Offshore Information for Area Contingency Planning

Arctic and Western Alaska

Worst Case Discharge Scenario Modeling Overview

and

WCD Scenario Appendices (2A-2C)

Technical Document #2

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1 Introduction

1.1 Purpose

In 2019, the Bureau of Safety and Environmental Enforcement (BSEE) sponsored a project in cooperation with the United States Coast Guard (USCG) to improve the content of the coastal zone area contingency plans (ACPs) with respect to the information necessary to effectively plan for and respond to large oil spills from offshore oil and gas facilities. This collaboration between BSEE, the Bureau of Ocean Energy Management (BOEM), USCG Sector Anchorage, Alaska Department of Environmental Conservation (ADEC), resource trustees, state agencies, oil spill removal organizations (OSROs), and the Arctic and Western Alaska Area Committee resulted in a series of technical documents that provide offshore information on:

- Oil and Gas Infrastructure (Arctic and Western Alaska Technical Document #1)
- **Worst Case Discharge Scenarios (Arctic and Western Alaska Technical Document #2 and Appendices 2A-C)**
- Response Concept of Operations (Arctic and Western Alaska Technical Document #3)
- Response Strategies and BMPs (Arctic and Western Alaska Technical Document #4)
- Sensitive Species Profiles (Arctic and Western Alaska Technical Document #5)
- Offshore Environmental Sensitivity Index Atlas (Arctic and Western Alaska Technical Document #6)

These documents were developed specifically for incorporation by reference into the ACP and are hosted on the BSEE Oil Spill Preparedness Division's (OSPD) website. In addition to the above technical documents, an inventory of offshore spill response equipment and a set of offshore Environmental Sensitivity Indices (ESI) maps were created and embedded in NOAA's Environmental Response Management Application (ERMA). Collectively, these materials provide a foundation of risk assessment, resources at risk, and conceptual response information to inform coastal zone ACP planning and responses to a significant offshore facility oil spill incident.

The WCD scenario information in this technical document is organized into three main components: Section 1 describes the background for this project and explains how the WCD scenarios were selected. Section 2 contains a description of key modeling concepts and reference scales that are useful for understanding the oil spill trajectory data and figures that were developed for each of the WCD scenarios. Section 3 contains a series of tables that collate and summarize key information regarding all of the WCD scenarios that were developed for the Arctic and Western Alaska. Appendices 2A – 2C contain specific, more detailed WCD scenario modeling data and trajectory figures (see hyperlinks below). Each of these scenarios was modeled during a designated time in the seasonal ice cycle.

- Appendix 2A – Cook Inlet
    a. Hilcorp Cook Inlet Exploration Well Blowout – Open Water
    b. Cosmo A-1 Batch Spill – Open Water

- Appendix 2B – Chukchi Sea
    a. Burger J Well Blowout – Open Water

- Appendix 2C – Beaufort Sea
    a. Nikaitchuq North Exploration Well Blowout – Open Water
    b. Nikaitchuq North Exploration Well Blowout – Ice Break Up
    c. Endicott Pipeline Discharge – Open Water
    d. Liberty A Development Well Blowout – Solid Ice
    e. Liberty B Production Well Blowout – Open Water

A standard set of figures were created for each scenario. If the scenario did not involve oil exceeding the threshold captured in the figure, that figure was not included in the Appendix. Figures showing no oil impacts are not included in this document. Therefore, if one of the below listed figures are not included for a given scenario, there were no oil impacts above the listed threshold. The only exception to this standard is the figures for Scenario 7 for the Liberty A Development Well Blowout in Solid Ice. Due to the full ice in this scenario, different figures were created.

Figures that may be included for each scenario (other than Scenario 7) are:

- Annual Wind Rose
- Annual Current Rose
- Probability Footprint for Oil on the Water Surface with Average Thickness greater than the Ecological Threshold of 10 μm
- Minimum Time for Oil on the Water Surface with Average Thickness greater than the Ecological Threshold of 10 μm
- Probability Footprint for Oil on the Shoreline with Average Thickness greater than the Ecological Threshold of 10 μm
- Probability Footprint for Total Hydrocarbon Concentration (THC) concentrations in the Water Column greater than the Ecological Threshold of 10 μg/L (~10 ppb)
- Mass Balance over Time for worst case deterministic simulation
- Cumulative Maximum Concentration of Dissolved Polycyclic Aromatic Hydrocarbons (PAH) within the water column at any time during the worst case deterministic simulation period
- Probability Footprint for Surface Oil exposure greater than 50 μm
- Probability Footprint for Surface Oil exposure greater than 50 μm
- Cumulative Maximum Concentration of Floating Oil on the Water Surface and Total Hydrocarbons on the Shoreline at any time during the worst case deterministic simulation
- Cumulative footprint of exposure to surface floating oil greater than the minimum oil viscosity over a 75-day period for the worst case deterministic simulation

1.2 Project History and Participating Organizations

The Offshore ACP Project Team, consisting of personnel from the BSEE Oil Spill Preparedness Division (OSPD), the USCG Sector Anchorage, the Bureau of Ocean Energy Management (BOEM), Alaska Department of Environmental Conservation (ADEC), and RPS Group, conducted a comprehensive review of the current offshore oil and gas activities located within the U.S. portion of the waters of the Arctic and Western Alaska. The activities within the data set includes current and planned exploratory drilling activities, pipelines, and platforms with associated production wells and pipelines. The goal of the review was to identify the most significant WCDs located within the Arctic and Western Alaska ACP Planning Area and to ensure that these scenarios were modeled at different stages of the seasonal ice cycle.

