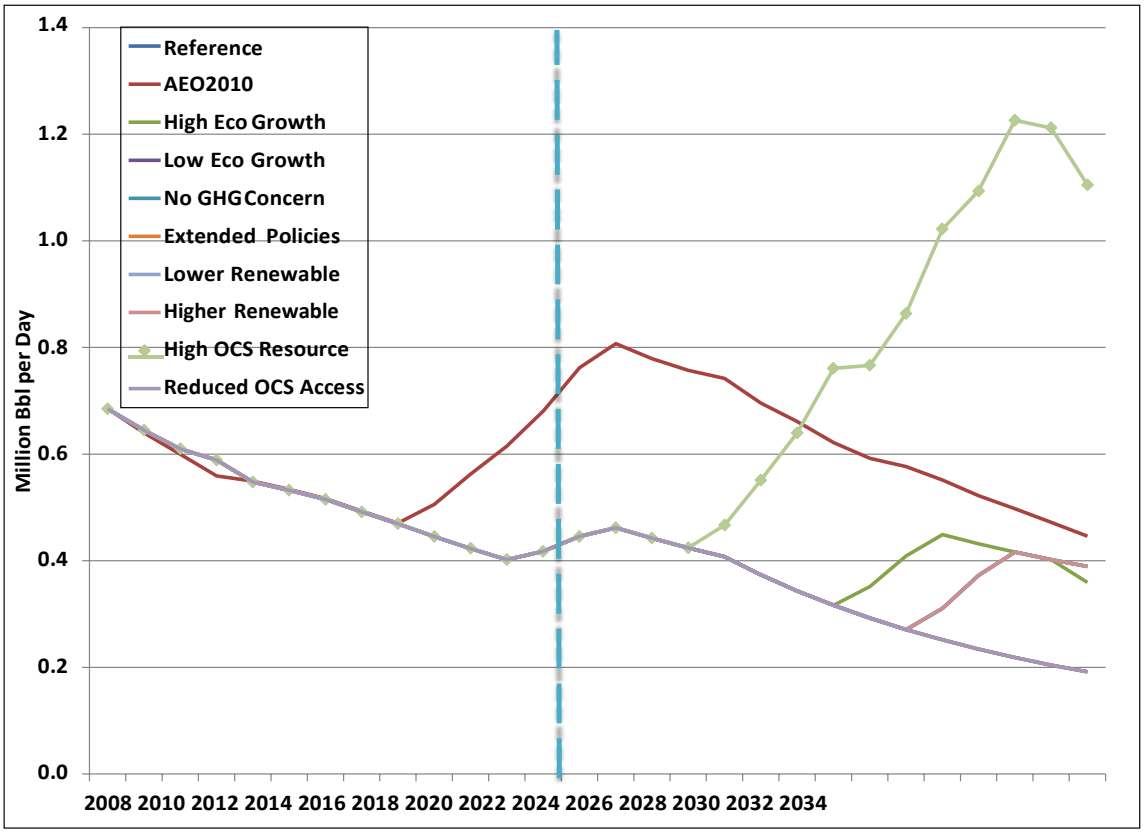

Figure 45: US EIA Forecasts for Alaskan Oil Production

8 Forecasts for Future Spillage

Clearly, forecasting patterns of future spillage in Alaska is a complex task. There are a large number of interrelated economic and environmental factors to consider, along with a great deal of uncertainty. The large number of studies reviewed presents a broad spectrum of data and predictions that may be applied.

8.1 Factors for Changes in Incident Rates for 2025

The factors that could conceivably affect future spillage rates from vessels and facilities are summarized in Table 88.

Table 88: Potential Factors Impacting Future Incident Rates

Factor	Confounding Factors	Potential for Incident Increases by 2025	Potential for Incident Decreases by 2025

Table 88: Potential Factors Impacting Future Incident Rates			
Factor	**Confounding Factors**	**Potential for Incident Increases by 2025**	**Potential for Incident Decreases by 2025**
Cargo Shipping Vessel Traffic	• US economic conditions • World markets for commodities • Traffic routes (opening of Arctic shipping routes) • Implementation of double hulls regulations on bunker tanks • Changes in conditions of cargo vessel fleets • Changes in vessel traffic management and safety regulation enforcement. • Changes in USCG inspection rates. • Increases in sizes of cargo vessels (fewer trips) • Expansion of Roberts Bank Terminal in Vancouver, BC	If cargo shipping (bulk commodities, containers) increases or if Arctic shipping routes increase, there will be increased pass-through vessel traffic, particularly in the Aleutians. With expansion of Roberts Bank Terminal, there may be more incidents involving container ships and bulk carriers in the Southeast.	If there is decreased overall shipping due to economic conditions, there may be less traffic. This would particularly affect the Aleutians. Continued implementation of double-hull regulations on bunker tanks will reduce spillage due to collisions, allisions, and groundings. Improved enforcement of safety regulations and better vessel traffic management in ports and higher-volume shipping lanes will reduce spills. Increases in port state vessel inspections will decrease incidents.
Crude Tanker Vessel Traffic	• World markets for oil • Degree of production on Alaska North Slope and other areas • Relative reliance on Trans-Alaska Pipeline vs. tankers for transport of crude from North Slope to Valdez • Changes of conditions in tanker fleets • US economic conditions	Increased oil production in the Beaufort and Chukchi Sea areas along with other production could increase the need for tanker traffic out of Valdez.	Decreased oil production could lead to decreases in crude oil tanker transport.
Product Tanker and Tank Barge Vessel Traffic	• Changes in demands for refined products • Changes in refinery throughput rates • US economic conditions	Increased demand for refined products and increased refinery throughput could lead to increases in product traffic.	Decreased demand for refined products and decreased refinery throughput could lead to decreases in product traffic.
Fishing Vessel Traffic	• Changes in levels of fishing activity • Changes in fisheries (overfishing, available catches) • Native tribe populations	Increased fishing activity due to discovery of new fishing grounds or increases in fish populations due to environmental factors could increase fishing vessel traffic.	Decreased fishing activity due to decreases in fish populations or changes in environmental factors could decrease fishing vessel traffic.

Table 88: Potential Factors Impacting Future Incident Rates			
Factor	**Confounding Factors**	**Potential for Incident Increases by 2025**	**Potential for Incident Decreases by 2025**
Cruise Vessel Traffic	• US economic conditions • Tourism industry changes	Increased tourism to Alaska could lead to increased cruise ship traffic.	Decreased tourism to Alaska could lead to decreased cruise ship traffic.
Other Vessel Traffic	• Changes in local economic conditions • Populations changes	Increased population levels and general increased economy could lead to increased vessel traffic.	Decreased population levels and general decreased economy could lead to increased vessel traffic.
Oil Exploration and Production Activities	• US and world economy • Regulatory issues • Reliance on alternative energy	Increased oil production could lead to increased potential for spillage.	Decreased oil production could lead to decreased potential for spillage.

8.2 Types of Changes in Forecasts

There are four general types of changes in spillage patterns that might occur in the future:

- Changes in the frequency (annual probability) of spillage;
- Changes in the volume of spillage;
- Changes in spill locations; and
- Changes in oil types spilled.

8.3 Assumptions Applied to Forecasts for 2025

Based on a review of the spectrum of studies related to future spillage risk the following assumptions were applied to forecasting spill rates for the year 2025 for this study:

- Potential reduction in overall tanker spillage rates by 34% attributable to additional changes in risk mitigation measures for causes other than impact accidents;[194]
- Reduction in spill probability based on full implementation of double hulls for tank vessels (tankers and tank barges) due to impact accidents,[195] which make up 2% of tanker incidents and 16% of barge incidents in Alaska, as follows:[196]
    - Crude tankers – 67% reduction;
    - Product tankers – 63% reduction;
    - Tank barges – 58% reduction;
- Increase of vessel traffic in Cook Inlet and other regions (except Aleutians, Beaufort Sea, and Chukchi Sea) by 25%;
- Decrease in the probability of spillage from non-tank vessels by 23% due to the presence of double-hulls on bunker tanks on 45% of vessels;[197]

[194] Conservative application of 68% reduction rate potential in Prince William Sound Risk Assessment (Harrald, et al. 1996; Merrick, et al. 2002; Grabowski 2005).
[195] Collisions, allisions, and groundings only.
[196] Based on Kirtley, et al. (2012), based on Etkin (2002) with modifications for findings in Yip, et al. (2011) and National Research Council (1991); and Etkin (2013).

- Increase in vessel traffic in the Aleutians, Beaufort Sea, and Chukchi Sea as follows:
    - Container ships: 34%
    - Bulk carriers: 6%
    - General cargo vessels: 82%
    - Product tankers: 133%
- Increase in Beaufort Sea oil exploration and production-related spillage rates by 400% and in Chukchi Sea by 150%;[198]
- Overall increases spills from facility and vessel activities (if not otherwise addressed in another category in this list) of 14%;[199] and
- An increase of 20% Cook Inlet spillage rates from oil exploration and production.[200]

The only assumption for change in spill volume is:

- 50% reduction in WCD volumes for crude and product tankers.

The assumption for change in oil type is:

- Shift of 50% from heavy bunker fuel to diesel fuel on larger ships due to regulatory changes related to air emissions in in-port areas.[201]

Seasonal distribution of incidents is assumed to change as follows:

- For any time periods for which the incident rate is zero for shipping, oil production, and other activities, with the exception of recreational boating and cruise ship transits, the incident rate will be distributed across these time periods due to the presumed lower rate of ice coverage.

9 Forecasted Spillage for 2025

Applying the assumptions on incident rates, oil type, and WCD volumes to the methodology used to determine the baseline spillage rates, the results in Table 89 were derived. Table 90 compares the values for the baseline data and the forecasted data. Table 91 shows the forecasted data in order of decreasing frequency.

[197] Based on Kirtley, et al. (2012), based on Etkin (2002) with modifications for findings in Yip, et al. (2011) and National Research Council (1991); and Etkin (2013).
[198] Conservative application of high forecast rates from Bercha (2011).
[199] Based on an annual increase in economic growth of 2.5% coupled with an increase in spill prevention and risk mitigation measures to reduce spillage by 30%;
[200] Slight decrease predicted by US EIA forecasts coupled with potential increase in production predicted by Eley 2012.
[201] This means that there will be less heavy fuel oil on board many vessels with a shift to diesel. Many of the vessels will still run on heavy fuel oil at sea.

Table 89: Forecasted Frequency of Incidents by Season, Oil Type, and Region with WCD and MA-MMPD Volumes													
Region	**Period**	**Volume (bbl)**											
		Crude			**Distillate**			**Heavy**			**Light**		
		Inc. Freq.	**WCD[202]**	**WA-MMPD[203]**	**Inc. Freq.**	**WCD**	**WA-MMPD**	**Inc. Freq.**	**WCD**	**WA-MMPD**	**Inc. Freq.**	**WCD**	**WA-MMPD**
Aleutians	**Dec-Jan**	0.0653	950,000	600	0.2481	950,000	400	0.4034	950,000	1,500	12.9977	950,000	200
	Feb-Mar	0.0653	950,000	600	0.8087	950,000	400	0.3618	950,000	1,500	22.7957	950,000	200
	Apr-May	0.0653	950,000	600	0.5790	950,000	400	0.1601	950,000	1,500	14.3347	950,000	200
	Jun-Jul	0.0653	950,000	600	1.0384	950,000	400	0.2817	950,000	1,500	15.4982	950,000	200
	Aug-Sep	0.0653	950,000	600	0.5790	950,000	400	0.4834	950,000	1,500	18.9479	950,000	200
	Oct-Nov	0.0653	950,000	600	0.4595	950,000	400	0.3169	950,000	1,500	13.0589	950,000	200
Aniakchak	**Dec-Jan**	0.0075	261,500	1,900	0.0421	261,500	400	0.0175	261,500	2,300	0.1274	261,500	400
	Feb-Mar	0.0075	261,500	1,900	0.0421	261,500	400	0.0175	261,500	2,300	0.8967	261,500	400
	Apr-May	0.0075	261,500	1,900	0.0421	261,500	400	0.0175	261,500	2,300	0.4484	261,500	400
	Jun-Jul	0.0075	261,500	1,900	0.0421	261,500	400	0.0175	261,500	2,300	0.7031	261,500	400
	Aug-Sep	0.0075	261,500	1,900	0.0421	261,500	400	0.0175	261,500	2,300	0.7031	261,500	400
	Oct-Nov	0.0075	261,500	1,900	0.0421	261,500	400	0.0175	261,500	2,300	0.3210	261,500	400
Beaufort Sea	**Dec-Jan**	10.0116	3,900,000	1,200	0.3663	950,000	1,100	0.0585	950,000	1,600	50.9039	950,000	1,200
	Feb-Mar	17.9627	3,900,000	1,200	0.3663	950,000	1,100	0.0585	950,000	1,600	64.4009	950,000	1,200
	Apr-May	20.3626	3,900,000	1,200	0.3663	950,000	1,100	0.0585	950,000	1,600	57.2405	950,000	1,200
	Jun-Jul	25.2351	3,900,000	1,200	0.3663	950,000	1,100	0.0585	950,000	1,600	47.1865	950,000	1,200
	Aug-Sep	15.8295	3,900,000	1,200	0.3663	950,000	1,100	0.0585	950,000	1,600	44.5040	950,000	1,200
	Oct-Nov	13.0902	3,900,000	1,200	0.3663	950,000	1,100	0.0585	950,000	1,600	36.8156	950,000	1,200
Bristol Bay	**Dec-Jan**	0.0000	n/a	n/a	0.0923	163,000	1,000	0.0112	163,000	500	0.3268	163,000	200
	Feb-Mar	0.0000	n/a	n/a	0.0923	163,000	1,000	0.0112	163,000	500	0.6536	163,000	200
	Apr-May	0.0000	n/a	n/a	0.2285	163,000	1,000	0.0174	163,000	500	2.4121	163,000	200
	Jun-Jul	0.0000	n/a	n/a	0.1777	163,000	1,000	0.0784	163,000	500	7.5579	163,000	200
	Aug-Sep	0.0000	n/a	n/a	0.0877	163,000	1,000	0.0311	163,000	500	1.4317	163,000	200
	Oct-Nov	0.0000	n/a	n/a	0.0623	163,000	1,000	0.0112	163,000	500	0.4565	163,000	200
Cook Inlet	**Dec-Jan**	1.2577	950,000	1,200	0.4903	261,500	800	0.8900	950,000	1,200	7.4082	950,000	700
	Feb-Mar	1.6266	950,000	1,200	0.6296	261,500	800	0.8900	950,000	1,200	8.3179	950,000	700
	Apr-May	2.7250	950,000	1,200	1.3984	261,500	800	1.2432	950,000	1,200	10.8098	950,000	700
	Jun-Jul	1.9997	950,000	1,200	0.9081	261,500	800	1.5964	950,000	1,200	13.9647	950,000	700
	Aug-Sep	2.7837	950,000	1,200	1.0419	261,500	800	2.1332	950,000	1,200	12.4453	950,000	700

[202] WCD = worst-case discharge
[203] WA-MMPD = weight-averaged maximum most-probable discharge

Table 89: Forecasted Frequency of Incidents by Season, Oil Type, and Region with WCD and MA-MMPD Volumes													
Region	Period	Volume (bbl)											
		Crude			Distillate			Heavy			Light		
		Inc. Freq.	WCD[202]	WA-MMPD[203]	Inc. Freq.	WCD	WA-MMPD	Inc. Freq.	WCD	WA-MMPD	Inc. Freq.	WCD	WA-MMPD
	Oct-Nov	1.2577	950,000	1,200	0.4903	261,500	800	1.2432	950,000	1,200	7.7130	950,000	700
Kotzebue Sound/ Hope Basin	Dec-Jan	0.0000	n/a	n/a	0.2162	163,000	300	0.0185	163,000	1,400	0.1087	163,000	800
	Feb-Mar	0.0000	n/a	n/a	0.2162	163,000	300	0.0185	163,000	1,400	0.2739	163,000	800
	Apr-May	0.0000	n/a	n/a	0.0378	163,000	300	0.0185	163,000	1,400	0.1652	163,000	800
	Jun-Jul	0.0000	n/a	n/a	0.0730	163,000	300	0.0185	163,000	1,400	0.7086	163,000	800
	Aug-Sep	0.0000	n/a	n/a	0.0676	163,000	300	0.0185	163,000	1,400	0.3260	163,000	800
	Oct-Nov	0.0000	n/a	n/a	0.0378	163,000	300	0.0185	163,000	1,400	0.4304	163,000	800
Kodiak/ Shelikof Strait	Dec-Jan	0.0144	950,000	1,700	0.6093	261,500	300	0.0909	950,000	1,200	7.9391	950,000	100
	Feb-Mar	0.0144	950,000	1,700	0.2031	261,500	300	0.0598	950,000	1,200	8.4463	950,000	100
	Apr-May	0.0144	950,000	1,700	0.7149	261,500	300	0.0909	950,000	1,200	8.2555	950,000	100
	Jun-Jul	0.0144	950,000	1,700	0.5118	261,500	300	0.0335	950,000	1,200	10.3997	950,000	100
	Aug-Sep	0.0144	950,000	1,700	0.2031	261,500	300	0.0909	950,000	1,200	7.8136	950,000	100
	Oct-Nov	0.0144	950,000	1,700	0.4225	261,500	300	0.1507	950,000	1,200	6.8042	950,000	100
Chukchi Sea	Dec-Jan	0.0610	2,200,000	1,200	0.0259	950,000	200	0.0271	950,000	2,000	0.1828	950,000	800
	Feb-Mar	0.0610	2,200,000	1,200	0.0259	950,000	200	0.0271	950,000	2,000	0.2553	950,000	800
	Apr-May	0.0610	2,200,000	1,200	0.0259	950,000	200	0.0271	950,000	2,000	0.2176	950,000	800
	Jun-Jul	0.0610	2,200,000	1,200	0.0259	950,000	200	0.0271	950,000	2,000	0.9835	950,000	800
	Aug-Sep	0.0610	2,200,000	1,200	0.0259	950,000	200	0.0271	950,000	2,000	0.6934	950,000	800
	Oct-Nov	0.0610	2,200,000	1,200	0.0259	950,000	200	0.0271	950,000	2,000	0.4729	950,000	800
Norton Sound/ St. Lawrence Island	Dec-Jan	0.0000	n/a	n/a	0.1322	163,000	700	0.0227	163,000	200	0.3049	163,000	500
	Feb-Mar	0.0000	n/a	n/a	0.1224	163,000	700	0.0227	163,000	200	0.4259	163,000	500
	Apr-May	0.0000	n/a	n/a	0.0685	163,000	700	0.0054	163,000	200	0.3630	163,000	500
	Jun-Jul	0.0000	n/a	n/a	0.2008	163,000	700	0.0066	163,000	200	1.6407	163,000	500
	Aug-Sep	0.0000	n/a	n/a	0.1861	163,000	700	0.0054	163,000	200	1.1567	163,000	500
	Oct-Nov	0.0000	n/a	n/a	0.0685	163,000	700	0.0054	163,000	200	0.7889	163,000	500
Off Kenai Peninsula	Dec-Jan	0.0031	261,500	1,900	0.0792	261,500	300	0.0489	261,500	700	1.4822	261,500	100
	Feb-Mar	0.0031	261,500	1,900	0.0792	261,500	300	0.0489	261,500	700	2.4463	261,500	100
	Apr-May	0.0031	261,500	1,900	0.1204	261,500	300	0.0137	261,500	700	3.0207	261,500	100
	Jun-Jul	0.0031	261,500	1,900	0.0792	261,500	300	0.0137	261,500	700	3.4772	261,500	100
	Aug-Sep	0.0031	261,500	1,900	0.2377	261,500	300	0.0137	261,500	700	2.5694	261,500	100
	Oct-Nov	0.0031	261,500	1,900	0.5166	261,500	300	0.0137	261,500	700	1.9335	261,500	100
South-Central	Dec-Jan	0.0617	950,000	2,500	0.0295	950,000	300	0.0258	950,000	2,200	0.4808	950,000	400