RPS Group conducted an oil spill fate and trajectory analysis for each scenario to estimate the projected level of oiling for the water surface, water column, and affected shorelines if no response actions were taken. A single deterministic trajectory simulation was developed for each scenario, using metocean data for each location that in past analyses had yielded the highest levels of shoreline oiling. In the fall of 2022, a virtual meeting was held with federal, state, and tribal stakeholders to determine which scenarios would be selected for inclusion in the ACP. Figure 1 shows the factors and scoring used by the Project Team and stakeholders to conduct a comparative analysis and select the scenarios for further development in the ACP. The WCD scenarios in this technical document are the eights WCD scenarios that were chosen by the stakeholders at those meetings.

Parameters	Red (Most Significant)	Yellow	Green (Least Significant)	Comments
Discharge Volume	Over 100,000 bbl	Greater than 10,000 bbl Less than 100,000 bbl	Less than 10,000 bbl	Relative ratings by size.
Distance to Shore	Within barrier islands	Outside barrier islands	N/A	Only two categories are provided since all scenarios are not located far offshore in the Beaufort Sea.
Time to Shore	Less than 12 hours	Greater than 12 hours	Greater than 24 hours	Spills with the shortest response times for shoreline impact received highest rating.
Seasonality	Less than 50% ice coverage	50-100% ice coverage	100% ice coverage	A response in open water will be most difficult compared to oil sitting on 100% ice cover.
Oil Type/API Gravity (persistence)	Less than 30 API Gravity	30-40 API Gravity	Greater than 40 API Gravity	The heavier the grade of crude oil, the more persistent it will be in the environment.
Surface Oiling	Greater than 100,000 square miles	25,000 to 100,000 square miles	Less than 25,000 square miles	Spills with the largest surface swept area of oiling received highest rating.
Shoreline Oiling	Greater than 200 miles	Less than 200 miles	N/A	Spills with the greatest length of shoreline oiling received highest rating.
Water Column Oiling	Significant water column oiling, greater than 1 million cubic meters	Less than 1 million cubic meters	N/A	Spills with the most significant water column oiling received the highest rating.

Figure 1. Rationale for Rating Scenario Parameters & Environmental Oil Exposure.

2 Oil Spill Modeling Information

2.1 Models Used

2.1.1 OILMAPDeep

The OILMAPDeep Model is a tool to evaluate potential accidental discharges of oil and gas from a deep-water well blowout. The results provide a description of the behavior of the blowout plume, its evolution within the water column and the expected initial dilution (concentration decrease) with distance from the wellhead (seafloor). It provides information about the termination ("trap") height of the plume and the oil droplet size distribution(s) associated with the discharge. These results are used as initial conditions for modeling the far-field fate and trajectory modeling of the resulting subsurface plume and surface oil slick.

2.1.2 Spill Impact Model Application Package (SIMAP)

RPS' oil spill modeling system, SIMAP, or Spill Impact Model Application Package, was used to evaluate transport and weathering of oil in the far-field. SIMAP uses site-specific wind data and current data, and state-of-the-art transport and oil weathering algorithms. SIMAP was used to quantify areas swept by floating surface oil of varying thicknesses, concentrations of subsurface oil components (dissolved and particulate) in space and over time, and areas of shoreline impacted to varying degrees.

Processes simulated in the SIMAP include oil spreading (gravitational and by shearing), evaporation, transport, vertical and horizontal dispersion, emulsification, entrainment (natural and facilitated by dispersant), dissolution, volatilization of dissolved hydrocarbons from the surface water, adherence of oil droplets to suspended sediments, adsorption of soluble and sparingly-soluble aromatics to suspended sediments, sedimentation, and degradation (Figure 2). SIMAP is unique in that it not only models particulate oil content at the surface and in the water column, but it also accounts for the dissolved component of oil. SIMAP calculates the dissolved in-water concentrations and tracks them over time.

The SIMAP model was run for 45 days for instantaneous discharges, such as spills from pipelines, and for 75 days for continuous discharges from well blowouts (30 days continuous discharge + 45 days simulation time).

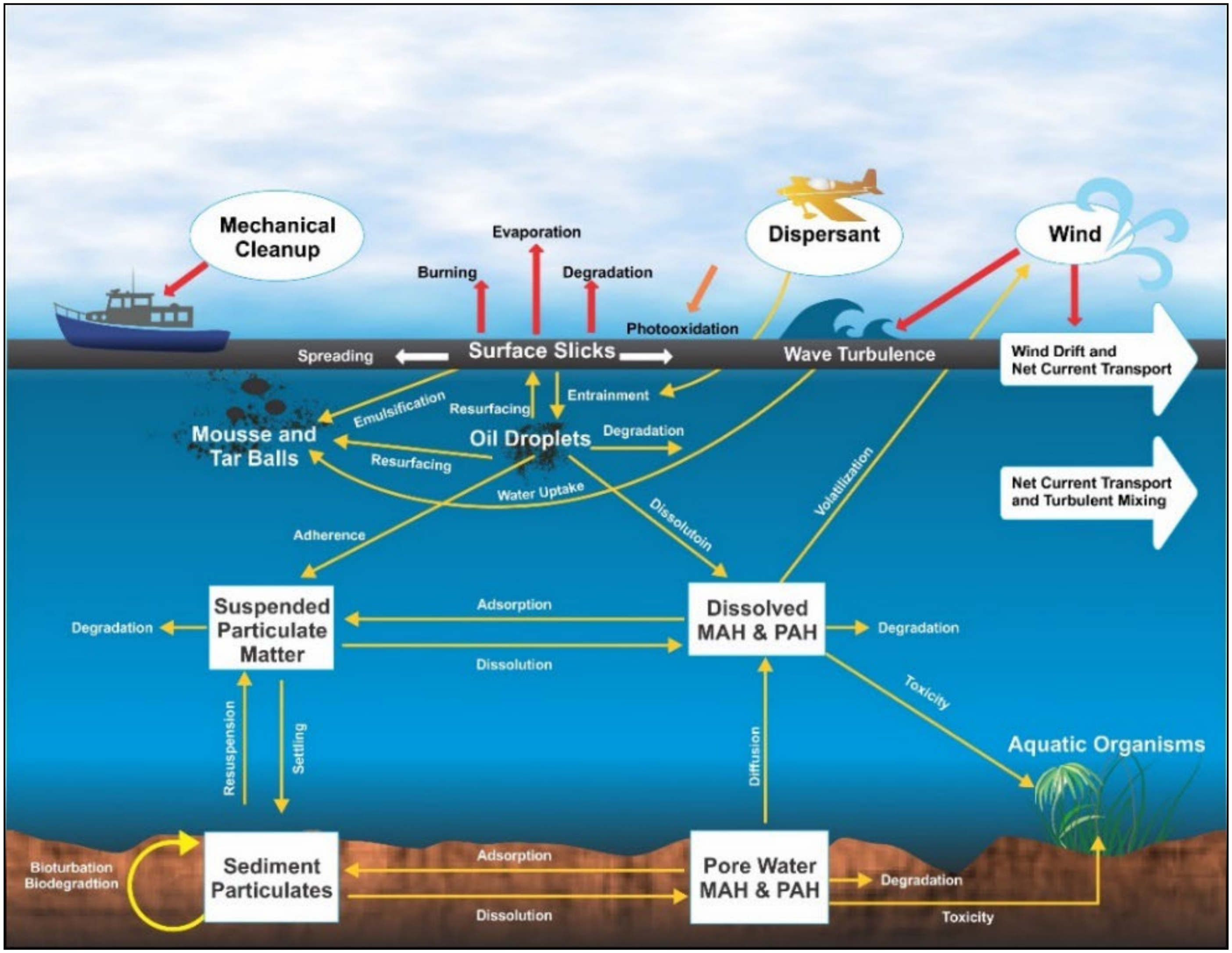

Figure 2. Open water oil fates and behavior processes simulated in the SIMAP modeling system.

2.2 Modeling Thresholds

The trajectory footprints for oiling and “minimum travel time” contours were calculated for specific thresholds where a minimum amount of oil thickness or waterborne concentrations were present (Table 1). Only those regions with oiling above the thresholds are shown in the figures.

Table 1. Thresholds used in the oil spill modeling.

Environmental Compartment	Surface Oiling	Surface Oiling	Surface Oiling	Shoreline Oiling	Water Column Oil Exposure
Threshold Amount	0.04 µm	10 µm	50 µm	10 µm	10 ppb Dissolved PAH*
Rationale For Threshold	A conservative threshold used to determine effects on socioeconomic resources (e.g., fishing may be prohibited when sheens are visible on the sea surface).	A conservative threshold for consideration of potential effects on birds, marine mammals, and sea turtles from floating oil	Industry-standard surface thickness for recoverable oil	A conservative screening threshold for potential ecological effects on shoreline fauna. Potential lethal effects threshold for birds on the shoreline.	Water column impacts (lethal) to plankton in the upper 20 m, and sublethal to lethal to other water column biota (adult, juvenile fish and invertebrates)
Visual Appearance	Fresh oil at this minimum thickness corresponds to a slick being barely visible as a colorless or silvery/grey sheen.	Fresh oil at this minimum thickness corresponds to a slick being barely visible or scattered sheen (colorless or silvery/grey), scattered tarballs, or widely scattered patches of thicker oil.	Heavy metallic sheen with patches of discontinuous brown oil	Transparent or Iridescent Films/Sheens	N/A

*10 ppb (µg/L) of whole oil Total hydrocarbon Concentration (THC) in the water column corresponds to ~0.1 ppb (µg/L) of dissolved Polycyclic Aromatic Hydrocarbons (PAHs) for fresh unweathered crude oil types (the soluble PAHs are approximately 1% of the total mass of fresh oil). This threshold can result in lethal water column impacts to fish larvae in deep waters (without UV exposure) and sublethal impacts to fish larvae in the upper 20 m.

2.3 Stochastic Modeling Outputs

Stochastic simulations provide insight into the probable behavior of an oil spill in response to temporally and spatially varying meteorological and oceanographic conditions. The stochastic model computes oil fate and transport for an ensemble of hundreds of individual simulations for each scenario, sampling the variability in regional and seasonal wind and current forces by starting each simulation on different dates within the chosen time period. It then summates the results of all the simulations into a spatially-based probabilistic footprint for oiling at a specified threshold.

The stochastic analysis provides two main types of information: 1) footprints for the water's surface, water column, and shorelines, based on the associated probabilities that each area might be oiled, and 2) the shortest time required for oil to reach any point within the areas predicted to be oiled. It is important to note that any single simulation may encounter only a relatively small portion of this footprint.

2.3.1 Probability of surface oil exposure at the chosen threshold:

These maps define the area and probability in which the sea surface may be oiled at a particular concentration based on the summation of the resulting trajectories from the ensemble of simulations. The map does not imply that the entire contoured area would be covered with oil in the event of a spill. The map also does not provide any information on the quantity of oil in a given area.

2.3.2 Minimum travel times:

The footprint on these maps corresponds to the probability map and illustrates the shortest time required for surface oil to reach any point within the footprint at a chosen threshold. These results are also based on the ensemble of all individual simulations. The stochastical data also provides estimates of the average time for oil to make landfall.