Table 89: Forecasted Frequency of Incidents by Season, Oil Type, and Region with WCD and MA-MMPD Volumes													
Region	Period	Volume (bbl)											
		Crude			Distillate			Heavy			Light		
		Inc. Freq.	WCD[202]	WA-MMPD[203]	Inc. Freq.	WCD	WA-MMPD	Inc. Freq.	WCD	WA-MMPD	Inc. Freq.	WCD	WA-MMPD
	Feb-Mar	0.0617	950,000	2,500	0.0295	950,000	300	0.0586	950,000	2,200	1.0217	950,000	400
	Apr-May	0.0271	950,000	2,500	0.0739	950,000	300	0.0586	950,000	2,200	1.3714	950,000	400
	Jun-Jul	0.0222	950,000	2,500	0.0369	950,000	300	0.0211	950,000	2,200	0.9616	950,000	400
	Aug-Sep	0.0222	950,000	2,500	0.0369	950,000	300	0.0211	950,000	2,200	1.1583	950,000	400
	Oct-Nov	0.0271	950,000	2,500	0.0295	950,000	300	0.0258	950,000	2,200	0.5409	950,000	400
Prince William Sound	Dec-Jan	0.4957	261,500	2,000	0.4625	950,000	600	0.5221	950,000	1,200	5.7062	950,000	200
	Feb-Mar	0.3658	261,500	2,000	0.4625	950,000	600	0.5221	950,000	1,200	6.2634	950,000	200
	Apr-May	0.2996	261,500	2,000	0.9251	950,000	600	0.5221	950,000	1,200	7.6097	950,000	200
	Jun-Jul	0.4003	261,500	2,000	0.9987	950,000	600	2.3494	950,000	1,200	12.2504	950,000	200
	Aug-Sep	0.1670	261,500	2,000	0.3311	950,000	600	0.5221	950,000	1,200	8.5592	950,000	200
	Oct-Nov	0.3340	261,500	2,000	0.8673	950,000	600	1.4171	950,000	1,200	5.0330	950,000	200
Southeast Alaska	Dec-Jan	0.0419	950,000	1,200	2.6772	950,000	200	0.3002	950,000	900	23.2539	950,000	200
	Feb-Mar	0.0419	950,000	1,200	2.6772	950,000	200	0.2559	950,000	900	31.7744	950,000	200
	Apr-May	0.0419	950,000	1,200	2.6772	950,000	200	0.2559	950,000	900	29.7936	950,000	200
	Jun-Jul	0.0419	950,000	1,200	2.6772	950,000	200	0.3855	950,000	900	51.0515	950,000	200
	Aug-Sep	0.0419	950,000	1,200	2.6772	950,000	200	0.5151	950,000	900	44.9049	950,000	200
	Oct-Nov	0.0419	950,000	1,200	2.6772	950,000	200	0.6004	950,000	900	30.1714	950,000	200
Western Alaska	Dec-Jan	0.0000	n/a	n/a	0.1835	950,000	700	0.0410	950,000	800	1.4753	950,000	400
	Feb-Mar	0.0000	n/a	n/a	0.0918	950,000	700	0.0410	950,000	800	1.9245	950,000	400
	Apr-May	0.0000	n/a	n/a	0.1909	950,000	700	0.0410	950,000	800	3.3334	950,000	400
	Jun-Jul	0.0000	n/a	n/a	0.5983	950,000	700	0.0410	950,000	800	4.6096	950,000	400
	Aug-Sep	0.0000	n/a	n/a	0.4148	950,000	700	0.0410	950,000	800	5.0588	950,000	400
	Oct-Nov	0.0000	n/a	n/a	0.4148	950,000	700	0.0410	950,000	800	1.9806	950,000	400

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
Aleutians	Dec-Jan	Crude	0	n/a	n/a	0.0653	950,000	600
	Feb-Mar	Crude	0	n/a	n/a	0.0653	950,000	600
	Apr-May	Crude	0	n/a	n/a	0.0653	950,000	600
	Jun-Jul	Crude	0	n/a	n/a	0.0653	950,000	600

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
	Aug-Sep	Crude	0	n/a	n/a	0.0653	950,000	600
	Oct-Nov	Crude	0	n/a	n/a	0.0653	950,000	600
	Dec-Jan	Distillate	0.12	523,000	250	0.2481	950,000	400
	Feb-Mar	Distillate	0.39	523,000	560	0.8087	950,000	400
	Apr-May	Distillate	0.28	523,000	560	0.579	950,000	400
	Jun-Jul	Distillate	0.5	523,000	560	1.0384	950,000	400
	Aug-Sep	Distillate	0.28	523,000	560	0.579	950,000	400
	Oct-Nov	Distillate	0.22	523,000	560	0.4595	950,000	400
	Dec-Jan	Heavy	0.56	523,000	250	0.4034	950,000	1,500
	Feb-Mar	Heavy	0.5	523,000	560	0.3618	950,000	1,500
	Apr-May	Heavy	0.22	523,000	560	0.1601	950,000	1,500
	Jun-Jul	Heavy	0.39	523,000	560	0.2817	950,000	1,500
	Aug-Sep	Heavy	0.67	523,000	560	0.4834	950,000	1,500
	Oct-Nov	Heavy	0.44	523,000	560	0.3169	950,000	1,500
	Dec-Jan	Light	11.28	523,000	250	12.9977	950,000	200
	Feb-Mar	Light	19.78	523,000	560	22.7957	950,000	200
	Apr-May	Light	12.44	523,000	560	14.3347	950,000	200
	Jun-Jul	Light	13.45	523,000	560	15.4982	950,000	200
	Aug-Sep	Light	16.44	523,000	560	18.9479	950,000	200
	Oct-Nov	Light	11.33	523,000	560	13.0589	950,000	200
Aniakchak	Dec-Jan	Crude	0.02	523,000	560	0.0075	261,500	1,900
	Feb-Mar	Crude	0.02	523,000	150	0.0075	261,500	1,900
	Apr-May	Crude	0.02	523,000	150	0.0075	261,500	1,900
	Jun-Jul	Crude	0.02	523,000	150	0.0075	261,500	1,900
	Aug-Sep	Crude	0.02	523,000	150	0.0075	261,500	1,900
	Oct-Nov	Crude	0.02	523,000	150	0.0075	261,500	1,900
	Dec-Jan	Distillate	0.03	523,000	560	0.0421	261,500	400
	Feb-Mar	Distillate	0.03	523,000	150	0.0421	261,500	400
	Apr-May	Distillate	0.03	523,000	150	0.0421	261,500	400
	Jun-Jul	Distillate	0.03	523,000	150	0.0421	261,500	400
	Aug-Sep	Distillate	0.03	523,000	150	0.0421	261,500	400
	Oct-Nov	Distillate	0.03	523,000	150	0.0421	261,500	400
	Dec-Jan	Heavy	0.04	523,000	560	0.0175	261,500	2,300

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
	Feb-Mar	Heavy	0.04	523,000	150	0.0175	261,500	2,300
	Apr-May	Heavy	0.04	523,000	150	0.0175	261,500	2,300
	Jun-Jul	Heavy	0.04	523,000	150	0.0175	261,500	2,300
	Aug-Sep	Heavy	0.04	523,000	150	0.0175	261,500	2,300
	Oct-Nov	Heavy	0.04	523,000	150	0.0175	261,500	2,300
	Dec-Jan	Light	0.11	523,000	560	0.1274	261,500	400
	Feb-Mar	Light	0.78	523,000	150	0.8967	261,500	400
	Apr-May	Light	0.39	523,000	150	0.4484	261,500	400
	Jun-Jul	Light	0.61	523,000	150	0.7031	261,500	400
	Aug-Sep	Light	0.61	523,000	150	0.7031	261,500	400
	Oct-Nov	Light	0.28	523,000	150	0.321	261,500	400
Beaufort Sea	Dec-Jan	Crude	1.83	3,900,000	1,200	10.0116	3,900,000	1,200
	Feb-Mar	Crude	3.28	1,900,000	830	17.9627	3,900,000	1,200
	Apr-May	Crude	3.72	1,900,000	830	20.3626	3,900,000	1,200
	Jun-Jul	Crude	4.61	1,900,000	830	25.2351	3,900,000	1,200
	Aug-Sep	Crude	2.89	1,900,000	830	15.8295	3,900,000	1,200
	Oct-Nov	Crude	2.39	1,900,000	830	13.0902	3,900,000	1,200
	Dec-Jan	Distillate	0	n/a	n/a	0.3663	950,000	1,100
	Feb-Mar	Distillate	0	n/a	n/a	0.3663	950,000	1,100
	Apr-May	Distillate	0.06	523,000	830	0.3663	950,000	1,100
	Jun-Jul	Distillate	0.06	523,000	830	0.3663	950,000	1,100
	Aug-Sep	Distillate	0.06	523,000	830	0.3663	950,000	1,100
	Oct-Nov	Distillate	0.06	523,000	830	0.3663	950,000	1,100
	Dec-Jan	Heavy	0	n/a	n/a	0.0585	950,000	1,600
	Feb-Mar	Heavy	0	n/a	n/a	0.0585	950,000	1,600
	Apr-May	Heavy	0.07	1,900,000	830	0.0585	950,000	1,600
	Jun-Jul	Heavy	0.07	1,900,000	830	0.0585	950,000	1,600
	Aug-Sep	Heavy	0.07	1,900,000	830	0.0585	950,000	1,600
	Oct-Nov	Heavy	0.07	1,900,000	830	0.0585	950,000	1,600
	Dec-Jan	Light	10.67	523,000	1,200	50.9039	950,000	1,200
	Feb-Mar	Light	13.5	1,900,000	830	64.4009	950,000	1,200
	Apr-May	Light	12	1,900,000	830	57.2405	950,000	1,200
	Jun-Jul	Light	9.89	1,900,000	830	47.1865	950,000	1,200

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
	Aug-Sep	Light	9.33	1,900,000	830	44.504	950,000	1,200
	Oct-Nov	Light	7.72	1,900,000	830	36.8156	950,000	1,200
Bristol Bay	Dec-Jan	Crude	0	n/a	n/a	0	n/a	n/a
	Feb-Mar	Crude	0	n/a	n/a	0	n/a	n/a
	Apr-May	Crude	0	n/a	n/a	0	n/a	n/a
	Jun-Jul	Crude	0	n/a	n/a	0	n/a	n/a
	Aug-Sep	Crude	0	n/a	n/a	0	n/a	n/a
	Oct-Nov	Crude	0	n/a	n/a	0	n/a	n/a
	Dec-Jan	Distillate	0	n/a	n/a	0.0923	163,000	1,000
	Feb-Mar	Distillate	0	n/a	n/a	0.0923	163,000	1,000
	Apr-May	Distillate	0.44	523,000	150	0.2285	163,000	1,000
	Jun-Jul	Distillate	0.34	523,000	150	0.1777	163,000	1,000
	Aug-Sep	Distillate	0.17	523,000	150	0.0877	163,000	1,000
	Oct-Nov	Distillate	0.12	523,000	150	0.0623	163,000	1,000
	Dec-Jan	Heavy	0.04	163,000	420	0.0112	163,000	500
	Feb-Mar	Heavy	0.04	1,900,000	150	0.0112	163,000	500
	Apr-May	Heavy	0.06	1,900,000	150	0.0174	163,000	500
	Jun-Jul	Heavy	0.28	1,900,000	150	0.0784	163,000	500
	Aug-Sep	Heavy	0.11	1,900,000	150	0.0311	163,000	500
	Oct-Nov	Heavy	0.04	1,900,000	150	0.0112	163,000	500
	Dec-Jan	Light	0.28	163,000	420	0.3268	163,000	200
	Feb-Mar	Light	0.56	1,900,000	150	0.6536	163,000	200
	Apr-May	Light	2.06	1,900,000	150	2.4121	163,000	200
	Jun-Jul	Light	6.45	1,900,000	150	7.5579	163,000	200
	Aug-Sep	Light	1.22	1,900,000	150	1.4317	163,000	200
	Oct-Nov	Light	0.39	1,900,000	150	0.4565	163,000	200
Cook Inlet	Dec-Jan	Crude	1.33	1,900,000	830	1.2577	950,000	1,200
	Feb-Mar	Crude	1.72	1,900,000	670	1.6266	950,000	1,200
	Apr-May	Crude	2.88	1,900,000	670	2.725	950,000	1,200
	Jun-Jul	Crude	2.11	1,900,000	670	1.9997	950,000	1,200
	Aug-Sep	Crude	2.94	1,900,000	670	2.7837	950,000	1,200
	Oct-Nov	Crude	1.33	1,900,000	670	1.2577	950,000	1,200
	Dec-Jan	Distillate	0.39	523,000	830	0.4903	261,500	800

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	**Period**	**Oil Type**	**Baseline**			**Forecasted (2025)**		
			Annual Frequency	**WCD (bbl)**	**WA-MMPD (bbl)**	**Annual Frequency**	**WCD (bbl)**	**WA-MMPD (bbl)**
	Feb-Mar	**Distillate**	0.5	523,000	670	0.6296	261,500	800
	Apr-May	**Distillate**	1.11	523,000	670	1.3984	261,500	800
	Jun-Jul	**Distillate**	0.72	523,000	670	0.9081	261,500	800
	Aug-Sep	**Distillate**	0.83	523,000	670	1.0419	261,500	800
	Oct-Nov	**Distillate**	0.39	523,000	670	0.4903	261,500	800
	Dec-Jan	**Heavy**	0.28	1,900,000	830	0.89	950,000	1,200
	Feb-Mar	**Heavy**	0.28	1,900,000	670	0.89	950,000	1,200
	Apr-May	**Heavy**	0.39	1,900,000	670	1.2432	950,000	1,200
	Jun-Jul	**Heavy**	0.5	1,900,000	670	1.5964	950,000	1,200
	Aug-Sep	**Heavy**	0.67	1,900,000	670	2.1332	950,000	1,200
	Oct-Nov	**Heavy**	0.39	1,900,000	670	1.2432	950,000	1,200
	Dec-Jan	**Light**	6.78	1,900,000	830	7.4082	950,000	700
	Feb-Mar	**Light**	7.61	1,900,000	670	8.3179	950,000	700
	Apr-May	**Light**	9.89	1,900,000	670	10.8098	950,000	700
	Jun-Jul	**Light**	12.78	1,900,000	670	13.9647	950,000	700
	Aug-Sep	**Light**	11.39	1,900,000	670	12.4453	950,000	700
	Oct-Nov	**Light**	7.06	1,900,000	670	7.713	950,000	700
Kotzebue Sound/ Hope Basin	**Dec-Jan**	**Crude**	0	n/a	n/a	0	n/a	n/a
	Feb-Mar	**Crude**	0	n/a	n/a	0	n/a	n/a
	Apr-May	**Crude**	0	n/a	n/a	0	n/a	n/a
	Jun-Jul	**Crude**	0	n/a	n/a	0	n/a	n/a
	Aug-Sep	**Crude**	0	n/a	n/a	0	n/a	n/a
	Oct-Nov	**Crude**	0	n/a	n/a	0	n/a	n/a
	Dec-Jan	**Distillate**	0	n/a	n/a	0.2162	163,000	300
	Feb-Mar	**Distillate**	0	n/a	n/a	0.2162	163,000	300
	Apr-May	**Distillate**	0.06	523,000	520	0.0378	163,000	300
	Jun-Jul	**Distillate**	0.12	523,000	520	0.073	163,000	300
	Aug-Sep	**Distillate**	0.11	523,000	520	0.0676	163,000	300
	Oct-Nov	**Distillate**	0.06	523,000	520	0.0378	163,000	300
	Dec-Jan	**Heavy**	0	n/a	n/a	0.0185	163,000	1,400
	Feb-Mar	**Heavy**	0	n/a	n/a	0.0185	163,000	1,400
	Apr-May	**Heavy**	0.03	1,900,000	520	0.0185	163,000	1,400
	Jun-Jul	**Heavy**	0.03	1,900,000	520	0.0185	163,000	1,400

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
	Aug-Sep	Heavy	0.03	1,900,000	520	0.0185	163,000	1,400
	Oct-Nov	Heavy	0.03	1,900,000	520	0.0185	163,000	1,400
	Dec-Jan	Light	0.11	163,000	790	0.1087	163,000	800
	Feb-Mar	Light	0.28	1,900,000	520	0.2739	163,000	800
	Apr-May	Light	0.17	1,900,000	520	0.1652	163,000	800
	Jun-Jul	Light	0.72	1,900,000	520	0.7086	163,000	800
	Aug-Sep	Light	0.33	1,900,000	520	0.326	163,000	800
	Oct-Nov	Light	0.44	1,900,000	520	0.4304	163,000	800
Kodiak/ Shelikof Strait	Dec-Jan	Crude	0.05	1,900,000	150	0.0144	950,000	1,700
	Feb-Mar	Crude	0.05	1,900,000	230	0.0144	950,000	1,700
	Apr-May	Crude	0.05	1,900,000	230	0.0144	950,000	1,700
	Jun-Jul	Crude	0.05	1,900,000	230	0.0144	950,000	1,700
	Aug-Sep	Crude	0.05	1,900,000	230	0.0144	950,000	1,700
	Oct-Nov	Crude	0.05	1,900,000	230	0.0144	950,000	1,700
	Dec-Jan	Distillate	0.33	523,000	150	0.6093	261,500	300
	Feb-Mar	Distillate	0.11	523,000	230	0.2031	261,500	300
	Apr-May	Distillate	0.39	523,000	230	0.7149	261,500	300
	Jun-Jul	Distillate	0.28	523,000	230	0.5118	261,500	300
	Aug-Sep	Distillate	0.11	523,000	230	0.2031	261,500	300
	Oct-Nov	Distillate	0.23	523,000	230	0.4225	261,500	300
	Dec-Jan	Heavy	0.17	1,900,000	150	0.0909	950,000	1,200
	Feb-Mar	Heavy	0.11	1,900,000	230	0.0598	950,000	1,200
	Apr-May	Heavy	0.17	1,900,000	230	0.0909	950,000	1,200
	Jun-Jul	Heavy	0.06	1,900,000	230	0.0335	950,000	1,200
	Aug-Sep	Heavy	0.17	1,900,000	230	0.0909	950,000	1,200
	Oct-Nov	Heavy	0.28	1,900,000	230	0.1507	950,000	1,200
	Dec-Jan	Light	7	1,900,000	150	7.9391	950,000	100
	Feb-Mar	Light	7.45	1,900,000	230	8.4463	950,000	100
	Apr-May	Light	7.28	1,900,000	230	8.2555	950,000	100
	Jun-Jul	Light	9.17	1,900,000	230	10.3997	950,000	100
	Aug-Sep	Light	6.89	1,900,000	230	7.8136	950,000	100
	Oct-Nov	Light	6	1,900,000	230	6.8042	950,000	100
Chukchi Sea	Dec-Jan	Crude	0.01	2,200,000	560	0.061	2,200,000	1,200

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
	Feb-Mar	Crude	0.01	2,200,000	1,200	0.061	2,200,000	1,200
	Apr-May	Crude	0.01	2,200,000	1,200	0.061	2,200,000	1,200
	Jun-Jul	Crude	0.01	2,200,000	1,200	0.061	2,200,000	1,200
	Aug-Sep	Crude	0.01	2,200,000	1,200	0.061	2,200,000	1,200
	Oct-Nov	Crude	0.01	2,200,000	1,200	0.061	2,200,000	1,200
	Dec-Jan	Distillate	0.07	50,000	560	0.0259	950,000	200
	Feb-Mar	Distillate	0.07	523,000	1,200	0.0259	950,000	200
	Apr-May	Distillate	0.07	523,000	1,200	0.0259	950,000	200
	Jun-Jul	Distillate	0.07	523,000	1,200	0.0259	950,000	200
	Aug-Sep	Distillate	0.07	523,000	1,200	0.0259	950,000	200
	Oct-Nov	Distillate	0.07	523,000	1,200	0.0259	950,000	200
	Dec-Jan	Heavy	0	n/a	n/a	0.0271	950,000	2,000
	Feb-Mar	Heavy	0	n/a	n/a	0.0271	950,000	2,000
	Apr-May	Heavy	0.02	523,000	1,200	0.0271	950,000	2,000
	Jun-Jul	Heavy	0.02	523,000	1,200	0.0271	950,000	2,000
	Aug-Sep	Heavy	0.02	523,000	1,200	0.0271	950,000	2,000
	Oct-Nov	Heavy	0.02	523,000	1,200	0.0271	950,000	2,000
	Dec-Jan	Light	0.22	50,000	560	0.1828	950,000	800
	Feb-Mar	Light	0.11	523,000	1,200	0.2553	950,000	800
	Apr-May	Light	0.11	523,000	1,200	0.2176	950,000	800
	Jun-Jul	Light	0.11	523,000	1,200	0.9835	950,000	800
	Aug-Sep	Light	0.61	523,000	1,200	0.6934	950,000	800
	Oct-Nov	Light	0.06	523,000	1,200	0.4729	950,000	800
Norton Sound/ St. Lawrence Island	Dec-Jan	Crude	0	n/a	n/a	0	n/a	n/a
	Feb-Mar	Crude	0	n/a	n/a	0	n/a	n/a
	Apr-May	Crude	0	n/a	n/a	0	n/a	n/a
	Jun-Jul	Crude	0	n/a	n/a	0	n/a	n/a
	Aug-Sep	Crude	0	n/a	n/a	0	n/a	n/a
	Oct-Nov	Crude	0	n/a	n/a	0	n/a	n/a
	Dec-Jan	Distillate	0.12	163,000	650	0.1322	163,000	700
	Feb-Mar	Distillate	0.11	50,000	560	0.1224	163,000	700
	Apr-May	Distillate	0.06	50,000	560	0.0685	163,000	700
	Jun-Jul	Distillate	0.18	50,000	560	0.2008	163,000	700