2.3.3 Probability of shoreline oil exposure at the chosen threshold:

The map defines the area in which shoreline oiling may be expected and the associated probability of oiling based on summation of the resulting trajectories from the ensemble of individual simulations run. The map does not imply that the entire contoured area would be covered with oil in the event of a spill. The map also does not provide any information on the quantity of oil in a given area. The stochastical data also provides estimates for the percentage of simulations where oil makes landfall, and the maximum and average percentages of the oil discharge to make landfall.

2.3.4 Probability of water column oil exposure at the chosen threshold:

The map defines the area in which subsurface oiling may be expected and the associated probability of oiling based on the summation of the resulting trajectories from the ensemble of simulations.

2.4 Deterministic Modeling Outputs

For each spill scenario, one deterministic trajectory/fate simulation was run to investigate the specific "worst-case" simulation that could potentially occur using the metocean data from the corresponding stochastic simulations. The worst-case simulation was selected based on the start date and ensuing winds and currents that resulted in the largest amount of shoreline oiling. The "total length of shoreline oiled" was used as the indicator to compare and assess the degree of shoreline oiling.

2.4.1 Color Codes for Maximum Surface Oil Concentrations

Table 2 shows the figure colors, and corresponding oil appearance for the maximum *surface* oil concentrations that occurred, at any given location over the period of the simulation. The scale used in these deterministic figures for *water surface* oil concentrations is loosely based on the equivalent oil thicknesses described in the Bonn Agreement Oil Appearance Code (BAOAC) and are summarized as follows:

Table 2. Figure colors and corresponding oil appearance for the maximum surface oil concentrations.

Oil Concentrations on Water Surface (g/m^2)	Figure Color	Oil Appearance
1-5	Purple	Silver to Rainbow Sheen
5-25	Light Blue	Light Metallic Sheen
25-50	Light Brown	Heavy Metallic Sheen
50-100	Dark Brown	Discontinuous Dark Oil
100-200	Gray	Heavy Discontinuous Dark Oil
> 200	Black	Continuous Dark Oil

Note: Each g/m^2 of surface oil concentration is equal to 1 micrometer (µm) of surface oil thickness on average over the grid cell (i.e., 1 µm = 1 g/m^2).

This information is useful when viewing the nature/severity of the deterministic surface oil trajectories shown in each of the WCD scenarios. For example, the area in purple (1-5 g/m^2) would represent areas that experienced maximum concentrations mainly in the range of silver and rainbow sheens. This observation should be caveated, however, by the fact that the concentration shown is based on an average oil thickness/concentration for the area. Areas shown in purple may also contain patches of heavier and lighter oiling, as slicks are rarely uniform in their distribution. As such, where an area is depicted in purple for silver/rainbow sheen, it may have also experienced some smaller, thicker patches of oil in the metallic or dark range surrounded by larger areas of silver sheen or no oil, etc.

2.4.2 Color Codes for Shoreline Oil Concentrations

Table 3 shows the figure colors and corresponding oil appearance for the maximum shoreline concentrations of oiling that occurred at any given location over the period of the simulation. This scale can be used as visual reference points for the deterministic figures with regard to *shoreline* oil concentrations.

Table 3. Figure colors and corresponding oil appearance for the maximum shoreline oil concentrations.

Oiling on Shorelines (g/m^2)	Figure Colors	Oil Appearance
Less than 100	Dark Green	Transparent or Iridescent Films/Sheens
100	Light Green	Visible oil stains that are too thin to scrape off
100-1,000	Light Green – Yellow Green	Stains to oil coatings that can be scraped off
1,000-10,000	Yellow – Dark Orange	Increasingly Thick Oil Cover
> 10,000	Red	Areas of Pooled Oil

2.4.3 Maximum Oil Concentration Maps

These figures show the maximum surface and shoreline concentrations that occur at any time and place over the entire period of the simulation. It is important to note that the deterministic trajectories of the spills for any single timestep will usually be much smaller in size, and in many areas less concentrated, than what is shown in the compilation maps. To illustrate this point, Figure 3 shows different timesteps of a slick trajectory from Day 2, Day 10, Day 20, Day 40, and Day 75. At the bottom right of the figure is the compilation map that shows the single highest oil concentrations that were recorded for any given time during the full 75 days of the simulation across the entire impacted area.

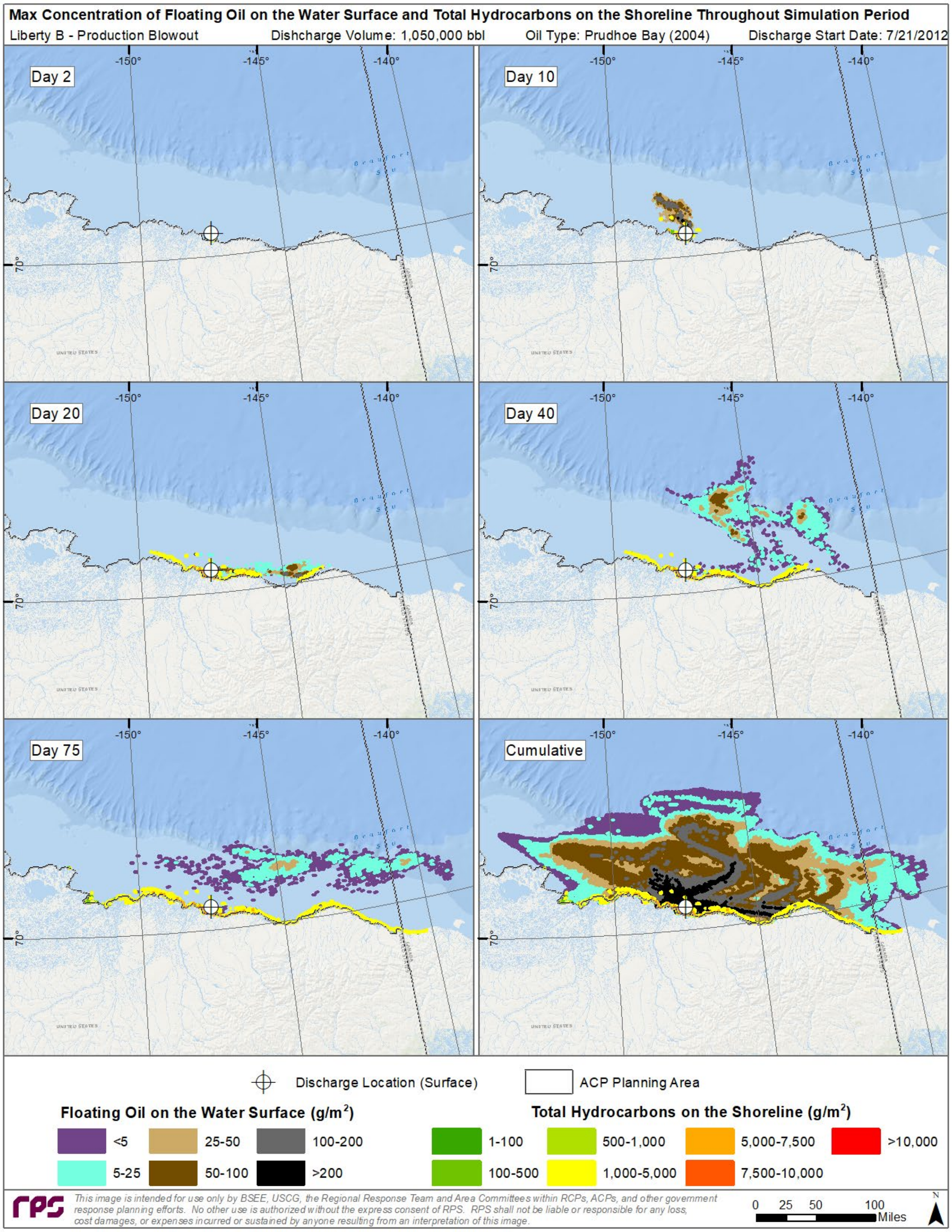

Figure 3. Deterministic modeling trajectory for maximum concentration of floating oil on the surface and total hydrocarbons on the shoreline at different points of the simulation period.

2.4.4 Maximum Water Column Oil Concentration:

The well blow out scenarios include figures showing a compilation of the single highest water column concentrations of dissolved Polycyclic Aromatic Hydrocarbons (PAHs) that were observed at any given location over the entire period of the simulation.

2.4.5 Total Oil Exposure and Mass Balance Information:

Information is provided on the total area oiled on the surface, subsurface, and shoreline at the specified ecological thresholds, and the mass balance information on the fate of the oil in various environmental compartments throughout the simulation. Note that surface area exposure provided here is the cumulative sum of areas swept by floating oil (spillets), which may include multiple exposures over the same area.

2.4.6 Minimum Surface Oil Viscosity Information*:*

As an oil spill is discharged into the environment and is exposed to wind, sunlight, and mixing energy from waves, it undergoes a weathering process. This weathering involves a number of processes, but for response purposes, two of the most important are the evaporation of the lighter components, and the formation of water in oil emulsions. Both processes effectively increase the viscosity of the oil. While the viscosity of spilled oil will generally increase over time, it can also be extremely sensitive to metocean changes, such as periods of increased wind and wave energy or significant temperature changes. As a result, the viscosity of an oil slick can be a very dynamic situation over time.

The oil viscosity figures in the WCD Scenario Appendices (2A-2C) show the minimum surface oil viscosity that occurred at any given location over the entire period of the simulation. It is important to note that the viscosities shown for the different areas of the oil slick for any single timestep may be very different than what is shown in the compilation maps. To illustrate this point, Figure 4 shows different timesteps of a slick's surface viscosity from Day 2, Day 10, Day 20, Day 40, and Day 75. At the bottom right of the figure is the compilation map that shows the minimum surface viscosity recorded for any given time during the full 75 days of the simulation across the entire impacted area.