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
	Aug-Sep	Distillate	0.17	50,000	560	0.1861	163,000	700
	Oct-Nov	Distillate	0.06	50,000	560	0.0685	163,000	700
	Dec-Jan	Heavy	0	n/a	n/a	0.0227	163,000	200
	Feb-Mar	Heavy	0	n/a	n/a	0.0227	163,000	200
	Apr-May	Heavy	0.04	30,000	560	0.0054	163,000	200
	Jun-Jul	Heavy	0.05	30,000	560	0.0066	163,000	200
	Aug-Sep	Heavy	0.04	30,000	560	0.0054	163,000	200
	Oct-Nov	Heavy	0.04	30,000	560	0.0054	163,000	200
	Dec-Jan	Light	0.28	163,000	650	0.3049	163,000	500
	Feb-Mar	Light	0.39	50,000	560	0.4259	163,000	500
	Apr-May	Light	0.33	50,000	560	0.363	163,000	500
	Jun-Jul	Light	1.5	50,000	560	1.6407	163,000	500
	Aug-Sep	Light	1.06	50,000	560	1.1567	163,000	500
	Oct-Nov	Light	0.72	50,000	560	0.7889	163,000	500
Off Kenai Peninsula	Dec-Jan	Crude	0.01	523,000	150	0.0031	261,500	1,900
	Feb-Mar	Crude	0.01	523,000	150	0.0031	261,500	1,900
	Apr-May	Crude	0.01	523,000	150	0.0031	261,500	1,900
	Jun-Jul	Crude	0.01	523,000	150	0.0031	261,500	1,900
	Aug-Sep	Crude	0.01	523,000	150	0.0031	261,500	1,900
	Oct-Nov	Crude	0.01	523,000	150	0.0031	261,500	1,900
	Dec-Jan	Distillate	0.11	523,000	150	0.0792	261,500	300
	Feb-Mar	Distillate	0.11	523,000	250	0.0792	261,500	300
	Apr-May	Distillate	0.17	523,000	250	0.1204	261,500	300
	Jun-Jul	Distillate	0.11	523,000	250	0.0792	261,500	300
	Aug-Sep	Distillate	0.33	523,000	250	0.2377	261,500	300
	Oct-Nov	Distillate	0.06	523,000	250	0.5166	261,500	300
	Dec-Jan	Heavy	0.11	523,000	150	0.0489	261,500	700
	Feb-Mar	Heavy	0.11	523,000	250	0.0489	261,500	700
	Apr-May	Heavy	0.03	523,000	250	0.0137	261,500	700
	Jun-Jul	Heavy	0.03	523,000	250	0.0137	261,500	700
	Aug-Sep	Heavy	0.03	523,000	250	0.0137	261,500	700
	Oct-Nov	Heavy	0.03	523,000	250	0.0137	261,500	700
	Dec-Jan	Light	1.28	523,000	150	1.4822	261,500	100

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	**Period**	**Oil Type**	**Baseline**			**Forecasted (2025)**		
			Annual Frequency	**WCD (bbl)**	**WA-MMPD (bbl)**	**Annual Frequency**	**WCD (bbl)**	**WA-MMPD (bbl)**
	Feb-Mar	**Light**	2.11	523,000	250	2.4463	261,500	100
	Apr-May	**Light**	2.61	523,000	250	3.0207	261,500	100
	Jun-Jul	**Light**	3	523,000	250	3.4772	261,500	100
	Aug-Sep	**Light**	2.22	523,000	250	2.5694	261,500	100
	Oct-Nov	**Light**	1.67	523,000	250	1.9335	261,500	100
South-Central Alaska	**Dec-Jan**	**Crude**	0.11	1,900,000	670	0.0617	950,000	2,500
	Feb-Mar	**Crude**	0.11	1,900,000	520	0.0617	950,000	2,500
	Apr-May	**Crude**	0.05	1,900,000	420	0.0271	950,000	2,500
	Jun-Jul	**Crude**	0.04	1,900,000	420	0.0222	950,000	2,500
	Aug-Sep	**Crude**	0.04	1,900,000	420	0.0222	950,000	2,500
	Oct-Nov	**Crude**	0.05	1,900,000	420	0.0271	950,000	2,500
	Dec-Jan	**Distillate**	0	n/a	n/a	0.0295	950,000	300
	Feb-Mar	**Distillate**	0	n/a	n/a	0.0295	950,000	300
	Apr-May	**Distillate**	0.22	163,000	420	0.0739	950,000	300
	Jun-Jul	**Distillate**	0.11	163,000	420	0.0369	950,000	300
	Aug-Sep	**Distillate**	0.11	163,000	420	0.0369	950,000	300
	Oct-Nov	**Distillate**	0	n/a	n/a	0.0295	950,000	300
	Dec-Jan	**Heavy**	0.05	1,900,000	670	0.0258	950,000	2,200
	Feb-Mar	**Heavy**	0.11	163,000	420	0.0586	950,000	2,200
	Apr-May	**Heavy**	0.11	163,000	420	0.0586	950,000	2,200
	Jun-Jul	**Heavy**	0.04	163,000	420	0.0211	950,000	2,200
	Aug-Sep	**Heavy**	0.04	163,000	420	0.0211	950,000	2,200
	Oct-Nov	**Heavy**	0.05	163,000	420	0.0258	950,000	2,200
	Dec-Jan	**Light**	0.39	1,900,000	670	0.4808	950,000	400
	Feb-Mar	**Light**	0.83	163,000	420	1.0217	950,000	400
	Apr-May	**Light**	1.11	163,000	420	1.3714	950,000	400
	Jun-Jul	**Light**	0.78	163,000	420	0.9616	950,000	400
	Aug-Sep	**Light**	0.94	163,000	420	1.1583	950,000	400
	Oct-Nov	**Light**	0.44	163,000	420	0.5409	950,000	400
Prince William Sound	**Dec-Jan**	**Crude**	0.83	1,900,000	520	0.4957	261,500	2,000
	Feb-Mar	**Crude**	0.61	1,900,000	520	0.3658	261,500	2,000
	Apr-May	**Crude**	0.5	1,900,000	520	0.2996	261,500	2,000
	Jun-Jul	**Crude**	0.67	1,900,000	520	0.4003	261,500	2,000

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
	Aug-Sep	Crude	0.28	1,900,000	520	0.167	261,500	2,000
	Oct-Nov	Crude	0.56	1,900,000	520	0.334	261,500	2,000
	Dec-Jan	Distillate	0.39	523,000	520	0.4625	950,000	600
	Feb-Mar	Distillate	0.39	163,000	790	0.4625	950,000	600
	Apr-May	Distillate	0.78	163,000	790	0.9251	950,000	600
	Jun-Jul	Distillate	0.84	163,000	790	0.9987	950,000	600
	Aug-Sep	Distillate	0.28	163,000	790	0.3311	950,000	600
	Oct-Nov	Distillate	0.73	163,000	790	0.8673	950,000	600
	Dec-Jan	Heavy	0.06	1,900,000	520	0.5221	950,000	1,200
	Feb-Mar	Heavy	0.06	163,000	790	0.5221	950,000	1,200
	Apr-May	Heavy	0.06	163,000	790	0.5221	950,000	1,200
	Jun-Jul	Heavy	0.28	163,000	790	2.3494	950,000	1,200
	Aug-Sep	Heavy	0.06	163,000	790	0.5221	950,000	1,200
	Oct-Nov	Heavy	0.17	163,000	790	1.4171	950,000	1,200
	Dec-Jan	Light	5.67	1,900,000	520	5.7062	950,000	200
	Feb-Mar	Light	6.22	163,000	790	6.2634	950,000	200
	Apr-May	Light	7.56	163,000	790	7.6097	950,000	200
	Jun-Jul	Light	12.17	163,000	790	12.2504	950,000	200
	Aug-Sep	Light	8.5	163,000	790	8.5592	950,000	200
	Oct-Nov	Light	5	163,000	790	5.033	950,000	200
Southeast Alaska	Dec-Jan	Crude	0.03	1,900,000	230	0.0419	950,000	1,200
	Feb-Mar	Crude	0.03	1,900,000	230	0.0419	950,000	1,200
	Apr-May	Crude	0.03	1,900,000	230	0.0419	950,000	1,200
	Jun-Jul	Crude	0.03	1,900,000	230	0.0419	950,000	1,200
	Aug-Sep	Crude	0.03	1,900,000	230	0.0419	950,000	1,200
	Oct-Nov	Crude	0.03	1,900,000	230	0.0419	950,000	1,200
	Dec-Jan	Distillate	2.11	523,000	230	2.6772	950,000	200
	Feb-Mar	Distillate	1.61	163,000	650	2.6772	950,000	200
	Apr-May	Distillate	1.72	163,000	650	2.6772	950,000	200
	Jun-Jul	Distillate	3.72	163,000	650	2.6772	950,000	200
	Aug-Sep	Distillate	3.61	163,000	650	2.6772	950,000	200
	Oct-Nov	Distillate	2.83	163,000	650	2.6772	950,000	200
	Dec-Jan	Heavy	0.39	1,900,000	230	0.3002	950,000	900

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes								
Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
	Feb-Mar	Heavy	0.33	163,000	650	0.2559	950,000	900
	Apr-May	Heavy	0.33	163,000	650	0.2559	950,000	900
	Jun-Jul	Heavy	0.5	163,000	650	0.3855	950,000	900
	Aug-Sep	Heavy	0.67	163,000	650	0.5151	950,000	900
	Oct-Nov	Heavy	0.78	163,000	650	0.6004	950,000	900
	Dec-Jan	Light	20.17	1,900,000	230	23.2539	950,000	200
	Feb-Mar	Light	27.56	163,000	650	31.7744	950,000	200
	Apr-May	Light	25.84	163,000	650	29.7936	950,000	200
	Jun-Jul	Light	44.28	163,000	650	51.0515	950,000	200
	Aug-Sep	Light	38.95	163,000	650	44.9049	950,000	200
	Oct-Nov	Light	26.17	163,000	650	30.1714	950,000	200
Western Alaska	Dec-Jan	Crude	0	n/a	n/a	0	n/a	n/a
	Feb-Mar	Crude	0	n/a	n/a	0	n/a	n/a
	Apr-May	Crude	0	n/a	n/a	0	n/a	n/a
	Jun-Jul	Crude	0	n/a	n/a	0	n/a	n/a
	Aug-Sep	Crude	0	n/a	n/a	0	n/a	n/a
	Oct-Nov	Crude	0	n/a	n/a	0	n/a	n/a
	Dec-Jan	Distillate	0.22	163,000	510	0.1835	950,000	700
	Feb-Mar	Distillate	0.11	163,000	510	0.0918	950,000	700
	Apr-May	Distillate	0.23	163,000	510	0.1909	950,000	700
	Jun-Jul	Distillate	0.72	163,000	510	0.5983	950,000	700
	Aug-Sep	Distillate	0.5	163,000	510	0.4148	950,000	700
	Oct-Nov	Distillate	0.5	163,000	510	0.4148	950,000	700
	Dec-Jan	Heavy	0	n/a	n/a	0.041	950,000	800
	Feb-Mar	Heavy	0	n/a	n/a	0.041	950,000	800
	Apr-May	Heavy	0.07	163,000	510	0.041	950,000	800
	Jun-Jul	Heavy	0.07	163,000	510	0.041	950,000	800
	Aug-Sep	Heavy	0.07	163,000	510	0.041	950,000	800
	Oct-Nov	Heavy	0.07	163,000	510	0.041	950,000	800
	Dec-Jan	Light	1.28	163,000	510	1.4753	950,000	400
	Feb-Mar	Light	1.67	163,000	510	1.9245	950,000	400
	Apr-May	Light	2.89	163,000	510	3.3334	950,000	400
	Jun-Jul	Light	4	163,000	510	4.6096	950,000	400

Table 90: Comparison of Baseline and Forecasted Incident Rates and Volumes

Region	Period	Oil Type	Baseline			Forecasted (2025)		
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	WCD (bbl)	WA-MMPD (bbl)
	Aug-Sep	Light	4.39	163,000	510	5.0588	950,000	400
	Oct-Nov	Light	1.72	163,000	510	1.9806	950,000	400

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Beaufort Sea	Feb-Mar	Light	13.5	1,900,000	830	64.4009	HIGHEST >20/YEAR	950,000	1,200
Beaufort Sea	Apr-May	Light	12	1,900,000	830	57.2405		950,000	1,200
Southeast Alaska	Jun-Jul	Light	44.28	163,000	650	51.0515		950,000	200
Beaufort Sea	Dec-Jan	Light	10.67	523,000	1,200	50.9039		950,000	1,200
Beaufort Sea	Jun-Jul	Light	9.89	1,900,000	830	47.1865		950,000	1,200
Southeast Alaska	Aug-Sep	Light	38.95	163,000	650	44.9049		950,000	200
Beaufort Sea	Aug-Sep	Light	9.33	1,900,000	830	44.504		950,000	1,200
Beaufort Sea	Oct-Nov	Light	7.72	1,900,000	830	36.8156		950,000	1,200
Southeast Alaska	Feb-Mar	Light	27.56	163,000	650	31.7744		950,000	200
Southeast Alaska	Oct-Nov	Light	26.17	163,000	650	30.1714		950,000	200
Southeast Alaska	Apr-May	Light	25.84	163,000	650	29.7936		950,000	200
Beaufort Sea	Jun-Jul	Crude	4.61	1,900,000	830	25.2351		3,900,000	1,200
Southeast Alaska	Dec-Jan	Light	20.17	1,900,000	230	23.2539		950,000	200
Aleutians	Feb-Mar	Light	19.78	523,000	560	22.7957		950,000	200
Beaufort Sea	Apr-May	Crude	3.72	1,900,000	830	20.3626		3,900,000	1,200
Aleutians	Aug-Sep	Light	16.44	523,000	560	18.9479	VERY HIGH 10 – 20/YEAR	950,000	200
Beaufort Sea	Feb-Mar	Crude	3.28	1,900,000	830	17.9627		3,900,000	1,200
Beaufort Sea	Aug-Sep	Crude	2.89	1,900,000	830	15.8295		3,900,000	1,200
Aleutians	Jun-Jul	Light	13.45	523,000	560	15.4982		950,000	200
Aleutians	Apr-May	Light	12.44	523,000	560	14.3347		950,000	200
Cook Inlet	Jun-Jul	Light	12.78	1,900,000	670	13.9647		950,000	700
Beaufort Sea	Oct-Nov	Crude	2.39	1,900,000	830	13.0902		3,900,000	1,200
Aleutians	Oct-Nov	Light	11.33	523,000	560	13.0589		950,000	200
Aleutians	Dec-Jan	Light	11.28	523,000	250	12.9977		950,000	200
Cook Inlet	Aug-Sep	Light	11.39	1,900,000	670	12.4453		950,000	700
Prince William Sound	Jun-Jul	Light	12.17	163,000	790	12.2504		950,000	200

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Cook Inlet	**Apr-May**	**Light**	9.89	1,900,000	670	10.8098		950,000	700
Kodiak	**Jun-Jul**	**Light**	9.17	1,900,000	230	10.3997		950,000	100
Beaufort Sea	**Dec-Jan**	**Crude**	1.83	3,900,000	1,200	10.0116		3,900,000	1,200
Prince William Sound	**Aug-Sep**	**Light**	8.5	163,000	790	8.5592	**HIGH 5 – 9/YEAR**	950,000	200
Kodiak	**Feb-Mar**	**Light**	7.45	1,900,000	230	8.4463		950,000	100
Cook Inlet	**Feb-Mar**	**Light**	7.61	1,900,000	670	8.3179		950,000	700
Kodiak	**Apr-May**	**Light**	7.28	1,900,000	230	8.2555		950,000	100
Kodiak	**Dec-Jan**	**Light**	7	1,900,000	150	7.9391		950,000	100
Kodiak	**Aug-Sep**	**Light**	6.89	1,900,000	230	7.8136		950,000	100
Cook Inlet	**Oct-Nov**	**Light**	7.06	1,900,000	670	7.713		950,000	700
Prince William Sound	**Apr-May**	**Light**	7.56	163,000	790	7.6097		950,000	200
Bristol Bay	**Jun-Jul**	**Light**	6.45	1,900,000	150	7.5579		163,000	200
Cook Inlet	**Dec-Jan**	**Light**	6.78	1,900,000	830	7.4082		950,000	700
Kodiak	**Oct-Nov**	**Light**	6	1,900,000	230	6.8042		950,000	100
Prince William Sound	**Feb-Mar**	**Light**	6.22	163,000	790	6.2634		950,000	200
Prince William Sound	**Dec-Jan**	**Light**	5.67	1,900,000	520	5.7062		950,000	200
Western Alaska	**Aug-Sep**	**Light**	4.39	163,000	510	5.0588		950,000	400
Prince William Sound	**Oct-Nov**	**Light**	5	163,000	790	5.033		950,000	200
Western Alaska	**Jun-Jul**	**Light**	4	163,000	510	4.6096	**MODERATE 2 – 4/YEAR**	950,000	400
Off Kenai	**Jun-Jul**	**Light**	3	523,000	250	3.4772		261,500	100
Western Alaska	**Apr-May**	**Light**	2.89	163,000	510	3.3334		950,000	400
Off Kenai	**Apr-May**	**Light**	2.61	523,000	250	3.0207		261,500	100
Cook Inlet	**Aug-Sep**	**Crude**	2.94	1,900,000	670	2.7837		950,000	1,200
Cook Inlet	**Apr-May**	**Crude**	2.88	1,900,000	670	2.725		950,000	1,200
Southeast Alaska	**Jun-Jul**	**Distillate**	3.72	163,000	650	2.6772		950,000	200
Southeast Alaska	**Aug-Sep**	**Distillate**	3.61	163,000	650	2.6772		950,000	200
Southeast Alaska	**Oct-Nov**	**Distillate**	2.83	163,000	650	2.6772		950,000	200
Southeast Alaska	**Dec-Jan**	**Distillate**	2.11	523,000	230	2.6772		950,000	200
Southeast Alaska	**Apr-May**	**Distillate**	1.72	163,000	650	2.6772		950,000	200
Southeast Alaska	**Feb-Mar**	**Distillate**	1.61	163,000	650	2.6772		950,000	200
Off Kenai	**Aug-Sep**	**Light**	2.22	523,000	250	2.5694		261,500	100
Off Kenai	**Feb-Mar**	**Light**	2.11	523,000	250	2.4463		261,500	100
Bristol Bay	**Apr-May**	**Light**	2.06	1,900,000	150	2.4121		163,000	200