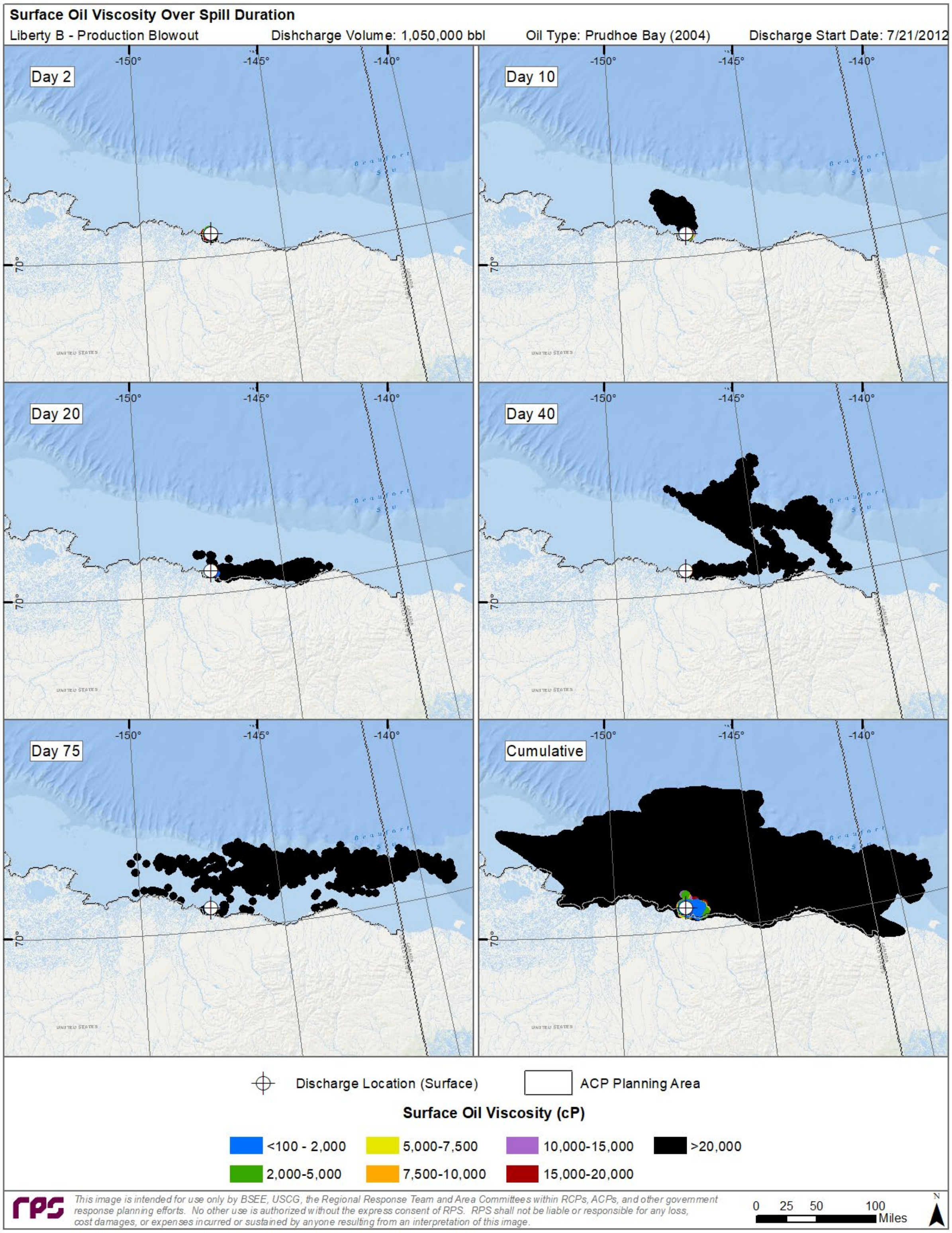

Figure 4. Deterministic modeling trajectory for minimum surface oil viscosity at different points of the simulation period.

Surface oil viscosity is an important factor for responders to consider when evaluating and selecting spill countermeasures and equipment types during an oil spill. A general rule of thumb is that the lower the oil viscosity is, the more countermeasures that may be applied. Alternatively, the higher the viscosity of the oil, the more difficult it will become for certain response equipment types or alternative technologies, such as in-situ burning or dispersants, to effectively remove the oil. For example, a fresh light or medium crude with a low viscosity may be a good candidate for mechanical recovery, dispersants, or in-situ burning. As oil weathers and emulsifies, its viscosity will increase, and the spill countermeasures that can be effectively applied may become more limited. Oil viscosity is particularly important with respect to how dispersible the oil will be. There is usually an upper viscosity limit, above which oil cannot be dispersed. Although this dispersibility limit is dependent upon the oil's specific chemical and physical properties, generally, dispersibility decreases with increasing viscosity. One general rule of thumb is that dispersants are optimally effective when viscosity is less than 2,000 cP and become increasingly ineffective when viscosity becomes greater than 10,000 cP. Table 4 provides a list of viscosities of common substances for reference.

Table 4. Viscosities of common substances for reference.

Product	Viscosity (cP)
Water at 70F	1
Corn Oil	65
Maple Syrup	150-200
Honey	2,000-3,000
Chocolate Syrup	10,000-25,000
Ketchup or Mustard	50,000-70,000
Peanut Butter	150,000-250,000
Vegetable Shortening	1,000,000-2,000,000

Viscosity of an oil also impacts the effectiveness of mechanical recovery to remove the oil. Viscosity increases significantly in oils with a tendency to form water-in-oil emulsions where the material becomes much more viscous, and the volume of oil spilled can increase by three to four times. Different skimmer types should be used to maximize their effectiveness depending on the viscosity of the oil at different temporal points along its trajectory during the response. Weir, vortex, oleophilic rope, and disc skimmers are best used with oils at lower viscosities. For oil with higher viscosities, up to 100,000 cP, skimmer designs that can physically grab and move the oil into the skimmer's recovery sump are more effective.