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Prince William Sound	**Jun-Jul**	**Heavy**	0.28	163,000	790	2.3494		950,000	1,200
Cook Inlet	**Aug-Sep**	**Heavy**	0.67	1,900,000	670	2.1332		950,000	1,200
Cook Inlet	**Jun-Jul**	**Crude**	2.11	1,900,000	670	1.9997		950,000	1,200
Western Alaska	**Oct-Nov**	**Light**	1.72	163,000	510	1.9806		950,000	400
Off Kenai	**Oct-Nov**	**Light**	1.67	523,000	250	1.9335		261,500	100
Western Alaska	**Feb-Mar**	**Light**	1.67	163,000	510	1.9245		950,000	400
Norton/St. Lawrence	**Jun-Jul**	**Light**	1.5	50,000	560	1.6407		163,000	500
Cook Inlet	**Feb-Mar**	**Crude**	1.72	1,900,000	670	1.6266		950,000	1,200
Cook Inlet	**Jun-Jul**	**Heavy**	0.5	1,900,000	670	1.5964		950,000	1,200
Off Kenai	**Dec-Jan**	**Light**	1.28	523,000	150	1.4822		261,500	100
Western Alaska	**Dec-Jan**	**Light**	1.28	163,000	510	1.4753		950,000	400
Bristol Bay	**Aug-Sep**	**Light**	1.22	1,900,000	150	1.4317		163,000	200
Prince William Sound	**Oct-Nov**	**Heavy**	0.17	163,000	790	1.4171		950,000	1,200
Cook Inlet	**Apr-May**	**Distillate**	1.11	523,000	670	1.3984		261,500	800
South-Central	**Apr-May**	**Light**	1.11	163,000	420	1.3714		950,000	400
Cook Inlet	**Dec-Jan**	**Crude**	1.33	1,900,000	830	1.2577	**LOW 1/YEAR**	950,000	1,200
Cook Inlet	**Oct-Nov**	**Crude**	1.33	1,900,000	670	1.2577		950,000	1,200
Cook Inlet	**Apr-May**	**Heavy**	0.39	1,900,000	670	1.2432		950,000	1,200
Cook Inlet	**Oct-Nov**	**Heavy**	0.39	1,900,000	670	1.2432		950,000	1,200
South-Central	**Aug-Sep**	**Light**	0.94	163,000	420	1.1583		950,000	400
Norton/St. Lawrence	**Aug-Sep**	**Light**	1.06	50,000	560	1.1567		163,000	500
Cook Inlet	**Aug-Sep**	**Distillate**	0.83	523,000	670	1.0419		261,500	800
Aleutians	**Jun-Jul**	**Distillate**	0.5	523,000	560	1.0384		261,500	400
South-Central	**Feb-Mar**	**Light**	0.83	163,000	420	1.0217		950,000	400
Prince William Sound	**Jun-Jul**	**Distillate**	0.84	163,000	790	0.9987		950,000	600
Chukchi Sea	**Jun-Jul**	**Light**	0.11	523,000	1,200	0.9835		950,000	800
South-Central	**Jun-Jul**	**Light**	0.78	163,000	420	0.9616		950,000	400
Prince William Sound	**Apr-May**	**Distillate**	0.78	163,000	790	0.9251	**VERY LOW < 1/YEAR**	950,000	600
Cook Inlet	**Jun-Jul**	**Distillate**	0.72	523,000	670	0.9081		261,500	800
Aniakchak	**Feb-Mar**	**Light**	0.78	523,000	150	0.8967		261,500	400
Cook Inlet	**Dec-Jan**	**Heavy**	0.28	1,900,000	830	0.89		950,000	1,200
Cook Inlet	**Feb-Mar**	**Heavy**	0.28	1,900,000	670	0.89		950,000	1,200
Prince William Sound	**Oct-Nov**	**Distillate**	0.73	163,000	790	0.8673		950,000	600

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Aleutians	**Feb-Mar**	**Distillate**	0.39	523,000	560	0.8087		950,000	400
Norton/St. Lawrence	**Oct-Nov**	**Light**	0.72	50,000	560	0.7889		163,000	500
Kodiak	**Apr-May**	**Distillate**	0.39	523,000	230	0.7149		261,500	300
Kotzebue/Hope	**Jun-Jul**	**Light**	0.72	1,900,000	520	0.7086		163,000	800
Aniakchak	**Jun-Jul**	**Light**	0.61	523,000	150	0.7031		261,500	400
Aniakchak	**Aug-Sep**	**Light**	0.61	523,000	150	0.7031		261,500	400
Chukchi Sea	**Aug-Sep**	**Light**	0.61	523,000	1,200	0.6934		950,000	800
Bristol Bay	**Feb-Mar**	**Light**	0.56	1,900,000	150	0.6536		163,000	200
Cook Inlet	**Feb-Mar**	**Distillate**	0.5	523,000	670	0.6296		261,500	800
Kodiak	**Dec-Jan**	**Distillate**	0.33	523,000	150	0.6093		261,500	300
Southeast Alaska	**Oct-Nov**	**Heavy**	0.78	163,000	650	0.6004		950,000	900
Western Alaska	**Jun-Jul**	**Distillate**	0.72	163,000	510	0.5983		950,000	700
Aleutians	**Apr-May**	**Distillate**	0.28	523,000	560	0.579		950,000	400
Aleutians	**Aug-Sep**	**Distillate**	0.28	523,000	560	0.579		950,000	400
South-Central	**Oct-Nov**	**Light**	0.44	163,000	420	0.5409		950,000	400
Prince William Sound	**Dec-Jan**	**Heavy**	0.06	1,900,000	520	0.5221		950,000	1,200
Prince William Sound	**Feb-Mar**	**Heavy**	0.06	163,000	790	0.5221		950,000	1,200
Prince William Sound	**Apr-May**	**Heavy**	0.06	163,000	790	0.5221		950,000	1,200
Prince William Sound	**Aug-Sep**	**Heavy**	0.06	163,000	790	0.5221		950,000	1,200
Off Kenai	**Oct-Nov**	**Distillate**	0.06	523,000	250	0.5166		261,500	300
Southeast Alaska	**Aug-Sep**	**Heavy**	0.67	163,000	650	0.5151		950,000	900
Kodiak	**Jun-Jul**	**Distillate**	0.28	523,000	230	0.5118		261,500	300
Prince William Sound	**Dec-Jan**	**Crude**	0.83	1,900,000	520	0.4957		261,500	2,000
Cook Inlet	**Dec-Jan**	**Distillate**	0.39	523,000	830	0.4903		261,500	800
Cook Inlet	**Oct-Nov**	**Distillate**	0.39	523,000	670	0.4903		261,500	800
Aleutians	**Aug-Sep**	**Heavy**	0.67	523,000	560	0.4834		950,000	1,500
South-Central	**Dec-Jan**	**Light**	0.39	1,900,000	670	0.4808		950,000	400
Chukchi Sea	**Oct-Nov**	**Light**	0.06	523,000	1,200	0.4729		950,000	800
Prince William Sound	**Dec-Jan**	**Distillate**	0.39	523,000	520	0.4625		950,000	600
Prince William Sound	**Feb-Mar**	**Distillate**	0.39	163,000	790	0.4625		950,000	600
Aleutians	**Oct-Nov**	**Distillate**	0.22	523,000	560	0.4595		950,000	400
Bristol Bay	**Oct-Nov**	**Light**	0.39	1,900,000	150	0.4565		163,000	200
Aniakchak	**Apr-May**	**Light**	0.39	523,000	150	0.4484		261,500	400

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Kotzebue/Hope	**Oct-Nov**	**Light**	0.44	1,900,000	520	0.4304		163,000	800
Norton/St. Lawrence	**Feb-Mar**	**Light**	0.39	50,000	560	0.4259		163,000	500
Kodiak	**Oct-Nov**	**Distillate**	0.23	523,000	230	0.4225		261,500	300
Western Alaska	**Aug-Sep**	**Distillate**	0.5	163,000	510	0.4148		950,000	700
Western Alaska	**Oct-Nov**	**Distillate**	0.5	163,000	510	0.4148		950,000	700
Aleutians	**Dec-Jan**	**Heavy**	0.56	523,000	250	0.4034		950,000	1,500
Prince William Sound	**Jun-Jul**	**Crude**	0.67	1,900,000	520	0.4003		261,500	2,000
Southeast Alaska	**Jun-Jul**	**Heavy**	0.5	163,000	650	0.3855		950,000	900
Beaufort Sea	**Apr-May**	**Distillate**	0.06	523,000	830	0.3663		950,000	1,100
Beaufort Sea	**Jun-Jul**	**Distillate**	0.06	523,000	830	0.3663		950,000	1,100
Beaufort Sea	**Aug-Sep**	**Distillate**	0.06	523,000	830	0.3663		950,000	1,100
Beaufort Sea	**Oct-Nov**	**Distillate**	0.06	523,000	830	0.3663		950,000	1,100
Beaufort Sea	**Dec-Jan**	**Distillate**	0	n/a	n/a	0.3663		950,000	1,100
Beaufort Sea	**Feb-Mar**	**Distillate**	0	n/a	n/a	0.3663		950,000	1,100
Prince William Sound	**Feb-Mar**	**Crude**	0.61	1,900,000	520	0.3658		261,500	2,000
Norton/St. Lawrence	**Apr-May**	**Light**	0.33	50,000	560	0.363		163,000	500
Aleutians	**Feb-Mar**	**Heavy**	0.5	523,000	560	0.3618		950,000	1,500
Prince William Sound	**Oct-Nov**	**Crude**	0.56	1,900,000	520	0.334		261,500	2,000
Prince William Sound	**Aug-Sep**	**Distillate**	0.28	163,000	790	0.3311		950,000	600
Bristol Bay	**Dec-Jan**	**Light**	0.28	163,000	420	0.3268		163,000	200
Kotzebue/Hope	**Aug-Sep**	**Light**	0.33	1,900,000	520	0.326		163,000	800
Aniakchak	**Oct-Nov**	**Light**	0.28	523,000	150	0.321		261,500	400
Aleutians	**Oct-Nov**	**Heavy**	0.44	523,000	560	0.3169		950,000	1,500
Norton/St. Lawrence	**Dec-Jan**	**Light**	0.28	163,000	650	0.3049		163,000	500
Southeast Alaska	**Dec-Jan**	**Heavy**	0.39	1,900,000	230	0.3002		950,000	900
Prince William Sound	**Apr-May**	**Crude**	0.5	1,900,000	520	0.2996		261,500	2,000
Aleutians	**Jun-Jul**	**Heavy**	0.39	523,000	560	0.2817		950,000	1,500
Kotzebue/Hope	**Feb-Mar**	**Light**	0.28	1,900,000	520	0.2739		163,000	800
Southeast Alaska	**Feb-Mar**	**Heavy**	0.33	163,000	650	0.2559		950,000	900
Southeast Alaska	**Apr-May**	**Heavy**	0.33	163,000	650	0.2559		950,000	900
Chukchi Sea	**Feb-Mar**	**Light**	0.11	523,000	1,200	0.2553		950,000	800
Aleutians	**Dec-Jan**	**Distillate**	0.12	523,000	250	0.2481		950,000	400
Off Kenai	**Aug-Sep**	**Distillate**	0.33	523,000	250	0.2377		261,500	300

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Bristol Bay	**Apr-May**	**Distillate**	0.44	523,000	150	0.2285		163,000	1,000
Chukchi Sea	**Apr-May**	**Light**	0.11	523,000	1,200	0.2176		950,000	800
Kotzebue/Hope	**Dec-Jan**	**Distillate**	0	n/a	n/a	0.2162		163,000	300
Kotzebue/Hope	**Feb-Mar**	**Distillate**	0	n/a	n/a	0.2162		163,000	300
Kodiak	**Feb-Mar**	**Distillate**	0.11	523,000	230	0.2031		261,500	300
Kodiak	**Aug-Sep**	**Distillate**	0.11	523,000	230	0.2031		261,500	300
Norton/St. Lawrence	**Jun-Jul**	**Distillate**	0.18	50,000	560	0.2008		163,000	700
Western Alaska	**Apr-May**	**Distillate**	0.23	163,000	510	0.1909		950,000	700
Norton/St. Lawrence	**Aug-Sep**	**Distillate**	0.17	50,000	560	0.1861		163,000	700
Western Alaska	**Dec-Jan**	**Distillate**	0.22	163,000	510	0.1835		950,000	700
Chukchi Sea	**Dec-Jan**	**Light**	0.22	50,000	560	0.1828		950,000	800
Bristol Bay	**Jun-Jul**	**Distillate**	0.34	523,000	150	0.1777		163,000	1,000
Prince William Sound	**Aug-Sep**	**Crude**	0.28	1,900,000	520	0.167		261,500	2,000
Kotzebue/Hope	**Apr-May**	**Light**	0.17	1,900,000	520	0.1652		163,000	800
Aleutians	**Apr-May**	**Heavy**	0.22	523,000	560	0.1601		950,000	1,500
Kodiak	**Oct-Nov**	**Heavy**	0.28	1,900,000	230	0.1507		950,000	1,200
Norton/St. Lawrence	**Dec-Jan**	**Distillate**	0.12	163,000	650	0.1322		163,000	700
Aniakchak	**Dec-Jan**	**Light**	0.11	523,000	560	0.1274		261,500	400
Norton/St. Lawrence	**Feb-Mar**	**Distillate**	0.11	50,000	560	0.1224		163,000	700
Off Kenai	**Apr-May**	**Distillate**	0.17	523,000	250	0.1204		261,500	300
Kotzebue/Hope	**Dec-Jan**	**Light**	0.11	163,000	790	0.1087		163,000	800
Bristol Bay	**Dec-Jan**	**Distillate**	0	n/a	n/a	0.0923		163,000	1,000
Bristol Bay	**Feb-Mar**	**Distillate**	0	n/a	n/a	0.0923		163,000	1,000
Western Alaska	**Feb-Mar**	**Distillate**	0.11	163,000	510	0.0918		950,000	700
Kodiak	**Dec-Jan**	**Heavy**	0.17	1,900,000	150	0.0909		950,000	1,200
Kodiak	**Apr-May**	**Heavy**	0.17	1,900,000	230	0.0909		950,000	1,200
Kodiak	**Aug-Sep**	**Heavy**	0.17	1,900,000	230	0.0909		950,000	1,200
Bristol Bay	**Aug-Sep**	**Distillate**	0.17	523,000	150	0.0877		163,000	1,000
Off Kenai	**Dec-Jan**	**Distillate**	0.11	523,000	150	0.0792		261,500	300
Off Kenai	**Feb-Mar**	**Distillate**	0.11	523,000	250	0.0792		261,500	300
Off Kenai	**Jun-Jul**	**Distillate**	0.11	523,000	250	0.0792		261,500	300
Bristol Bay	**Jun-Jul**	**Heavy**	0.28	1,900,000	150	0.0784		163,000	500
South-Central	**Apr-May**	**Distillate**	0.22	163,000	420	0.0739		950,000	300

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Kotzebue/Hope	**Jun-Jul**	**Distillate**	0.12	523,000	520	0.073		163,000	300
Norton/St. Lawrence	**Apr-May**	**Distillate**	0.06	50,000	560	0.0685		163,000	700
Norton/St. Lawrence	**Oct-Nov**	**Distillate**	0.06	50,000	560	0.0685		163,000	700
Kotzebue/Hope	**Aug-Sep**	**Distillate**	0.11	523,000	520	0.0676		163,000	300
Aleutians	**Dec-Jan**	**Crude**	0	n/a	n/a	0.0653		950,000	600
Aleutians	**Feb-Mar**	**Crude**	0	n/a	n/a	0.0653		950,000	600
Aleutians	**Apr-May**	**Crude**	0	n/a	n/a	0.0653		950,000	600
Aleutians	**Jun-Jul**	**Crude**	0	n/a	n/a	0.0653		950,000	600
Aleutians	**Aug-Sep**	**Crude**	0	n/a	n/a	0.0653		950,000	600
Aleutians	**Oct-Nov**	**Crude**	0	n/a	n/a	0.0653		950,000	600
Bristol Bay	**Oct-Nov**	**Distillate**	0.12	523,000	150	0.0623		163,000	1,000
South-Central	**Dec-Jan**	**Crude**	0.11	1,900,000	670	0.0617		950,000	2,500
South-Central	**Feb-Mar**	**Crude**	0.11	1,900,000	520	0.0617		950,000	2,500
Chukchi Sea	**Dec-Jan**	**Crude**	0.01	2,200,000	560	0.061		2,200,000	1,200
Chukchi Sea	**Feb-Mar**	**Crude**	0.01	2,200,000	1,200	0.061		2,200,000	1,200
Chukchi Sea	**Apr-May**	**Crude**	0.01	2,200,000	1,200	0.061		2,200,000	1,200
Chukchi Sea	**Jun-Jul**	**Crude**	0.01	2,200,000	1,200	0.061		2,200,000	1,200
Chukchi Sea	**Aug-Sep**	**Crude**	0.01	2,200,000	1,200	0.061		2,200,000	1,200
Chukchi Sea	**Oct-Nov**	**Crude**	0.01	2,200,000	1,200	0.061		2,200,000	1,200
Kodiak	**Feb-Mar**	**Heavy**	0.11	1,900,000	230	0.0598		950,000	1,200
South-Central	**Feb-Mar**	**Heavy**	0.11	163,000	420	0.0586		950,000	2,200
South-Central	**Apr-May**	**Heavy**	0.11	163,000	420	0.0586		950,000	2,200
Beaufort Sea	**Apr-May**	**Heavy**	0.07	1,900,000	830	0.0585		950,000	1,600
Beaufort Sea	**Jun-Jul**	**Heavy**	0.07	1,900,000	830	0.0585		950,000	1,600
Beaufort Sea	**Aug-Sep**	**Heavy**	0.07	1,900,000	830	0.0585		950,000	1,600
Beaufort Sea	**Oct-Nov**	**Heavy**	0.07	1,900,000	830	0.0585		950,000	1,600
Beaufort Sea	**Dec-Jan**	**Heavy**	0	n/a	n/a	0.0585		950,000	1,600
Beaufort Sea	**Feb-Mar**	**Heavy**	0	n/a	n/a	0.0585		950,000	1,600
Off Kenai	**Dec-Jan**	**Heavy**	0.11	523,000	150	0.0489		261,500	700
Off Kenai	**Feb-Mar**	**Heavy**	0.11	523,000	250	0.0489		261,500	700
Aniakchak	**Dec-Jan**	**Distillate**	0.03	523,000	560	0.0421		261,500	400
Aniakchak	**Feb-Mar**	**Distillate**	0.03	523,000	150	0.0421		261,500	400
Aniakchak	**Apr-May**	**Distillate**	0.03	523,000	150	0.0421		261,500	400

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Aniakchak	**Jun-Jul**	**Distillate**	0.03	523,000	150	0.0421		261,500	400
Aniakchak	**Aug-Sep**	**Distillate**	0.03	523,000	150	0.0421		261,500	400
Aniakchak	**Oct-Nov**	**Distillate**	0.03	523,000	150	0.0421		261,500	400
Southeast Alaska	**Dec-Jan**	**Crude**	0.03	1,900,000	230	0.0419		950,000	1,200
Southeast Alaska	**Feb-Mar**	**Crude**	0.03	1,900,000	230	0.0419		950,000	1,200
Southeast Alaska	**Apr-May**	**Crude**	0.03	1,900,000	230	0.0419		950,000	1,200
Southeast Alaska	**Jun-Jul**	**Crude**	0.03	1,900,000	230	0.0419		950,000	1,200
Southeast Alaska	**Aug-Sep**	**Crude**	0.03	1,900,000	230	0.0419		950,000	1,200
Southeast Alaska	**Oct-Nov**	**Crude**	0.03	1,900,000	230	0.0419		950,000	1,200
Western Alaska	**Apr-May**	**Heavy**	0.07	163,000	510	0.041		950,000	800
Western Alaska	**Jun-Jul**	**Heavy**	0.07	163,000	510	0.041		950,000	800
Western Alaska	**Aug-Sep**	**Heavy**	0.07	163,000	510	0.041		950,000	800
Western Alaska	**Oct-Nov**	**Heavy**	0.07	163,000	510	0.041		950,000	800
Western Alaska	**Dec-Jan**	**Heavy**	0	n/a	n/a	0.041		950,000	800
Western Alaska	**Feb-Mar**	**Heavy**	0	n/a	n/a	0.041		950,000	800
Kotzebue/Hope	**Apr-May**	**Distillate**	0.06	523,000	520	0.0378		163,000	300
Kotzebue/Hope	**Oct-Nov**	**Distillate**	0.06	523,000	520	0.0378		163,000	300
South-Central	**Jun-Jul**	**Distillate**	0.11	163,000	420	0.0369		950,000	300
South-Central	**Aug-Sep**	**Distillate**	0.11	163,000	420	0.0369		950,000	300
Kodiak	**Jun-Jul**	**Heavy**	0.06	1,900,000	230	0.0335		950,000	1,200
Bristol Bay	**Aug-Sep**	**Heavy**	0.11	1,900,000	150	0.0311		163,000	500
South-Central	**Dec-Jan**	**Distillate**	0	n/a	n/a	0.0295		950,000	300
South-Central	**Feb-Mar**	**Distillate**	0	n/a	n/a	0.0295		950,000	300
South-Central	**Oct-Nov**	**Distillate**	0	n/a	n/a	0.0295		950,000	300
South-Central	**Apr-May**	**Crude**	0.05	1,900,000	420	0.0271		950,000	2,500
South-Central	**Oct-Nov**	**Crude**	0.05	1,900,000	420	0.0271		950,000	2,500
Chukchi Sea	**Apr-May**	**Heavy**	0.02	523,000	1,200	0.0271		950,000	2,000
Chukchi Sea	**Jun-Jul**	**Heavy**	0.02	523,000	1,200	0.0271		950,000	2,000
Chukchi Sea	**Aug-Sep**	**Heavy**	0.02	523,000	1,200	0.0271		950,000	2,000
Chukchi Sea	**Oct-Nov**	**Heavy**	0.02	523,000	1,200	0.0271		950,000	2,000
Chukchi Sea	**Dec-Jan**	**Heavy**	0	n/a	n/a	0.0271		950,000	2,000
Chukchi Sea	**Feb-Mar**	**Heavy**	0	n/a	n/a	0.0271		950,000	2,000
Chukchi Sea	**Dec-Jan**	**Distillate**	0.07	50,000	560	0.0259		950,000	200