3 WCD Scenarios

3.1 WCD Scenario Locations

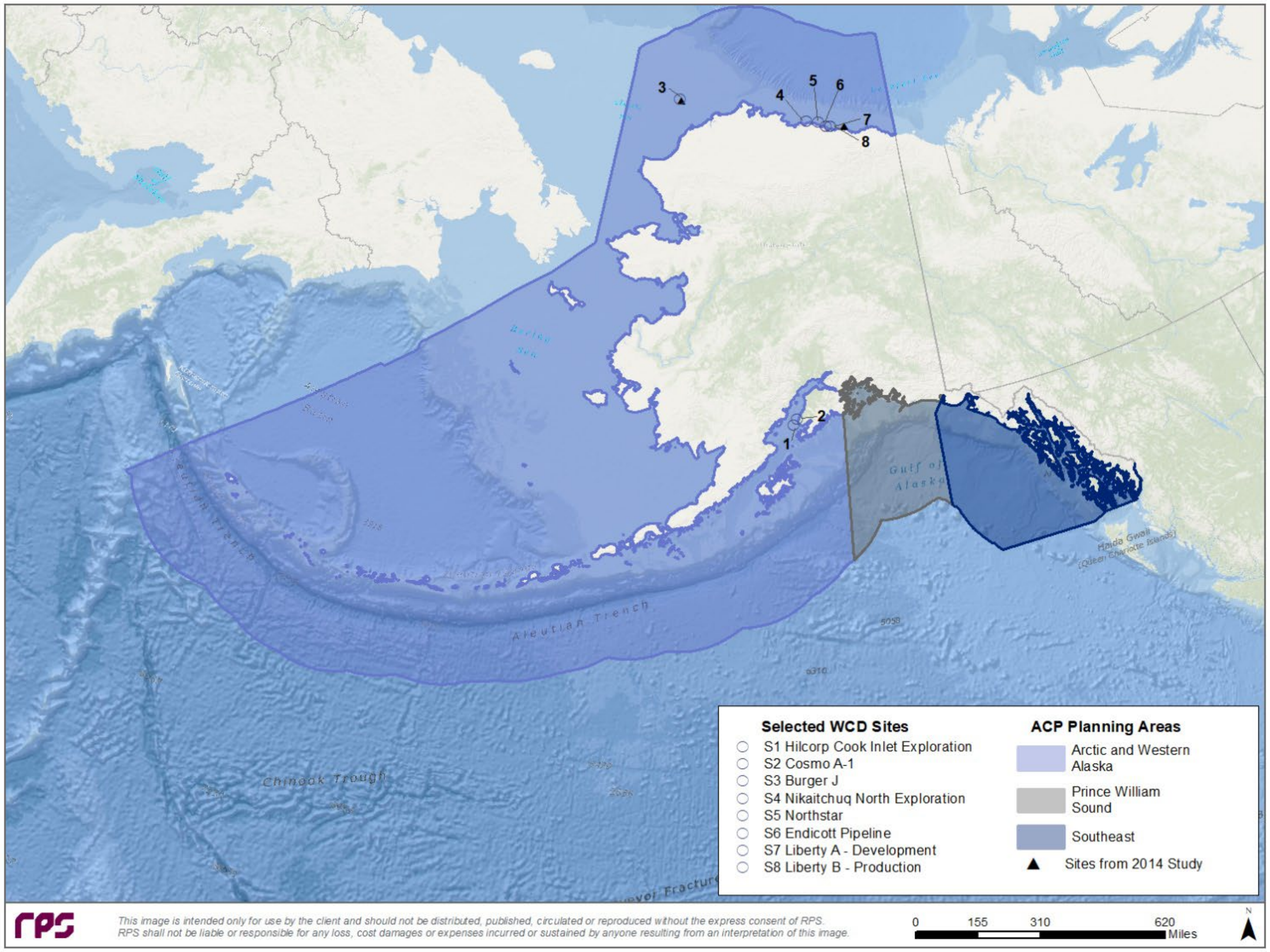

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Figure 5. WCD Scenario Locations in the Arctic and Western Alaska ACP Planning Area.

Note: *Scenario numbers on the chart correspond with each of the listed WCD scenarios in the tables below.*

3.2 WCD Scenario Particulars

Table 5. WCD Scenario Particulars.

Scenario Number	Region	Operator	OSRP	WCD Scenario Name	Lease Status	Latitude	Longitude	Miles from Shore	Ice Coverage	Spill Type	Blow Out (bopd)	Pipe (bbls)	Proxy Oil	Proxy API	Actual API	Discharge Duration	Simulation Duration	Water Depth of Discharge (m)	GOR (scf/stb)	Pipe Opening (in)
1	Cook Inlet	Hilcorp	1045	Hilcorp Cook Inlet Exploration	Current	59.686	-152.166	12.2	Open Water	Blowout	6,800	N/A	Chayvo #6	38.1	38	30 days	75 days	Surface	300	8.5"
2	Cook Inlet	BlueCrest	1054	Cosmo A-1	Current	59.886908	-151.882697	2.82	Open Water	Batch	800 bbls	N/A	Prudhoe Bay (2004)	23.8	24-27	1 day	45 days	Surface	300	8.5"
3	Chukchi Sea	N/A	N/A	Burger J	Inactive	71.1733497	-163.4718517	66.68	Open Water	Blowout	25,000	N/A	Prudhoe Bay (2004)	26.6	25-30	30 days	75 days	-42	800	8.5"
4	Beaufort Sea	Eni	1024	Nikaitchuq North Exploration	Inactive	70.5597805	-149.8999187	<1	Open Water	Blowout	25,927	N/A	Chayvo #6	38.1	40	30 days	75 days	Surface	1200	8.5"
5	Beaufort Sea	Eni	1024	Nikaitchuq North Exploration	Inactive	70.5597805	-149.8999187	<1	Ice Break Up	Blowout	25,927	N/A	Chayvo #6	38.1	40	30 days	75 days	Surface	1200	8.5"
6	Beaufort Sea	Harvest Alaska LLC	1056	Endicott Pipeline	Active	70.3119	-147.8827	0.25	Open Water	Pipeline	N/A	4,885	Liberty (1998)	23.8	23.5	1 day	45 days	Surface	N/A	N/A
7	Beaufort Sea	Hilcorp	1023	Liberty A - Development	Current	70.2789567	-147.4994328	4.5	Solid Ice	Blowout	91,000 (winter, landfast ice)	N/A	Prudhoe Bay (2004)	26.6	27	30 days	75 days	Surface	872	8.5"
8	Beaufort Sea	Hilcorp	1023	Liberty B - Production	Current	70.2789567	-147.4994328	4.5	Open Water	Blowout	35,000 (summer, open water)	N/A	Prudhoe Bay (2004)	26.6	27	30 days	75 days	Surface	872	8.5"

Note: While most of the scenario parameters in this table have been collated from source documents submitted by the owners or operators of offshore facilities to the US Government, RPS Group performed the WCD oil spill modeling trajectory analyses conducted for this document under a contract sponsored by the BSEE. The modeling products in each of the ACP-specific WCD Scenario Appendices (2A-2C) will be different from the trajectory analyses conducted by owners and operators in their source documents, as it is expected that different trajectory models, metocean data and modeling thresholds were used.