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Chukchi Sea	**Feb-Mar**	**Distillate**	0.07	523,000	1,200	0.0259		950,000	200
Chukchi Sea	**Apr-May**	**Distillate**	0.07	523,000	1,200	0.0259		950,000	200
Chukchi Sea	**Jun-Jul**	**Distillate**	0.07	523,000	1,200	0.0259		950,000	200
Chukchi Sea	**Aug-Sep**	**Distillate**	0.07	523,000	1,200	0.0259		950,000	200
Chukchi Sea	**Oct-Nov**	**Distillate**	0.07	523,000	1,200	0.0259		950,000	200
South-Central	**Dec-Jan**	**Heavy**	0.05	1,900,000	670	0.0258		950,000	2,200
South-Central	**Oct-Nov**	**Heavy**	0.05	163,000	420	0.0258		950,000	2,200
Norton/St. Lawrence	**Dec-Jan**	**Heavy**	0	n/a	n/a	0.0227		163,000	200
Norton/St. Lawrence	**Feb-Mar**	**Heavy**	0	n/a	n/a	0.0227		163,000	200
South-Central	**Jun-Jul**	**Crude**	0.04	1,900,000	420	0.0222		950,000	2,500
South-Central	**Aug-Sep**	**Crude**	0.04	1,900,000	420	0.0222		950,000	2,500
South-Central	**Jun-Jul**	**Heavy**	0.04	163,000	420	0.0211		950,000	2,200
South-Central	**Aug-Sep**	**Heavy**	0.04	163,000	420	0.0211		950,000	2,200
Kotzebue/Hope	**Apr-May**	**Heavy**	0.03	1,900,000	520	0.0185		163,000	1,400
Kotzebue/Hope	**Jun-Jul**	**Heavy**	0.03	1,900,000	520	0.0185		163,000	1,400
Kotzebue/Hope	**Aug-Sep**	**Heavy**	0.03	1,900,000	520	0.0185		163,000	1,400
Kotzebue/Hope	**Oct-Nov**	**Heavy**	0.03	1,900,000	520	0.0185		163,000	1,400
Kotzebue/Hope	**Dec-Jan**	**Heavy**	0	n/a	n/a	0.0185		163,000	1,400
Kotzebue/Hope	**Feb-Mar**	**Heavy**	0	n/a	n/a	0.0185		163,000	1,400
Aniakchak	**Dec-Jan**	**Heavy**	0.04	523,000	560	0.0175		261,500	2,300
Aniakchak	**Feb-Mar**	**Heavy**	0.04	523,000	150	0.0175		261,500	2,300
Aniakchak	**Apr-May**	**Heavy**	0.04	523,000	150	0.0175		261,500	2,300
Aniakchak	**Jun-Jul**	**Heavy**	0.04	523,000	150	0.0175		261,500	2,300
Aniakchak	**Aug-Sep**	**Heavy**	0.04	523,000	150	0.0175		261,500	2,300
Aniakchak	**Oct-Nov**	**Heavy**	0.04	523,000	150	0.0175		261,500	2,300
Bristol Bay	**Apr-May**	**Heavy**	0.06	1,900,000	150	0.0174		163,000	500
Kodiak	**Dec-Jan**	**Crude**	0.05	1,900,000	150	0.0144		950,000	1,700
Kodiak	**Feb-Mar**	**Crude**	0.05	1,900,000	230	0.0144		950,000	1,700
Kodiak	**Apr-May**	**Crude**	0.05	1,900,000	230	0.0144		950,000	1,700
Kodiak	**Jun-Jul**	**Crude**	0.05	1,900,000	230	0.0144		950,000	1,700
Kodiak	**Aug-Sep**	**Crude**	0.05	1,900,000	230	0.0144		950,000	1,700
Kodiak	**Oct-Nov**	**Crude**	0.05	1,900,000	230	0.0144		950,000	1,700
Off Kenai	**Apr-May**	**Heavy**	0.03	523,000	250	0.0137		261,500	700

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Off Kenai	**Jun-Jul**	**Heavy**	0.03	523,000	250	0.0137		261,500	700
Off Kenai	**Aug-Sep**	**Heavy**	0.03	523,000	250	0.0137		261,500	700
Off Kenai	**Oct-Nov**	**Heavy**	0.03	523,000	250	0.0137		261,500	700
Bristol Bay	**Dec-Jan**	**Heavy**	0.04	163,000	420	0.0112		163,000	500
Bristol Bay	**Feb-Mar**	**Heavy**	0.04	1,900,000	150	0.0112		163,000	500
Bristol Bay	**Oct-Nov**	**Heavy**	0.04	1,900,000	150	0.0112		163,000	500
Aniakchak	**Dec-Jan**	**Crude**	0.02	523,000	560	0.0075		261,500	1,900
Aniakchak	**Feb-Mar**	**Crude**	0.02	523,000	150	0.0075		261,500	1,900
Aniakchak	**Apr-May**	**Crude**	0.02	523,000	150	0.0075		261,500	1,900
Aniakchak	**Jun-Jul**	**Crude**	0.02	523,000	150	0.0075		261,500	1,900
Aniakchak	**Aug-Sep**	**Crude**	0.02	523,000	150	0.0075		261,500	1,900
Aniakchak	**Oct-Nov**	**Crude**	0.02	523,000	150	0.0075		261,500	1,900
Norton/St. Lawrence	**Jun-Jul**	**Heavy**	0.05	30,000	560	0.0066		163,000	200
Norton/St. Lawrence	**Apr-May**	**Heavy**	0.04	30,000	560	0.0054		163,000	200
Norton/St. Lawrence	**Aug-Sep**	**Heavy**	0.04	30,000	560	0.0054		163,000	200
Norton/St. Lawrence	**Oct-Nov**	**Heavy**	0.04	30,000	560	0.0054		163,000	200
Off Kenai	**Dec-Jan**	**Crude**	0.01	523,000	150	0.0031		261,500	1,900
Off Kenai	**Feb-Mar**	**Crude**	0.01	523,000	150	0.0031		261,500	1,900
Off Kenai	**Apr-May**	**Crude**	0.01	523,000	150	0.0031		261,500	1,900
Off Kenai	**Jun-Jul**	**Crude**	0.01	523,000	150	0.0031		261,500	1,900
Off Kenai	**Aug-Sep**	**Crude**	0.01	523,000	150	0.0031		261,500	1,900
Off Kenai	**Oct-Nov**	**Crude**	0.01	523,000	150	0.0031		261,500	1,900
Bristol Bay	**Dec-Jan**	**Crude**	0	n/a	n/a	0	**LOWEST (UNLIKELY)**	n/a	n/a
Bristol Bay	**Feb-Mar**	**Crude**	0	n/a	n/a	0		n/a	n/a
Bristol Bay	**Apr-May**	**Crude**	0	n/a	n/a	0		n/a	n/a
Bristol Bay	**Jun-Jul**	**Crude**	0	n/a	n/a	0		n/a	n/a
Bristol Bay	**Aug-Sep**	**Crude**	0	n/a	n/a	0		n/a	n/a
Bristol Bay	**Oct-Nov**	**Crude**	0	n/a	n/a	0		n/a	n/a
Kotzebue/Hope	**Dec-Jan**	**Crude**	0	n/a	n/a	0		n/a	n/a
Kotzebue/Hope	**Feb-Mar**	**Crude**	0	n/a	n/a	0		n/a	n/a
Kotzebue/Hope	**Apr-May**	**Crude**	0	n/a	n/a	0		n/a	n/a
Kotzebue/Hope	**Jun-Jul**	**Crude**	0	n/a	n/a	0		n/a	n/a
Kotzebue/Hope	**Aug-Sep**	**Crude**	0	n/a	n/a	0		n/a	n/a

Table 91: Forecasted Frequency Rates in Decreasing Order

Region	Period	Oil Type	Baseline			Forecasted (2025)			
			Annual Frequency	WCD (bbl)	WA-MMPD (bbl)	Annual Frequency	Frequency Category	WCD (bbl)	WA-MMPD (bbl)
Kotzebue/Hope	**Oct-Nov**	**Crude**	0	n/a	n/a	0		n/a	n/a
Norton/St. Lawrence	**Dec-Jan**	**Crude**	0	n/a	n/a	0		n/a	n/a
Norton/St. Lawrence	**Feb-Mar**	**Crude**	0	n/a	n/a	0		n/a	n/a
Norton/St. Lawrence	**Apr-May**	**Crude**	0	n/a	n/a	0		n/a	n/a
Norton/St. Lawrence	**Jun-Jul**	**Crude**	0	n/a	n/a	0		n/a	n/a
Norton/St. Lawrence	**Aug-Sep**	**Crude**	0	n/a	n/a	0		n/a	n/a
Norton/St. Lawrence	**Oct-Nov**	**Crude**	0	n/a	n/a	0		n/a	n/a
Western Alaska	**Dec-Jan**	**Crude**	0	n/a	n/a	0		n/a	n/a
Western Alaska	**Feb-Mar**	**Crude**	0	n/a	n/a	0		n/a	n/a
Western Alaska	**Apr-May**	**Crude**	0	n/a	n/a	0		n/a	n/a
Western Alaska	**Jun-Jul**	**Crude**	0	n/a	n/a	0		n/a	n/a
Western Alaska	**Aug-Sep**	**Crude**	0	n/a	n/a	0		n/a	n/a
Western Alaska	**Oct-Nov**	**Crude**	0	n/a	n/a	0		n/a	n/a

9.1 Uncertainties in Forecasting Spillage Rates

The outcomes of the incident rate analysis and forecasted spillage rates are integrally dependent on the assumptions applied to the forecasting. Given the uncertainty in the assumptions applied to the forecasts, there is a good measure of uncertainty in the forecasts for 2025 spillage, as summarized in Table 92. A more detailed analysis of the factors in the forecast for 2025 and beyond is outside the scope of the current project, but merit consideration for a future analysis. The assumptions may form the basis for such a future analysis.

Table 92: Uncertainties in Forecasting Assumptions

Assumption	Higher Spillage Rate	Lower Spillage Rate
Reduction in overall tanker spillage by 34% due to risk mitigation measures	Greater reduction in spillage rates due to greater than anticipated success of risk mitigation measures	Less reduction in spillage rates due to less than anticipated success in reducing tanker spillage
Spillage reduction in tankers involved in impact accidents due to double hulls	Greater reduction than anticipated due to better performance of double hulls than modeled or more impact accidents making up greater proportion of tanker incidents	Less reduction than anticipated due to lower performance of double hulls than modeled or more impact accidents making up lower proportion of tanker incidents
Increase of 25% in vessel traffic in regions other than Aleutians, Beaufort Sea, and Chukchi Sea	Greater increase in vessel traffic than anticipated	Less increase in vessel traffic than anticipated
Decrease in spillage from non-tank vessels due to double-hulls on bunker tanks	Slower rate of implementation of double-hulls than anticipated; or poorer performance of bunker tank protection than anticipated	Higher rate of implementation of double-hulls than anticipated; or better performance of bunker tank protection than anticipated
Increase in vessel traffic in Aleutians, Beaufort Sea, and Chukchi Sea	Greater increase in vessel traffic than anticipated	Less increase in vessel traffic than anticipated
Increase in Beaufort Sea and Chukchi Sea oil exploration and production activities	Greater increase than anticipated	Less increase than anticipated or reduction in activities currently underway
Increase in Cook Inlet oil exploration and production activities	Greater increase than anticipated	Less increase than anticipated or reduction in activities currently underway
Increases in overall facility and vessel activities due to economic growth	Greater economic growth than anticipated	Less economic growth than anticipated

Conclusions

An analysis of historical vessel and facility incidents for the years 1995 through 2012 that led to oil spillage or could potentially have led to spillage in Alaskan marine waters and coastal areas was conducted to determine incident rates by region, source, oil type, and two-month time period over the year. The results were to be applied to the environmental sensitivity of each region by oil type and time period for maximum most-probable discharges (MMPD) and worst-case discharges (WCD). A forecast for spillage in the year 2025 and beyond was also conducted.

The results are summarized in Table 93. The incident rates are shown in return years in Table 94.

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
Aleutians	Crude	Dec-Jan	0.000	n/a	n/a	0.065	950,000	600
		Feb-Mar	0.000	n/a	n/a	0.065	950,000	600
		Apr-May	0.000	n/a	n/a	0.065	950,000	600
		Jun-Jul	0.000	n/a	n/a	0.065	950,000	600
		Aug-Sep	0.000	n/a	n/a	0.065	950,000	600
		Oct-Nov	0.000	n/a	n/a	0.065	950,000	600
	Distillate	Dec-Jan	0.120	523,000	250	0.248	950,000	400
		Feb-Mar	0.390	523,000	560	0.809	950,000	400
		Apr-May	0.280	523,000	560	0.579	950,000	400
		Jun-Jul	0.500	523,000	560	1.038	950,000	400
		Aug-Sep	0.280	523,000	560	0.579	950,000	400
		Oct-Nov	0.220	523,000	560	0.460	950,000	400
	Heavy	Dec-Jan	0.560	523,000	250	0.403	950,000	1,500
		Feb-Mar	0.500	523,000	560	0.362	950,000	1,500
		Apr-May	0.220	523,000	560	0.160	950,000	1,500
		Jun-Jul	0.390	523,000	560	0.282	950,000	1,500
		Aug-Sep	0.670	523,000	560	0.483	950,000	1,500
		Oct-Nov	0.440	523,000	560	0.317	950,000	1,500
	Light	Dec-Jan	11.280	523,000	250	12.998	950,000	200
		Feb-Mar	19.780	523,000	560	22.796	950,000	200
		Apr-May	12.440	523,000	560	14.335	950,000	200
		Jun-Jul	13.450	523,000	560	15.498	950,000	200
		Aug-Sep	16.440	523,000	560	18.948	950,000	200
		Oct-Nov	11.330	523,000	560	13.059	950,000	200
Aniakchak	Crude	Dec-Jan	0.020	523,000	560	0.008	261,500	1,900
		Feb-Mar	0.020	523,000	150	0.008	261,500	1,900
		Apr-May	0.020	523,000	150	0.008	261,500	1,900

[204] Incident rates are color-coded so that dark red represents highest probability, red represent very high probability, orange represents high probability, yellow represents moderate probability, light green represents low probability, darker green represents very low probability, and blue represents lowest (unlikely) probability.
[205] WCD = worst-case discharge
[206] WA-MMPD = weight-average maximum most-probable discharge

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
		Jun-Jul	0.020	523,000	150	0.008	261,500	1,900
		Aug-Sep	0.020	523,000	150	0.008	261,500	1,900
		Oct-Nov	0.020	523,000	150	0.008	261,500	1,900
	Distillate	Dec-Jan	0.030	523,000	560	0.042	261,500	400
		Feb-Mar	0.030	523,000	150	0.042	261,500	400
		Apr-May	0.030	523,000	150	0.042	261,500	400
		Jun-Jul	0.030	523,000	150	0.042	261,500	400
		Aug-Sep	0.030	523,000	150	0.042	261,500	400
		Oct-Nov	0.030	523,000	150	0.042	261,500	400
	Heavy	Dec-Jan	0.040	523,000	560	0.018	261,500	2,300
		Feb-Mar	0.040	523,000	150	0.018	261,500	2,300
		Apr-May	0.040	523,000	150	0.018	261,500	2,300
		Jun-Jul	0.040	523,000	150	0.018	261,500	2,300
		Aug-Sep	0.040	523,000	150	0.018	261,500	2,300
		Oct-Nov	0.040	523,000	150	0.018	261,500	2,300
	Light	Dec-Jan	0.110	523,000	560	0.127	261,500	400
		Feb-Mar	0.780	523,000	150	0.897	261,500	400
		Apr-May	0.390	523,000	150	0.448	261,500	400
		Jun-Jul	0.610	523,000	150	0.703	261,500	400
		Aug-Sep	0.610	523,000	150	0.703	261,500	400
		Oct-Nov	0.280	523,000	150	0.321	261,500	400
Beaufort Sea	Crude	Dec-Jan	1.830	3,900,000	1,200	10.012	3,900,000	1,200
		Feb-Mar	3.280	1,900,000	830	17.963	3,900,000	1,200
		Apr-May	3.720	1,900,000	830	20.363	3,900,000	1,200
		Jun-Jul	4.610	1,900,000	830	25.235	3,900,000	1,200
		Aug-Sep	2.890	1,900,000	830	15.830	3,900,000	1,200
		Oct-Nov	2.390	1,900,000	830	13.090	3,900,000	1,200
	Distillate	Dec-Jan	0.000	n/a	n/a	0.366	950,000	1,100
		Feb-Mar	0.000	n/a	n/a	0.366	950,000	1,100
		Apr-May	0.060	523,000	830	0.366	950,000	1,100
		Jun-Jul	0.060	523,000	830	0.366	950,000	1,100
		Aug-Sep	0.060	523,000	830	0.366	950,000	1,100
		Oct-Nov	0.060	523,000	830	0.366	950,000	1,100

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
	Heavy	Dec-Jan	0.000	n/a	n/a	0.059	950,000	1,600
		Feb-Mar	0.000	n/a	n/a	0.059	950,000	1,600
		Apr-May	0.070	1,900,000	830	0.059	950,000	1,600
		Jun-Jul	0.070	1,900,000	830	0.059	950,000	1,600
		Aug-Sep	0.070	1,900,000	830	0.059	950,000	1,600
		Oct-Nov	0.070	1,900,000	830	0.059	950,000	1,600
	Light	Dec-Jan	10.670	523,000	1,200	50.904	950,000	1,200
		Feb-Mar	13.500	1,900,000	830	64.401	950,000	1,200
		Apr-May	12.000	1,900,000	830	57.241	950,000	1,200
		Jun-Jul	9.890	1,900,000	830	47.187	950,000	1,200
		Aug-Sep	9.330	1,900,000	830	44.504	950,000	1,200
		Oct-Nov	7.720	1,900,000	830	36.816	950,000	1,200
Bristol Bay	Crude	Dec-Jan	0.000	n/a	n/a	0.000	n/a	n/a
		Feb-Mar	0.000	n/a	n/a	0.000	n/a	n/a
		Apr-May	0.000	n/a	n/a	0.000	n/a	n/a
		Jun-Jul	0.000	n/a	n/a	0.000	n/a	n/a
		Aug-Sep	0.000	n/a	n/a	0.000	n/a	n/a
		Oct-Nov	0.000	n/a	n/a	0.000	n/a	n/a
	Distillate	Dec-Jan	0.000	n/a	n/a	0.092	163,000	1,000
		Feb-Mar	0.000	n/a	n/a	0.092	163,000	1,000
		Apr-May	0.440	523,000	150	0.229	163,000	1,000
		Jun-Jul	0.340	523,000	150	0.178	163,000	1,000
		Aug-Sep	0.170	523,000	150	0.088	163,000	1,000
		Oct-Nov	0.120	523,000	150	0.062	163,000	1,000
	Heavy	Dec-Jan	0.040	163,000	420	0.011	163,000	500
		Feb-Mar	0.040	1,900,000	150	0.011	163,000	500
		Apr-May	0.060	1,900,000	150	0.017	163,000	500
		Jun-Jul	0.280	1,900,000	150	0.078	163,000	500
		Aug-Sep	0.110	1,900,000	150	0.031	163,000	500
		Oct-Nov	0.040	1,900,000	150	0.011	163,000	500
	Light	Dec-Jan	0.280	163,000	420	0.327	163,000	200
		Feb-Mar	0.560	1,900,000	150	0.654	163,000	200
		Apr-May	2.060	1,900,000	150	2.412	163,000	200

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
		Jun-Jul	6.450	1,900,000	150	7.558	163,000	200
		Aug-Sep	1.220	1,900,000	150	1.432	163,000	200
		Oct-Nov	0.390	1,900,000	150	0.457	163,000	200
Cook Inlet	Crude	Dec-Jan	1.330	1,900,000	830	1.258	950,000	1,200
		Feb-Mar	1.720	1,900,000	670	1.627	950,000	1,200
		Apr-May	2.880	1,900,000	670	2.725	950,000	1,200
		Jun-Jul	2.110	1,900,000	670	2.000	950,000	1,200
		Aug-Sep	2.940	1,900,000	670	2.784	950,000	1,200
		Oct-Nov	1.330	1,900,000	670	1.258	950,000	1,200
	Distillate	Dec-Jan	0.390	523,000	830	0.490	261,500	800
		Feb-Mar	0.500	523,000	670	0.630	261,500	800
		Apr-May	1.110	523,000	670	1.398	261,500	800
		Jun-Jul	0.720	523,000	670	0.908	261,500	800
		Aug-Sep	0.830	523,000	670	1.042	261,500	800
		Oct-Nov	0.390	523,000	670	0.490	261,500	800
	Heavy	Dec-Jan	0.280	1,900,000	830	0.890	950,000	1,200
		Feb-Mar	0.280	1,900,000	670	0.890	950,000	1,200
		Apr-May	0.390	1,900,000	670	1.243	950,000	1,200
		Jun-Jul	0.500	1,900,000	670	1.596	950,000	1,200
		Aug-Sep	0.670	1,900,000	670	2.133	950,000	1,200
		Oct-Nov	0.390	1,900,000	670	1.243	950,000	1,200
	Light	Dec-Jan	6.780	1,900,000	830	7.408	950,000	700
		Feb-Mar	7.610	1,900,000	670	8.318	950,000	700
		Apr-May	9.890	1,900,000	670	10.810	950,000	700
		Jun-Jul	12.780	1,900,000	670	13.965	950,000	700
		Aug-Sep	11.390	1,900,000	670	12.445	950,000	700
		Oct-Nov	7.060	1,900,000	670	7.713	950,000	700
Kotzebue Sound/ Hope Basin	Crude	Dec-Jan	0.000	n/a	n/a	0.000	n/a	n/a
		Feb-Mar	0.000	n/a	n/a	0.000	n/a	n/a
		Apr-May	0.000	n/a	n/a	0.000	n/a	n/a
		Jun-Jul	0.000	n/a	n/a	0.000	n/a	n/a
		Aug-Sep	0.000	n/a	n/a	0.000	n/a	n/a
		Oct-Nov	0.000	n/a	n/a	0.000	n/a	n/a

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
	Distillate	Dec-Jan	0.000	n/a	n/a	0.216	163,000	300
		Feb-Mar	0.000	n/a	n/a	0.216	163,000	300
		Apr-May	0.060	523,000	520	0.038	163,000	300
		Jun-Jul	0.120	523,000	520	0.073	163,000	300
		Aug-Sep	0.110	523,000	520	0.068	163,000	300
		Oct-Nov	0.060	523,000	520	0.038	163,000	300
	Heavy	Dec-Jan	0.000	n/a	n/a	0.019	163,000	1,400
		Feb-Mar	0.000	n/a	n/a	0.019	163,000	1,400
		Apr-May	0.030	1,900,000	520	0.019	163,000	1,400
		Jun-Jul	0.030	1,900,000	520	0.019	163,000	1,400
		Aug-Sep	0.030	1,900,000	520	0.019	163,000	1,400
		Oct-Nov	0.030	1,900,000	520	0.019	163,000	1,400
	Light	Dec-Jan	0.110	163,000	790	0.109	163,000	800
		Feb-Mar	0.280	1,900,000	520	0.274	163,000	800
		Apr-May	0.170	1,900,000	520	0.165	163,000	800
		Jun-Jul	0.720	1,900,000	520	0.709	163,000	800
		Aug-Sep	0.330	1,900,000	520	0.326	163,000	800
		Oct-Nov	0.440	1,900,000	520	0.430	163,000	800
Kodiak/ Shelikof Strait	Crude	Dec-Jan	0.050	1,900,000	150	0.014	950,000	1,700
		Feb-Mar	0.050	1,900,000	230	0.014	950,000	1,700
		Apr-May	0.050	1,900,000	230	0.014	950,000	1,700
		Jun-Jul	0.050	1,900,000	230	0.014	950,000	1,700
		Aug-Sep	0.050	1,900,000	230	0.014	950,000	1,700
		Oct-Nov	0.050	1,900,000	230	0.014	950,000	1,700
	Distillate	Dec-Jan	0.330	523,000	150	0.609	261,500	300
		Feb-Mar	0.110	523,000	230	0.203	261,500	300
		Apr-May	0.390	523,000	230	0.715	261,500	300
		Jun-Jul	0.280	523,000	230	0.512	261,500	300
		Aug-Sep	0.110	523,000	230	0.203	261,500	300
		Oct-Nov	0.230	523,000	230	0.423	261,500	300
	Heavy	Dec-Jan	0.170	1,900,000	150	0.091	950,000	1,200
		Feb-Mar	0.110	1,900,000	230	0.060	950,000	1,200
		Apr-May	0.170	1,900,000	230	0.091	950,000	1,200

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
		Jun-Jul	0.060	1,900,000	230	0.034	950,000	1,200
		Aug-Sep	0.170	1,900,000	230	0.091	950,000	1,200
		Oct-Nov	0.280	1,900,000	230	0.151	950,000	1,200
	Light	Dec-Jan	7.000	1,900,000	150	7.939	950,000	100
		Feb-Mar	7.450	1,900,000	230	8.446	950,000	100
		Apr-May	7.280	1,900,000	230	8.256	950,000	100
		Jun-Jul	9.170	1,900,000	230	10.400	950,000	100
		Aug-Sep	6.890	1,900,000	230	7.814	950,000	100
		Oct-Nov	6.000	1,900,000	230	6.804	950,000	100
Chukchi Sea	Crude	Dec-Jan	0.010	2,200,000	560	0.061	2,200,000	1,200
		Feb-Mar	0.010	2,200,000	1,200	0.061	2,200,000	1,200
		Apr-May	0.010	2,200,000	1,200	0.061	2,200,000	1,200
		Jun-Jul	0.010	2,200,000	1,200	0.061	2,200,000	1,200
		Aug-Sep	0.010	2,200,000	1,200	0.061	2,200,000	1,200
		Oct-Nov	0.010	2,200,000	1,200	0.061	2,200,000	1,200
	Distillate	Dec-Jan	0.070	50,000	560	0.026	950,000	200
		Feb-Mar	0.070	523,000	1,200	0.026	950,000	200
		Apr-May	0.070	523,000	1,200	0.026	950,000	200
		Jun-Jul	0.070	523,000	1,200	0.026	950,000	200
		Aug-Sep	0.070	523,000	1,200	0.026	950,000	200
		Oct-Nov	0.070	523,000	1,200	0.026	950,000	200
	Heavy	Dec-Jan	0.000	n/a	n/a	0.027	950,000	2,000
		Feb-Mar	0.000	n/a	n/a	0.027	950,000	2,000
		Apr-May	0.020	523,000	1,200	0.027	950,000	2,000
		Jun-Jul	0.020	523,000	1,200	0.027	950,000	2,000
		Aug-Sep	0.020	523,000	1,200	0.027	950,000	2,000
		Oct-Nov	0.020	523,000	1,200	0.027	950,000	2,000
	Light	Dec-Jan	0.220	50,000	560	0.183	950,000	800
		Feb-Mar	0.110	523,000	1,200	0.255	950,000	800
		Apr-May	0.110	523,000	1,200	0.218	950,000	800
		Jun-Jul	0.110	523,000	1,200	0.984	950,000	800
		Aug-Sep	0.610	523,000	1,200	0.693	950,000	800
		Oct-Nov	0.060	523,000	1,200	0.473	950,000	800

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]								
Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
Norton Sound/ St. Lawrence Island	Crude	Dec-Jan	0.000	n/a	n/a	0.000	n/a	n/a
		Feb-Mar	0.000	n/a	n/a	0.000	n/a	n/a
		Apr-May	0.000	n/a	n/a	0.000	n/a	n/a
		Jun-Jul	0.000	n/a	n/a	0.000	n/a	n/a
		Aug-Sep	0.000	n/a	n/a	0.000	n/a	n/a
		Oct-Nov	0.000	n/a	n/a	0.000	n/a	n/a
	Distillate	Dec-Jan	0.120	163,000	650	0.132	163,000	700
		Feb-Mar	0.110	50,000	560	0.122	163,000	700
		Apr-May	0.060	50,000	560	0.069	163,000	700
		Jun-Jul	0.180	50,000	560	0.201	163,000	700
		Aug-Sep	0.170	50,000	560	0.186	163,000	700
		Oct-Nov	0.060	50,000	560	0.069	163,000	700
	Heavy	Dec-Jan	0.000	n/a	n/a	0.023	163,000	200
		Feb-Mar	0.000	n/a	n/a	0.023	163,000	200
		Apr-May	0.040	30,000	560	0.005	163,000	200
		Jun-Jul	0.050	30,000	560	0.007	163,000	200
		Aug-Sep	0.040	30,000	560	0.005	163,000	200
		Oct-Nov	0.040	30,000	560	0.005	163,000	200
	Light	Dec-Jan	0.280	163,000	650	0.305	163,000	500
		Feb-Mar	0.390	50,000	560	0.426	163,000	500
		Apr-May	0.330	50,000	560	0.363	163,000	500
		Jun-Jul	1.500	50,000	560	1.641	163,000	500
		Aug-Sep	1.060	50,000	560	1.157	163,000	500
		Oct-Nov	0.720	50,000	560	0.789	163,000	500
Off Kenai Peninsula	Crude	Dec-Jan	0.010	523,000	150	0.003	261,500	1,900
		Feb-Mar	0.010	523,000	150	0.003	261,500	1,900
		Apr-May	0.010	523,000	150	0.003	261,500	1,900
		Jun-Jul	0.010	523,000	150	0.003	261,500	1,900
		Aug-Sep	0.010	523,000	150	0.003	261,500	1,900
		Oct-Nov	0.010	523,000	150	0.003	261,500	1,900
	Distillate	Dec-Jan	0.110	523,000	150	0.079	261,500	300
		Feb-Mar	0.110	523,000	250	0.079	261,500	300
		Apr-May	0.170	523,000	250	0.120	261,500	300

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
		Jun-Jul	0.110	523,000	250	0.079	261,500	300
		Aug-Sep	0.330	523,000	250	0.238	261,500	300
		Oct-Nov	0.060	523,000	250	0.517	261,500	300
	Heavy	Dec-Jan	0.110	523,000	150	0.049	261,500	700
		Feb-Mar	0.110	523,000	250	0.049	261,500	700
		Apr-May	0.030	523,000	250	0.014	261,500	700
		Jun-Jul	0.030	523,000	250	0.014	261,500	700
		Aug-Sep	0.030	523,000	250	0.014	261,500	700
		Oct-Nov	0.030	523,000	250	0.014	261,500	700
	Light	Dec-Jan	1.280	523,000	150	1.482	261,500	100
		Feb-Mar	2.110	523,000	250	2.446	261,500	100
		Apr-May	2.610	523,000	250	3.021	261,500	100
		Jun-Jul	3.000	523,000	250	3.477	261,500	100
		Aug-Sep	2.220	523,000	250	2.569	261,500	100
		Oct-Nov	1.670	523,000	250	1.934	261,500	100
South-Central	Crude	Dec-Jan	0.110	1,900,000	670	0.062	950,000	2,500
		Feb-Mar	0.110	1,900,000	520	0.062	950,000	2,500
		Apr-May	0.050	1,900,000	420	0.027	950,000	2,500
		Jun-Jul	0.040	1,900,000	420	0.022	950,000	2,500
		Aug-Sep	0.040	1,900,000	420	0.022	950,000	2,500
		Oct-Nov	0.050	1,900,000	420	0.027	950,000	2,500
	Distillate	Dec-Jan	0.000	n/a	n/a	0.030	950,000	300
		Feb-Mar	0.000	n/a	n/a	0.030	950,000	300
		Apr-May	0.220	163,000	420	0.074	950,000	300
		Jun-Jul	0.110	163,000	420	0.037	950,000	300
		Aug-Sep	0.110	163,000	420	0.037	950,000	300
		Oct-Nov	0.000	n/a	n/a	0.030	950,000	300
	Heavy	Dec-Jan	0.050	1,900,000	670	0.026	950,000	2,200
		Feb-Mar	0.110	163,000	420	0.059	950,000	2,200
		Apr-May	0.110	163,000	420	0.059	950,000	2,200
		Jun-Jul	0.040	163,000	420	0.021	950,000	2,200
		Aug-Sep	0.040	163,000	420	0.021	950,000	2,200
		Oct-Nov	0.050	163,000	420	0.026	950,000	2,200

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
	Light	Dec-Jan	0.390	1,900,000	670	0.481	950,000	400
		Feb-Mar	0.830	163,000	420	1.022	950,000	400
		Apr-May	1.110	163,000	420	1.371	950,000	400
		Jun-Jul	0.780	163,000	420	0.962	950,000	400
		Aug-Sep	0.940	163,000	420	1.158	950,000	400
		Oct-Nov	0.440	163,000	420	0.541	950,000	400
Prince William Sound	Crude	Dec-Jan	0.830	1,900,000	520	0.496	261,500	2,000
		Feb-Mar	0.610	1,900,000	520	0.366	261,500	2,000
		Apr-May	0.500	1,900,000	520	0.300	261,500	2,000
		Jun-Jul	0.670	1,900,000	520	0.400	261,500	2,000
		Aug-Sep	0.280	1,900,000	520	0.167	261,500	2,000
		Oct-Nov	0.560	1,900,000	520	0.334	261,500	2,000
	Distillate	Dec-Jan	0.390	523,000	520	0.463	950,000	600
		Feb-Mar	0.390	163,000	790	0.463	950,000	600
		Apr-May	0.780	163,000	790	0.925	950,000	600
		Jun-Jul	0.840	163,000	790	0.999	950,000	600
		Aug-Sep	0.280	163,000	790	0.331	950,000	600
		Oct-Nov	0.730	163,000	790	0.867	950,000	600
	Heavy	Dec-Jan	0.060	1,900,000	520	0.522	950,000	1,200
		Feb-Mar	0.060	163,000	790	0.522	950,000	1,200
		Apr-May	0.060	163,000	790	0.522	950,000	1,200
		Jun-Jul	0.280	163,000	790	2.349	950,000	1,200
		Aug-Sep	0.060	163,000	790	0.522	950,000	1,200
		Oct-Nov	0.170	163,000	790	1.417	950,000	1,200
	Light	Dec-Jan	5.670	1,900,000	520	5.706	950,000	200
		Feb-Mar	6.220	163,000	790	6.263	950,000	200
		Apr-May	7.560	163,000	790	7.610	950,000	200
		Jun-Jul	12.170	163,000	790	12.250	950,000	200
		Aug-Sep	8.500	163,000	790	8.559	950,000	200
		Oct-Nov	5.000	163,000	790	5.033	950,000	200
Southeast Alaska	Crude	Dec-Jan	0.030	1,900,000	230	0.042	950,000	1,200
		Feb-Mar	0.030	1,900,000	230	0.042	950,000	1,200
		Apr-May	0.030	1,900,000	230	0.042	950,000	1,200

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
		Jun-Jul	0.030	1,900,000	230	0.042	950,000	1,200
		Aug-Sep	0.030	1,900,000	230	0.042	950,000	1,200
		Oct-Nov	0.030	1,900,000	230	0.042	950,000	1,200
	Distillate	Dec-Jan	2.110	523,000	230	2.677	950,000	200
		Feb-Mar	1.610	163,000	650	2.677	950,000	200
		Apr-May	1.720	163,000	650	2.677	950,000	200
		Jun-Jul	3.720	163,000	650	2.677	950,000	200
		Aug-Sep	3.610	163,000	650	2.677	950,000	200
		Oct-Nov	2.830	163,000	650	2.677	950,000	200
	Heavy	Dec-Jan	0.390	1,900,000	230	0.300	950,000	900
		Feb-Mar	0.330	163,000	650	0.256	950,000	900
		Apr-May	0.330	163,000	650	0.256	950,000	900
		Jun-Jul	0.500	163,000	650	0.386	950,000	900
		Aug-Sep	0.670	163,000	650	0.515	950,000	900
		Oct-Nov	0.780	163,000	650	0.600	950,000	900
	Light	Dec-Jan	20.170	1,900,000	230	23.254	950,000	200
		Feb-Mar	27.560	163,000	650	31.774	950,000	200
		Apr-May	25.840	163,000	650	29.794	950,000	200
		Jun-Jul	44.280	163,000	650	51.052	950,000	200
		Aug-Sep	38.950	163,000	650	44.905	950,000	200
		Oct-Nov	26.170	163,000	650	30.171	950,000	200
Western Alaska	Crude	Dec-Jan	0.000	n/a	n/a	0.000	n/a	n/a
		Feb-Mar	0.000	n/a	n/a	0.000	n/a	n/a
		Apr-May	0.000	n/a	n/a	0.000	n/a	n/a
		Jun-Jul	0.000	n/a	n/a	0.000	n/a	n/a
		Aug-Sep	0.000	n/a	n/a	0.000	n/a	n/a
		Oct-Nov	0.000	n/a	n/a	0.000	n/a	n/a
	Distillate	Dec-Jan	0.220	163,000	510	0.184	950,000	700
		Feb-Mar	0.110	163,000	510	0.092	950,000	700
		Apr-May	0.230	163,000	510	0.191	950,000	700
		Jun-Jul	0.720	163,000	510	0.598	950,000	700
		Aug-Sep	0.500	163,000	510	0.415	950,000	700
		Oct-Nov	0.500	163,000	510	0.415	950,000	700

Table 93: Comparison of Baseline and Forecasted Incident Rates and Volumes[204]

Region	Oil Type	Period	Baseline			Forecasted (2025)		
			Annual Freq.	WCD[205] (bbl)	WA-MMPD[206] (bbl)	Annual Freq.	WCD (bbl)	WA-MMPD (bbl)
	Heavy	Dec-Jan	0.000	n/a	n/a	0.041	950,000	800
		Feb-Mar	0.000	n/a	n/a	0.041	950,000	800
		Apr-May	0.070	163,000	510	0.041	950,000	800
		Jun-Jul	0.070	163,000	510	0.041	950,000	800
		Aug-Sep	0.070	163,000	510	0.041	950,000	800
		Oct-Nov	0.070	163,000	510	0.041	950,000	800
	Light	Dec-Jan	1.280	163,000	510	1.475	950,000	400
		Feb-Mar	1.670	163,000	510	1.925	950,000	400
		Apr-May	2.890	163,000	510	3.333	950,000	400
		Jun-Jul	4.000	163,000	510	4.610	950,000	400
		Aug-Sep	4.390	163,000	510	5.059	950,000	400
		Oct-Nov	1.720	163,000	510	1.981	950,000	400

Table 94: Baseline and Forecasted Incident Rates and Return Years[207]						
Region	Oil Type	Period	Baseline		Forecasted (2025)	
			Annual Freq.	Return Yrs.	Annual Freq.	Return Yrs.
Aleutians	Crude	Dec-Jan	0.000	n/a	0.065	15.38
		Feb-Mar	0.000	n/a	0.065	15.38
		Apr-May	0.000	n/a	0.065	15.38
		Jun-Jul	0.000	n/a	0.065	15.38
		Aug-Sep	0.000	n/a	0.065	15.38
		Oct-Nov	0.000	n/a	0.065	15.38
	Distillate	Dec-Jan	0.120	8.33	0.248	4.03
		Feb-Mar	0.390	2.56	0.809	1.24
		Apr-May	0.280	3.57	0.579	1.73
		Jun-Jul	0.500	2.00	1.038	0.96
		Aug-Sep	0.280	3.57	0.579	1.73
		Oct-Nov	0.220	4.55	0.460	2.17
	Heavy	Dec-Jan	0.560	1.79	0.403	2.48
		Feb-Mar	0.500	2.00	0.362	2.76
		Apr-May	0.220	4.55	0.160	6.25
		Jun-Jul	0.390	2.56	0.282	3.55
		Aug-Sep	0.670	1.49	0.483	2.07
		Oct-Nov	0.440	2.27	0.317	3.15
	Light	Dec-Jan	11.280	0.09	12.998	0.08
		Feb-Mar	19.780	0.05	22.796	0.04
		Apr-May	12.440	0.08	14.335	0.07
		Jun-Jul	13.450	0.07	15.498	0.06
		Aug-Sep	16.440	0.06	18.948	0.05
		Oct-Nov	11.330	0.09	13.059	0.08
Aniakchak	Crude	Dec-Jan	0.020	50.00	0.008	125.00
		Feb-Mar	0.020	50.00	0.008	125.00
		Apr-May	0.020	50.00	0.008	125.00
		Jun-Jul	0.020	50.00	0.008	125.00
		Aug-Sep	0.020	50.00	0.008	125.00
		Oct-Nov	0.020	50.00	0.008	125.00
	Distillate	Dec-Jan	0.030	33.33	0.042	23.81
		Feb-Mar	0.030	33.33	0.042	23.81
		Apr-May	0.030	33.33	0.042	23.81
		Jun-Jul	0.030	33.33	0.042	23.81
		Aug-Sep	0.030	33.33	0.042	23.81
		Oct-Nov	0.030	33.33	0.042	23.81
	Heavy	Dec-Jan	0.040	25.00	0.018	55.56
		Feb-Mar	0.040	25.00	0.018	55.56
		Apr-May	0.040	25.00	0.018	55.56
		Jun-Jul	0.040	25.00	0.018	55.56
		Aug-Sep	0.040	25.00	0.018	55.56
		Oct-Nov	0.040	25.00	0.018	55.56
	Light	Dec-Jan	0.110	9.09	0.127	7.87
		Feb-Mar	0.780	1.28	0.897	1.11
		Apr-May	0.390	2.56	0.448	2.23

[207] Incident rates are color-coded so that dark red represents highest probability, red represent very high probability, orange represents high probability, yellow represents moderate probability, light green represents low probability, darker green represents very low probability, and blue represents lowest (unlikely) probability.