3.3 WCD Scenario Summary Results for Oil Exposure

Table 6. Environmental Oil Exposure Summary Results.

Oil Spill Scenario Parameters									Environmental Oiling at Designated Thresholds				
ID	Region	Scenario Name	Ice Cover	Total Volume Discharged (bbl)	Discharge Duration (days)	Discharge Depth (m)	Approximate Distance to Shore (nm)	Oil Type + (API Gravity)	Swept Surface Area ($mi.^2$)** Exceeding 0.04 µm	Swept Surface Area ($mi.^2$)** Exceeding 10 µm	Shore Length (mi.) Exceeding 10 µm	Water Column Volume (million m^3) Exceeding 10 ppb Dissolved PAH	Time to Shore (hours)
1	Cook Inlet	Hillcorp Cook Inlet Exploration Well Blowout	Open Water	204,000	30 days	Surface	12.2	Light Crude (38)	649,795	632,653	2,492	14,925	27
2		Cosmo A-1 Batch Spill	Open Water	800	1 day	Surface	2.82	Heavy Crude (27)	2,250	2,162	142	21	22
3	Chukchi Sea	Burger J Well Blowout	Open Water	750,000	30 days	42	66.68	Heavy Crude (27)	479,698	474,979	1,090	38,828	368
4	Beaufort Sea	Nikaitchuq North Exploration Open Water Well Blowout	Open Water	777,810	30 days	Surface	<1	Light Crude (38)	1,018,580	1,013,572	826	10,151	<0.75
5		Nikaitchuq North Exploration Ice Breakup Well Blowout	Ice Breakup	777,810	30 days	Surface	<1	Light Crude (38)	1,101,137	1,101,136	448	23,542	<0.25
6		Endicott Pipeline Discharge	Open Water	4,885	1 day	Surface	0.25	Heavy Crude (23.5)	1,116	1,116	77	14	<0.5
7		Liberty A – Development Well Blowout	Solid Ice	2,730,000	30 days	Surface	4.5	Heavy Crude (27)	NA	NA	NA	NA	NA
8		Liberty B – Production Well Blowout	Open Water	1,050,000	30 days	Surface	4.5	Heavy Crude (27)	321,418	322,326	817	4,447	18.5

Note: The WCD scenario names in this document include the names of the owners or operators of the facility. It is not uncommon for ownership of offshore facilities to change over time, as companies merge, dissolve or change their portfolios of offshore infrastructure. The federal agencies sponsoring this effort will attempt to periodically update this information; however, ownership of the facilities may change before the scenario names and modeling products are updated.

Table 7. Mass Balance Information for Worst Case Shoreline Oiling Simulation for each Scenario.

Summary of Mass Balance (%) at the End of Simulation										
ID	Region	Scenario Name	Total Volume Discharged (bbl)	Surface (%)	Atmosphere (%)	Water Column (%)	Sediment (%)	Ashore (%)	Degradation (%)
1	Cook Inlet	Hillcorp Cook Inlet Exploration Well Blowout	204,000	5.3	55.7	2.2	<0.1	17.3	12.6
2	Cook Inlet	Cosmo A-1 Batch Spill	800	<0.1	30.6	<0.1	<0.1	60.1	9.3
3	Chukchi Sea	Burger J Well Blowout	750,000	29.9	19.7	2.5	<0.1	25.5	22.2
4	Beaufort Sea	Nikaitchuq North Exploration Open Water Well Blowout	777,810	5.4	50.8	0.9	<0.1	37.3	5.5
5	Beaufort Sea	Nikaitchuq North Exploration Ice Breakup Well Blowout	777,810	23.2	52.4	0.4	<0.1	18.6	5.3
6	Beaufort Sea	Endicott Pipeline Discharge	4,885	<0.1	7.6	<0.1	<0.1	80.2	12.2
7	Beaufort Sea	Liberty A – Development Well Blowout	2,730,000	NA	NA	NA	NA	NA	NA
8	Beaufort Sea	Liberty B Production Well Blowout	1,050,000	30.6	19.6	<0.1	<0.1	33.7	16.2

Table 8. Stochastic Information Regarding Shoreline Oiling for each Scenario.

Summary of Stochastic Results								
ID	Region	Scenario Name	Total Volume Discharged (bbl)	Percent of Simulation Reaching Shore (%)	Percent Volume of Released Oil Reaching Shore (%)		Time to Reach Shore (hours)	
					Maximum	Average	Minimum	Average
1	Cook Inlet	Hillcorp Cook Inlet Exploration Well Blowout	204,000	100	18	11	12.0	59.8
2	Cook Inlet	Cosmo A-1 Batch Spill	800	100	77	65	4.5	39.8
3	Chukchi Sea	Burger J Well Blowout	750,000	84	36	9	69.4	700.6
4	Beaufort Sea	Nikaitchuq North Exploration Open Water Well Blowout	777,810	100	48	35	0.50	0.52
5	Beaufort Sea	Nikaitchuq North Exploration Ice Breakup Well Blowout	777,810	100	41	10	0.50	0.52
6	Beaufort Sea	Endicott Pipeline Discharge	4,885	100	98	91	1.0	1.2
7	Beaufort Sea	Liberty A – Development Well Blowout	2,730,000	NA	NA	NA	NA	NA
8	Beaufort Sea	Liberty B – Production Well Blowout	1,050,000	100	43	26	6.0	51.8