Table 94: Baseline and Forecasted Incident Rates and Return Years[207]						
Region	Oil Type	Period	Baseline		Forecasted (2025)	
			Annual Freq.	Return Yrs.	Annual Freq.	Return Yrs.
		Jun-Jul	0.610	1.64	0.703	1.42
		Aug-Sep	0.610	1.64	0.703	1.42
		Oct-Nov	0.280	3.57	0.321	3.12
Beaufort Sea	Crude	Dec-Jan	1.830	0.55	10.012	0.10
		Feb-Mar	3.280	0.30	17.963	0.06
		Apr-May	3.720	0.27	20.363	0.05
		Jun-Jul	4.610	0.22	25.235	0.04
		Aug-Sep	2.890	0.35	15.830	0.06
		Oct-Nov	2.390	0.42	13.090	0.08
	Distillate	Dec-Jan	0.000	n/a	0.366	2.73
		Feb-Mar	0.000	n/a	0.366	2.73
		Apr-May	0.060	16.67	0.366	2.73
		Jun-Jul	0.060	16.67	0.366	2.73
		Aug-Sep	0.060	16.67	0.366	2.73
		Oct-Nov	0.060	16.67	0.366	2.73
	Heavy	Dec-Jan	0.000	n/a	0.059	16.95
		Feb-Mar	0.000	n/a	0.059	16.95
		Apr-May	0.070	14.29	0.059	16.95
		Jun-Jul	0.070	14.29	0.059	16.95
		Aug-Sep	0.070	14.29	0.059	16.95
		Oct-Nov	0.070	14.29	0.059	16.95
	Light	Dec-Jan	10.670	0.09	50.904	0.02
		Feb-Mar	13.500	0.07	64.401	0.02
		Apr-May	12.000	0.08	57.241	0.02
		Jun-Jul	9.890	0.10	47.187	0.02
		Aug-Sep	9.330	0.11	44.504	0.02
		Oct-Nov	7.720	0.13	36.816	0.03
Bristol Bay	Crude	Dec-Jan	0.000	n/a	0.000	n/a
		Feb-Mar	0.000	n/a	0.000	n/a
		Apr-May	0.000	n/a	0.000	n/a
		Jun-Jul	0.000	n/a	0.000	n/a
		Aug-Sep	0.000	n/a	0.000	n/a
		Oct-Nov	0.000	n/a	0.000	n/a
	Distillate	Dec-Jan	0.000	n/a	0.092	10.87
		Feb-Mar	0.000	n/a	0.092	10.87
		Apr-May	0.440	2.27	0.229	4.37
		Jun-Jul	0.340	2.94	0.178	5.62
		Aug-Sep	0.170	5.88	0.088	11.36
		Oct-Nov	0.120	8.33	0.062	16.13
	Heavy	Dec-Jan	0.040	25.00	0.011	90.91
		Feb-Mar	0.040	25.00	0.011	90.91
		Apr-May	0.060	16.67	0.017	58.82
		Jun-Jul	0.280	3.57	0.078	12.82
		Aug-Sep	0.110	9.09	0.031	32.26
		Oct-Nov	0.040	25.00	0.011	90.91
	Light	Dec-Jan	0.280	3.57	0.327	3.06
		Feb-Mar	0.560	1.79	0.654	1.53
		Apr-May	2.060	0.49	2.412	0.41
		Jun-Jul	6.450	0.16	7.558	0.13

Table 94: Baseline and Forecasted Incident Rates and Return Years[207]						
Region	Oil Type	Period	Baseline		Forecasted (2025)	
			Annual Freq.	Return Yrs.	Annual Freq.	Return Yrs.
		Aug-Sep	1.220	0.82	1.432	0.70
		Oct-Nov	0.390	2.56	0.457	2.19
Cook Inlet	Crude	Dec-Jan	1.330	0.75	1.258	0.79
		Feb-Mar	1.720	0.58	1.627	0.61
		Apr-May	2.880	0.35	2.725	0.37
		Jun-Jul	2.110	0.47	2.000	0.50
		Aug-Sep	2.940	0.34	2.784	0.36
		Oct-Nov	1.330	0.75	1.258	0.79
	Distillate	Dec-Jan	0.390	2.56	0.490	2.04
		Feb-Mar	0.500	2.00	0.630	1.59
		Apr-May	1.110	0.90	1.398	0.72
		Jun-Jul	0.720	1.39	0.908	1.10
		Aug-Sep	0.830	1.20	1.042	0.96
		Oct-Nov	0.390	2.56	0.490	2.04
	Heavy	Dec-Jan	0.280	3.57	0.890	1.12
		Feb-Mar	0.280	3.57	0.890	1.12
		Apr-May	0.390	2.56	1.243	0.80
		Jun-Jul	0.500	2.00	1.596	0.63
		Aug-Sep	0.670	1.49	2.133	0.47
		Oct-Nov	0.390	2.56	1.243	0.80
	Light	Dec-Jan	6.780	0.15	7.408	0.13
		Feb-Mar	7.610	0.13	8.318	0.12
		Apr-May	9.890	0.10	10.810	0.09
		Jun-Jul	12.780	0.08	13.965	0.07
		Aug-Sep	11.390	0.09	12.445	0.08
		Oct-Nov	7.060	0.14	7.713	0.13
Kotzebue Sound/ Hope Basin	Crude	Dec-Jan	0.000	n/a	0.000	n/a
		Feb-Mar	0.000	n/a	0.000	n/a
		Apr-May	0.000	n/a	0.000	n/a
		Jun-Jul	0.000	n/a	0.000	n/a
		Aug-Sep	0.000	n/a	0.000	n/a
		Oct-Nov	0.000	n/a	0.000	n/a
	Distillate	Dec-Jan	0.000	n/a	0.216	4.63
		Feb-Mar	0.000	n/a	0.216	4.63
		Apr-May	0.060	16.67	0.038	26.32
		Jun-Jul	0.120	8.33	0.073	13.70
		Aug-Sep	0.110	9.09	0.068	14.71
		Oct-Nov	0.060	16.67	0.038	26.32
	Heavy	Dec-Jan	0.000	n/a	0.019	52.63
		Feb-Mar	0.000	n/a	0.019	52.63
		Apr-May	0.030	33.33	0.019	52.63
		Jun-Jul	0.030	33.33	0.019	52.63
		Aug-Sep	0.030	33.33	0.019	52.63
		Oct-Nov	0.030	33.33	0.019	52.63
	Light	Dec-Jan	0.110	9.09	0.109	9.17
		Feb-Mar	0.280	3.57	0.274	3.65
		Apr-May	0.170	5.88	0.165	6.06
		Jun-Jul	0.720	1.39	0.709	1.41
		Aug-Sep	0.330	3.03	0.326	3.07

Table 94: Baseline and Forecasted Incident Rates and Return Years[207]						
Region	Oil Type	Period	Baseline		Forecasted (2025)	
			Annual Freq.	Return Yrs.	Annual Freq.	Return Yrs.
		Oct-Nov	0.440	2.27	0.430	2.33
Kodiak/ Shelikof Strait	Crude	Dec-Jan	0.050	20.00	0.014	71.43
		Feb-Mar	0.050	20.00	0.014	71.43
		Apr-May	0.050	20.00	0.014	71.43
		Jun-Jul	0.050	20.00	0.014	71.43
		Aug-Sep	0.050	20.00	0.014	71.43
		Oct-Nov	0.050	20.00	0.014	71.43
	Distillate	Dec-Jan	0.330	3.03	0.609	1.64
		Feb-Mar	0.110	9.09	0.203	4.93
		Apr-May	0.390	2.56	0.715	1.40
		Jun-Jul	0.280	3.57	0.512	1.95
		Aug-Sep	0.110	9.09	0.203	4.93
		Oct-Nov	0.230	4.35	0.423	2.36
	Heavy	Dec-Jan	0.170	5.88	0.091	10.99
		Feb-Mar	0.110	9.09	0.060	16.67
		Apr-May	0.170	5.88	0.091	10.99
		Jun-Jul	0.060	16.67	0.034	29.41
		Aug-Sep	0.170	5.88	0.091	10.99
		Oct-Nov	0.280	3.57	0.151	6.62
	Light	Dec-Jan	7.000	0.14	7.939	0.13
		Feb-Mar	7.450	0.13	8.446	0.12
		Apr-May	7.280	0.14	8.256	0.12
		Jun-Jul	9.170	0.11	10.400	0.10
		Aug-Sep	6.890	0.15	7.814	0.13
		Oct-Nov	6.000	0.17	6.804	0.15
Chukchi Sea	Crude	Dec-Jan	0.010	100.00	0.061	16.39
		Feb-Mar	0.010	100.00	0.061	16.39
		Apr-May	0.010	100.00	0.061	16.39
		Jun-Jul	0.010	100.00	0.061	16.39
		Aug-Sep	0.010	100.00	0.061	16.39
		Oct-Nov	0.010	100.00	0.061	16.39
	Distillate	Dec-Jan	0.070	14.29	0.026	38.46
		Feb-Mar	0.070	14.29	0.026	38.46
		Apr-May	0.070	14.29	0.026	38.46
		Jun-Jul	0.070	14.29	0.026	38.46
		Aug-Sep	0.070	14.29	0.026	38.46
		Oct-Nov	0.070	14.29	0.026	38.46
	Heavy	Dec-Jan	0.000	n/a	0.027	37.04
		Feb-Mar	0.000	n/a	0.027	37.04
		Apr-May	0.020	50.00	0.027	37.04
		Jun-Jul	0.020	50.00	0.027	37.04
		Aug-Sep	0.020	50.00	0.027	37.04
		Oct-Nov	0.020	50.00	0.027	37.04
	Light	Dec-Jan	0.220	4.55	0.183	5.46
		Feb-Mar	0.110	9.09	0.255	3.92
		Apr-May	0.110	9.09	0.218	4.59
		Jun-Jul	0.110	9.09	0.984	1.02
		Aug-Sep	0.610	1.64	0.693	1.44
		Oct-Nov	0.060	16.67	0.473	2.11

Table 94: Baseline and Forecasted Incident Rates and Return Years[207]						
Region	Oil Type	Period	Baseline		Forecasted (2025)	
			Annual Freq.	Return Yrs.	Annual Freq.	Return Yrs.
Norton Sound/ St. Lawrence Island	Crude	Dec-Jan	0.000	n/a	0.000	n/a
		Feb-Mar	0.000	n/a	0.000	n/a
		Apr-May	0.000	n/a	0.000	n/a
		Jun-Jul	0.000	n/a	0.000	n/a
		Aug-Sep	0.000	n/a	0.000	n/a
		Oct-Nov	0.000	n/a	0.000	n/a
	Distillate	Dec-Jan	0.120	8.33	0.132	7.58
		Feb-Mar	0.110	9.09	0.122	8.20
		Apr-May	0.060	16.67	0.069	14.49
		Jun-Jul	0.180	5.56	0.201	4.98
		Aug-Sep	0.170	5.88	0.186	5.38
		Oct-Nov	0.060	16.67	0.069	14.49
	Heavy	Dec-Jan	0.000	n/a	0.023	43.48
		Feb-Mar	0.000	n/a	0.023	43.48
		Apr-May	0.040	25.00	0.005	200.00
		Jun-Jul	0.050	20.00	0.007	142.86
		Aug-Sep	0.040	25.00	0.005	200.00
		Oct-Nov	0.040	25.00	0.005	200.00
	Light	Dec-Jan	0.280	3.57	0.305	3.28
		Feb-Mar	0.390	2.56	0.426	2.35
		Apr-May	0.330	3.03	0.363	2.75
		Jun-Jul	1.500	0.67	1.641	0.61
		Aug-Sep	1.060	0.94	1.157	0.86
		Oct-Nov	0.720	1.39	0.789	1.27
Off Kenai Peninsula	Crude	Dec-Jan	0.010	100.00	0.003	333.33
		Feb-Mar	0.010	100.00	0.003	333.33
		Apr-May	0.010	100.00	0.003	333.33
		Jun-Jul	0.010	100.00	0.003	333.33
		Aug-Sep	0.010	100.00	0.003	333.33
		Oct-Nov	0.010	100.00	0.003	333.33
	Distillate	Dec-Jan	0.110	9.09	0.079	12.66
		Feb-Mar	0.110	9.09	0.079	12.66
		Apr-May	0.170	5.88	0.120	8.33
		Jun-Jul	0.110	9.09	0.079	12.66
		Aug-Sep	0.330	3.03	0.238	4.20
		Oct-Nov	0.060	16.67	0.517	1.93
	Heavy	Dec-Jan	0.110	9.09	0.049	20.41
		Feb-Mar	0.110	9.09	0.049	20.41
		Apr-May	0.030	33.33	0.014	71.43
		Jun-Jul	0.030	33.33	0.014	71.43
		Aug-Sep	0.030	33.33	0.014	71.43
		Oct-Nov	0.030	33.33	0.014	71.43
	Light	Dec-Jan	1.280	0.78	1.482	0.67
		Feb-Mar	2.110	0.47	2.446	0.41
		Apr-May	2.610	0.38	3.021	0.33
		Jun-Jul	3.000	0.33	3.477	0.29
		Aug-Sep	2.220	0.45	2.569	0.39
		Oct-Nov	1.670	0.60	1.934	0.52
South-	Crude	Dec-Jan	0.110	9.09	0.062	16.13

Table 94: Baseline and Forecasted Incident Rates and Return Years[207]						
Region	Oil Type	Period	Baseline		Forecasted (2025)	
			Annual Freq.	Return Yrs.	Annual Freq.	Return Yrs.
Central Alaska		Feb-Mar	0.110	9.09	0.062	16.13
		Apr-May	0.050	20.00	0.027	37.04
		Jun-Jul	0.040	25.00	0.022	45.45
		Aug-Sep	0.040	25.00	0.022	45.45
		Oct-Nov	0.050	20.00	0.027	37.04
	Distillate	Dec-Jan	0.000	n/a	0.030	33.33
		Feb-Mar	0.000	n/a	0.030	33.33
		Apr-May	0.220	4.55	0.074	13.51
		Jun-Jul	0.110	9.09	0.037	27.03
		Aug-Sep	0.110	9.09	0.037	27.03
		Oct-Nov	0.000	n/a	0.030	33.33
	Heavy	Dec-Jan	0.050	20.00	0.026	38.46
		Feb-Mar	0.110	9.09	0.059	16.95
		Apr-May	0.110	9.09	0.059	16.95
		Jun-Jul	0.040	25.00	0.021	47.62
		Aug-Sep	0.040	25.00	0.021	47.62
		Oct-Nov	0.050	20.00	0.026	38.46
	Light	Dec-Jan	0.390	2.56	0.481	2.08
		Feb-Mar	0.830	1.20	1.022	0.98
		Apr-May	1.110	0.90	1.371	0.73
		Jun-Jul	0.780	1.28	0.962	1.04
		Aug-Sep	0.940	1.06	1.158	0.86
		Oct-Nov	0.440	2.27	0.541	1.85
Prince William Sound	Crude	Dec-Jan	0.830	1.20	0.496	2.02
		Feb-Mar	0.610	1.64	0.366	2.73
		Apr-May	0.500	2.00	0.300	3.33
		Jun-Jul	0.670	1.49	0.400	2.50
		Aug-Sep	0.280	3.57	0.167	5.99
		Oct-Nov	0.560	1.79	0.334	2.99
	Distillate	Dec-Jan	0.390	2.56	0.463	2.16
		Feb-Mar	0.390	2.56	0.463	2.16
		Apr-May	0.780	1.28	0.925	1.08
		Jun-Jul	0.840	1.19	0.999	1.00
		Aug-Sep	0.280	3.57	0.331	3.02
		Oct-Nov	0.730	1.37	0.867	1.15
	Heavy	Dec-Jan	0.060	16.67	0.522	1.92
		Feb-Mar	0.060	16.67	0.522	1.92
		Apr-May	0.060	16.67	0.522	1.92
		Jun-Jul	0.280	3.57	2.349	0.43
		Aug-Sep	0.060	16.67	0.522	1.92
		Oct-Nov	0.170	5.88	1.417	0.71
	Light	Dec-Jan	5.670	0.18	5.706	0.18
		Feb-Mar	6.220	0.16	6.263	0.16
		Apr-May	7.560	0.13	7.610	0.13
		Jun-Jul	12.170	0.08	12.250	0.08
		Aug-Sep	8.500	0.12	8.559	0.12
		Oct-Nov	5.000	0.20	5.033	0.20
Southeast Alaska	Crude	Dec-Jan	0.030	33.33	0.042	23.81
		Feb-Mar	0.030	33.33	0.042	23.81

Table 94: Baseline and Forecasted Incident Rates and Return Years[207]						
Region	Oil Type	Period	Baseline		Forecasted (2025)	
			Annual Freq.	Return Yrs.	Annual Freq.	Return Yrs.
		Apr-May	0.030	33.33	0.042	23.81
		Jun-Jul	0.030	33.33	0.042	23.81
		Aug-Sep	0.030	33.33	0.042	23.81
		Oct-Nov	0.030	33.33	0.042	23.81
	Distillate	Dec-Jan	2.110	0.47	2.677	0.37
		Feb-Mar	1.610	0.62	2.677	0.37
		Apr-May	1.720	0.58	2.677	0.37
		Jun-Jul	3.720	0.27	2.677	0.37
		Aug-Sep	3.610	0.28	2.677	0.37
		Oct-Nov	2.830	0.35	2.677	0.37
	Heavy	Dec-Jan	0.390	2.56	0.300	3.33
		Feb-Mar	0.330	3.03	0.256	3.91
		Apr-May	0.330	3.03	0.256	3.91
		Jun-Jul	0.500	2.00	0.386	2.59
		Aug-Sep	0.670	1.49	0.515	1.94
		Oct-Nov	0.780	1.28	0.600	1.67
	Light	Dec-Jan	20.170	0.05	23.254	0.04
		Feb-Mar	27.560	0.04	31.774	0.03
		Apr-May	25.840	0.04	29.794	0.03
		Jun-Jul	44.280	0.02	51.052	0.02
		Aug-Sep	38.950	0.03	44.905	0.02
		Oct-Nov	26.170	0.04	30.171	0.03
Western Alaska	Crude	Dec-Jan	0.000	n/a	0.000	n/a
		Feb-Mar	0.000	n/a	0.000	n/a
		Apr-May	0.000	n/a	0.000	n/a
		Jun-Jul	0.000	n/a	0.000	n/a
		Aug-Sep	0.000	n/a	0.000	n/a
		Oct-Nov	0.000	n/a	0.000	n/a
	Distillate	Dec-Jan	0.220	4.55	0.184	5.43
		Feb-Mar	0.110	9.09	0.092	10.87
		Apr-May	0.230	4.35	0.191	5.24
		Jun-Jul	0.720	1.39	0.598	1.67
		Aug-Sep	0.500	2.00	0.415	2.41
		Oct-Nov	0.500	2.00	0.415	2.41
	Heavy	Dec-Jan	0.000	n/a	0.041	24.39
		Feb-Mar	0.000	n/a	0.041	24.39
		Apr-May	0.070	14.29	0.041	24.39
		Jun-Jul	0.070	14.29	0.041	24.39
		Aug-Sep	0.070	14.29	0.041	24.39
		Oct-Nov	0.070	14.29	0.041	24.39
	Light	Dec-Jan	1.280	0.78	1.475	0.68
		Feb-Mar	1.670	0.60	1.925	0.52
		Apr-May	2.890	0.35	3.333	0.30
		Jun-Jul	4.000	0.25	4.610	0.22
		Aug-Sep	4.390	0.23	5.059	0.20
		Oct-Nov	1.720	0.58	1.981	0.50

Overall, there are likely to be 610 incidents per year that could lead to oil spillage. About 67% of the incidents would come from vessels and the rest from facilities. This comes to nearly two incidents per day. The vast majority of these incidents will result in little if any spillage.

Figures 44 through 49[208] show maps of the baseline and forecasted incident probability rates by oil type (across all seasons). Note that this only indicates the probability that there will be an incident, *not* the impact of the incident. Note that for distillate and light oil (Figures ES-4 and ES-6) there is no significant change in the rates.

The major change is the increase in the probability of crude spills in the Beaufort Sea and a slight increase in the probability of crude spills in the Aleutians.

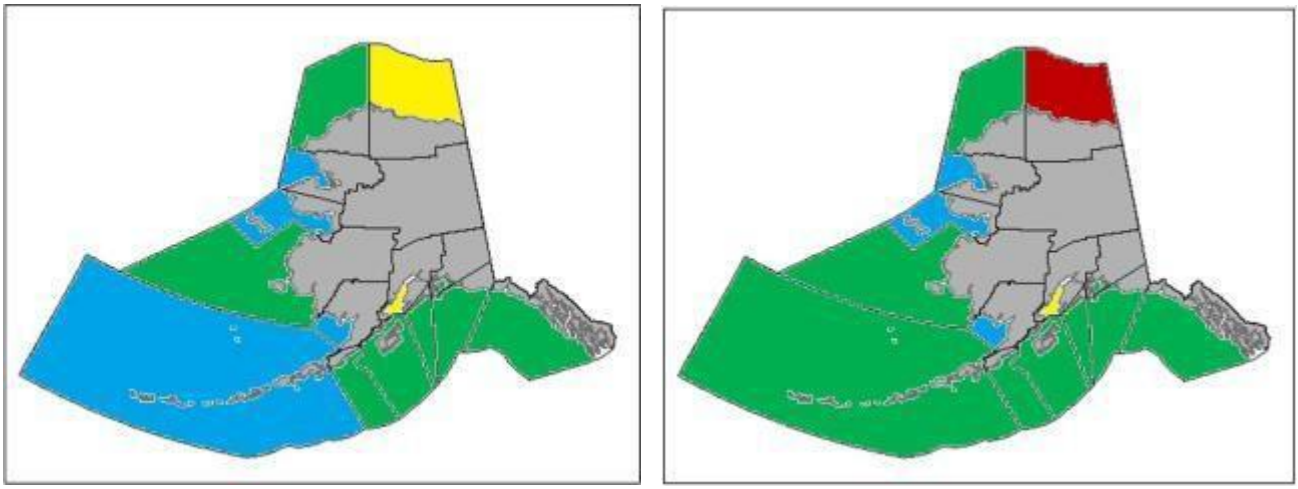

Figure 46: Baseline (left) and Forecasted (right) Crude Incident Rates

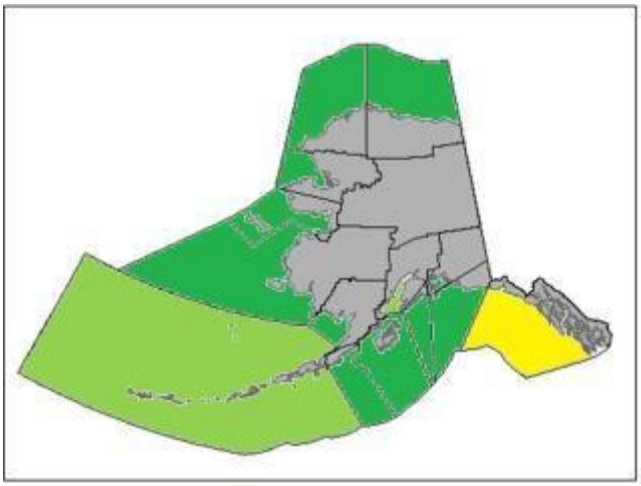

Figure 47: Baseline and Forecasted Distillate Incident Rates (No Change)

[208] Incident rates are color-coded so that dark red represents highest probability, red represent very high probability, orange represents high probability, yellow represents moderate probability, light green represents low probability, darker green represents very low probability, and blue represents lowest (unlikely) probability.

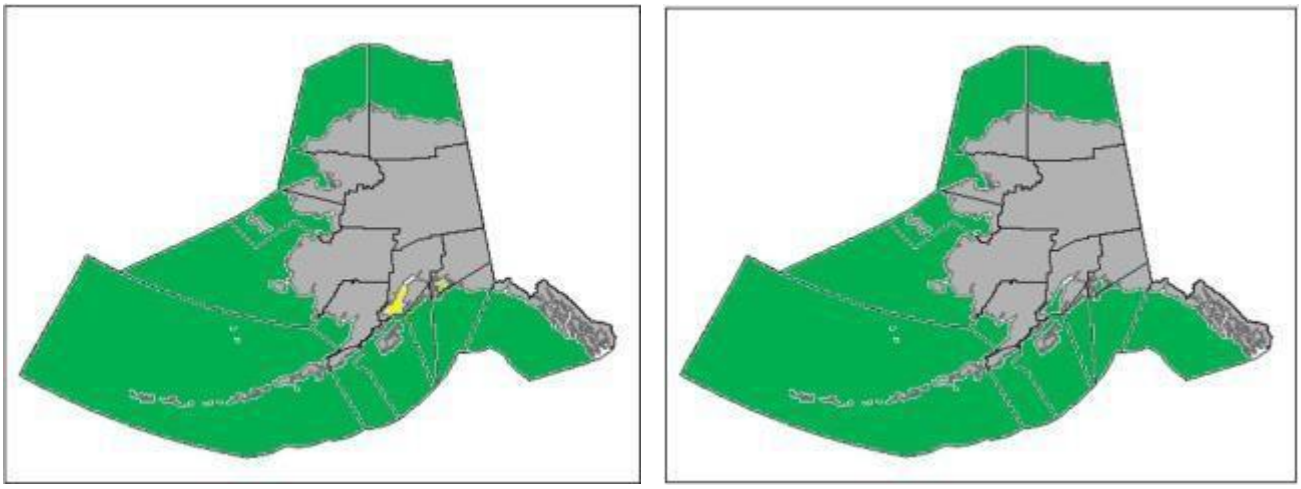

Figure 48: Baseline (left) and Forecasted (right) Heavy Oil Incident Rates

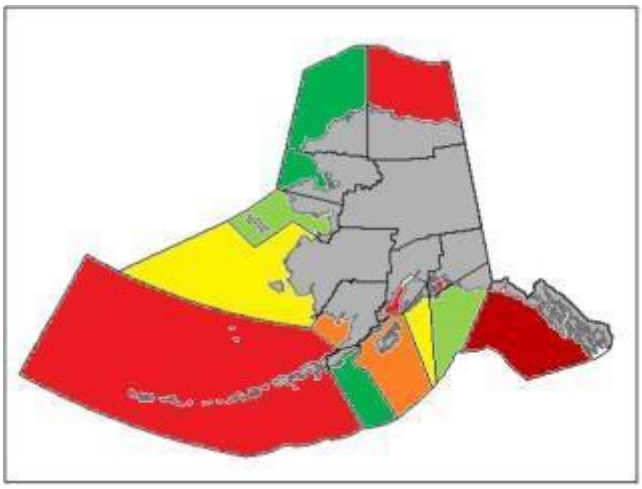

Figure 49: Baseline and Forecasted Light Oil Incident Rates (No Change)

Since there is unavoidable uncertainty in the incident rates for the future, as well as the fact that the WCD volumes are highly skewed toward a well blowout or very large tanker spill, the resulting risk calculations derived need to be viewed with appropriate awareness and caution, although the probability of well blowouts and large tanker spills is considered very low.

The project scope and purpose encompassed identifying those spill scenarios (regional location, oil type, yearly time period, and MMPD and WCD volume) that present the highest *risk* – that is, the highest probability and environmental impact combination. Because of the extremely large volumes involved with WCD well blowouts, as well as very large tanker WCDs, the overall risk is skewed towards these types of events. It is important to bear in mind that the probabilities of these "catastrophic" spill events are extremely low. Of course, this does not mean that these events could never happen.

The spill volumes shown in Table 90 are the weight-averaged maximum most-probable discharges (WA-MMPD) and the worst-case discharge (WCD) volumes. Both represent scenarios with a very low likelihood of occurrence. For all incident types, the volume tends to be small and even the maximum most-probable discharge is an anomaly. The WCD volumes, especially for large tanker spills and well blowouts are very unlikely, but must be taken into account for contingency planning and risk mitigation development.

The greatest potential for spill volume in Alaska is from offshore oil wells. For the 40 years prior to the 2010 Macondo MC252 spill in the Gulf of Mexico, the volume of spillage from US offshore wells and platforms had totaled 277,000 bbl. Of this, 80% had spilled during 1969 and 1970. Between 1978 and 2009, average annual spillage in the US was 1,500 bbl.[209] The estimated 4.2 million bbl of spillage from the Macondo MC252 incident[210] skewed all previous data, making up about 90% of the total spillage from US wells over the course of 45 years. An analysis of international data on well blowouts indicates that since 1968, there have been 11 well blowouts involving more than 50,000 bbl. Only two incidents involved more than 250,000 bbl. Though the term "blowout" seemingly implies a WCD, this is not the actual case.[211] Of the 18 well blowouts that have been reported in the US, only two have involved 100,000 bbl or more – the 1969 Alpha Well 21 Platform A blowout off Santa Barbara, California, and the Macondo MC252 blowout. Of the 18 blowouts that have occurred in the US over 45 years, one third have involved less 50 bbl, 22% less than 10 bbl (Table 95).

Table 95: Largest International Oil Well Blowouts (Ordered by Volume)[212]

Well	Date	Location	Bbl Spilled
Macondo MC252	April – July 2010	Gulf of Mexico	4,200,000
Ixtoc I	June 1979 – April 1980	Bahia del Campeche, Mexico	3,300,000
Abkatun 91	October 1986	Bahia del Campeche, Mexico	247,000
Ekofisk Bravo	April 1977	North Sea, Norway	202,381
Funiwa 5	January 1980	Forcados, Nigeria	200,000
Hasbah 6	October 1980	Gulf, Saudi Arabia	105,000
Iran Marine International	December 1971	Gulf, Iran	100,000
Alpha Well 21 Platform A	January 1969	Pacific, CA, USA	100,000
Main Pass Block 41 Platform C	March 1970	Gulf of Mexico	65,000
Yum II/Zapoteca	October 1987	Bahia del Campeche, Mexico	58,643
South Timbalier B-26	December 1970	Gulf of Mexico, USA	53,095

Though the term "blowout" seemingly implies a WCD, this is not the actual case. Of the 18 well blowouts that have been reported in the US, only two have involved 100,000 bbl or more (Table 96). Of

[209] Etkin (2009a).
[210] The total volume of spillage from the Macondo MC252 blowout is in dispute. BP and Anadarko claim that the total volume of spillage was 3,260,000 bbl of which 810,000 bbl were captured at the wellhead, releasing 2,450,000 bbl to the environment (Fitch et al. 2013). The US government claims that the total volume was 5,000,000 bbl of which 800,000 bbl were captured at the wellhead, releasing 4,200,000 bbl to the environment l (Hauck et al. 2013).
[211] NOAA defines a well blowout as "an uncontrolled flow of gas, oil, or other fluids from a well into the atmosphere or into an underground formation". The BOEM and BSEE define a "loss of well control" as "uncontrolled flow of formation or other fluids, including flow to an exposed formation (an underground blowout) or at the surface (a surface blowout),
flow through a diverter, or uncontrolled flow resulting from a failure of surface equipment or procedures".
[212] Adapted from Etkin (2009a).

the 18 blowouts that have occurred in the US over 45 years, one third have involved less 50 bbl, 22% less than 10 bbl.

Table 96: US Oil Well Blowouts (Ordered by Volume)[213]

Well[214]	Date	Location	Bbl Spilled	Oil Type
Macondo MC252	4/20/2010	Gulf of Mexico	4,200,000	crude
Alpha Well 21 Platform A	1/28/1969	Pacific (Santa Barbara, CA)	100,000	crude
Main Pass Block 41 Platform C	3/1/1970	Gulf of Mexico	65,000	crude
South Timbalier B-26	12/1/1970	Gulf of Mexico	53,095	crude
Ship Shoal 149/199	10/1/1964	Gulf of Mexico	11,847	crude
Greenhill Timbalier Bay 251*	9/29/1992	Gulf of Mexico	11,500	crude
Hebert Bravo 1A	2/19/1979	Gulf of Mexico	3,500	condensate
Ship Shoal 29	7/1/1965	Gulf of Mexico	1,690	crude
BLDSU 6	1/13/1995	Gulf of Mexico	800	crude
Block 60 SP0060	12/26/1992	Gulf of Mexico	595	condensate
Fred Stovall Well 9*	7/8/1994	Gulf of Mexico	595	condensate
MC 538	2/28/2000	Gulf of Mexico	200	crude
Houma Block PL0020	9/7/1974	Gulf of Mexico	75	crude
Lafayette Block EI 0215	10/16/1971	Gulf of Mexico	45	crude
EI-0296	9/9/1990	Gulf of Mexico	8	condensate
VR-0226	3/20/1987	Gulf of Mexico	6	crude
WD-0090	2/23/1985	Gulf of Mexico	5	crude
Houma Block PL0019	12/2/1974	Gulf of Mexico	2	crude

Theoretically, a very large or even a WCD-volume well blowout could occur in Alaskan waters, in either the Beaufort Sea or the Chukchi Sea. The probability is extremely small, but certainly needs to be considered in risk planning. The WCD volume for well blowouts in these regions is 3.9 million bbl and 2.2 million bbl, respectively – or 93% or 52% of the volume of the Macondo MC252 spillage.

The next largest WCD spill volume would be a spill from a fully-loaded crude tanker. In US coastal waters, between the years 1969 and 2013, there has never been a true WCD from an oil tanker with respect to volume of spillage. Note that despite its significant environmental and socioeconomic impacts, the 1989 Exxon Valdez spill was not a WCD. The tanker only spilled about 14% of its cargo load. Had it been a WCD, the volume of spillage would have been about 1.6 million bbl rather than 262,000 bbl. Average spillage volume from tankers is 435 bbl. Since 1969, there have been 13 tanker spill incidents involving 100,000 bbl or more. [215] While the likelihood of a WCD from a tanker is seemingly higher than a WCD due to a well blowout, this still represents a very low likelihood of occurrence. Again, risk planning and risk mitigation measures need to take into account the possibility of a WCD from a tanker.

The most significant conclusions from the incident analysis of historical incidents in Alaskan marine waters are:

- For each potential spill incident involving a vessel that occurs, there is a 61% probability that there will be spillage of oil;

[213] Adapted from Etkin (2009a).
[214] * indicates incidents in state waters.
[215] Etkin (2009a.).

- For each potential spill incident involving a facility (or pipeline) that occurs there is an 85% probability that there will be spillage of oil;
- The difference in rates between facilities and vessels most probably reflects the greater likelihood of a potential spill incident to be reported to or detected by US Coast Guard or state officials as part of vessel casualty reporting;
- Facility incident rates have remained fairly steady over the last 18 years, while vessel incident rates have declined dramatically;
- About one-third of all incidents occur in the Southeast Alaska region, followed by the Aleutians with 15% and Beaufort Sea with 14%;
- Nearly 87% of all incidents involve light oils, mostly diesel;
- Incidents are somewhat more likely in the summer months than during other time periods, probably due to more fishing and recreational boating activities;
- Annually, there are, on average, 610 incidents, the most common of which are light oil spills in Southeast Alaska and the Aleutians;
- The highest potential spill volume is a WCD due to a well blowout in the Beaufort or Chukchi Seas, though the likelihood of this occurring is extremely small;
- The theoretical volume of a WCD from a well blowout is 3.7 times the volume spilled from the 2010 Macondo MC252 well blowout in the Gulf of Mexico; and
- While there are, on average, 81 incidents per year involving Beaufort Sea oil exploration and production facilities, none of these incidents have involved a blowout; 85% of the incidents have involved less than one bbl or no spillage, and the total volume of spillage has been 2,020 bbl.

Future spillage rates are expected to change in the following ways:

- Potential reduction in overall tanker spillage rates by 34% attributable to additional changes in risk mitigation measures for causes other than impact accidents;
- Reduction in spill probability due to impact accidents based on full implementation of double hulls for tank vessels (tankers and tank barges), which make up 2% of tanker incidents and 16% of barge incidents in Alaska, as follows:
    - Crude tankers – 67% reduction;
    - Product tankers – 63% reduction;
    - Tank barges - 58% reduction;
- Increase of vessel traffic in Cook Inlet and other regions (except Aleutians, Beaufort Sea, and Chukchi Sea) by 25%;
- Decrease in probability of spillage from non-tank vessels by 23% due to the presence of double-hulls on bunker tanks on 45% of vessels;
- Increase in vessel traffic in the Aleutians, Beaufort Sea, and Chukchi Sea regions as follows:
    - Container ships: 34%
    - Bulk carriers: 6%
    - General cargo vessels: 82%
    - Product tankers: 133%
- Increase in Beaufort Sea oil exploration and production-related spillage rates by 400% and Chukchi Sea activities by 150%;

- Overall increases spills from facility and vessel activities (if not otherwise addressed in another category in this list) of 14%;
- Increase of 20% in Cook Inlet spillage rates from oil exploration and production;
- 50% reduction in WCD volumes for crude and product tankers; and
- Shift of 50% from heavy bunker fuel to diesel fuel on larger ships due to regulatory changes related to air emissions in in-port areas.

In the future projections, for any time periods for which the incident rate is zero for shipping, oil production, and other activities, incident rates were distributed evenly across these time periods due to the presumed lower rate of ice coverage. It was assumed that recreational boating and cruise ship transits would still follow typical seasonal patterns despite the changes in ice coverage.

Recommendations for Future Studies

The results of the analyses of incident rates and spillage volumes and their application to the overall analysis of environmental risk provide a perspective on the potential incidents that could cause the most significant environmental impacts to Alaskan waters and coastlines based on their volume, oil type, location, and seasonal time period. The study provides a preliminary assessment of spill risk to identify spill scenarios that present higher and lower risk. Further studies built on the results in this study could provide greater detail on various aspects of the factors that constitute risk – particularly spill volume and location.

As designed and as per the scope of this study, the results provide an analysis of the risk of maximum most-probable discharges (MMPD) and worst-case discharges (WCD). Both of these types of events are relatively unlikely to occur, but must be accounted for in risk planning. The most common types of incidents generally involve small amounts of oil. For the purposes of response planning, these smaller incidents (often only a few bbl at most), which represent the average most-probably discharges (AMPD) are those events which are most likely to occur.

A more detailed analysis of the causes of incidents by source type (e.g., numbers of tanker collisions or groundings) and the development of probability distribution functions of spill volumes by source type, cause, oil type, and location would provide important information that could be applied to response planning and risk mitigation development.

The incident analyses also identify the locations of spills only as far as the region. In reality, the incidents are not evenly distributed throughout the region, but tend to be clustered in port areas, in vessel traffic lanes, and at specific facility locations. Likewise, the environmental vulnerability of the regions also varies within the larger regional boundaries.

The data for each of the individual incidents in the incident database include specific locations (latitude/longitude, port location, etc.) in addition to the classification of incidents into study regions. A more detailed analysis of spill location coupled with analyses of specific environmental impacts by actual location within the region would provide more information on spill risk.

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