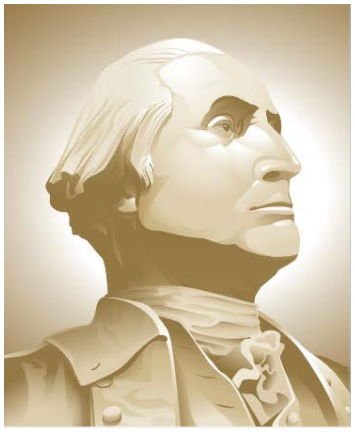
SUMMARY OF RISK MITIGATION MEASURE (RMM) ANALYSIS RESULTS BY POTENTIAL OIL SPILL SIZE



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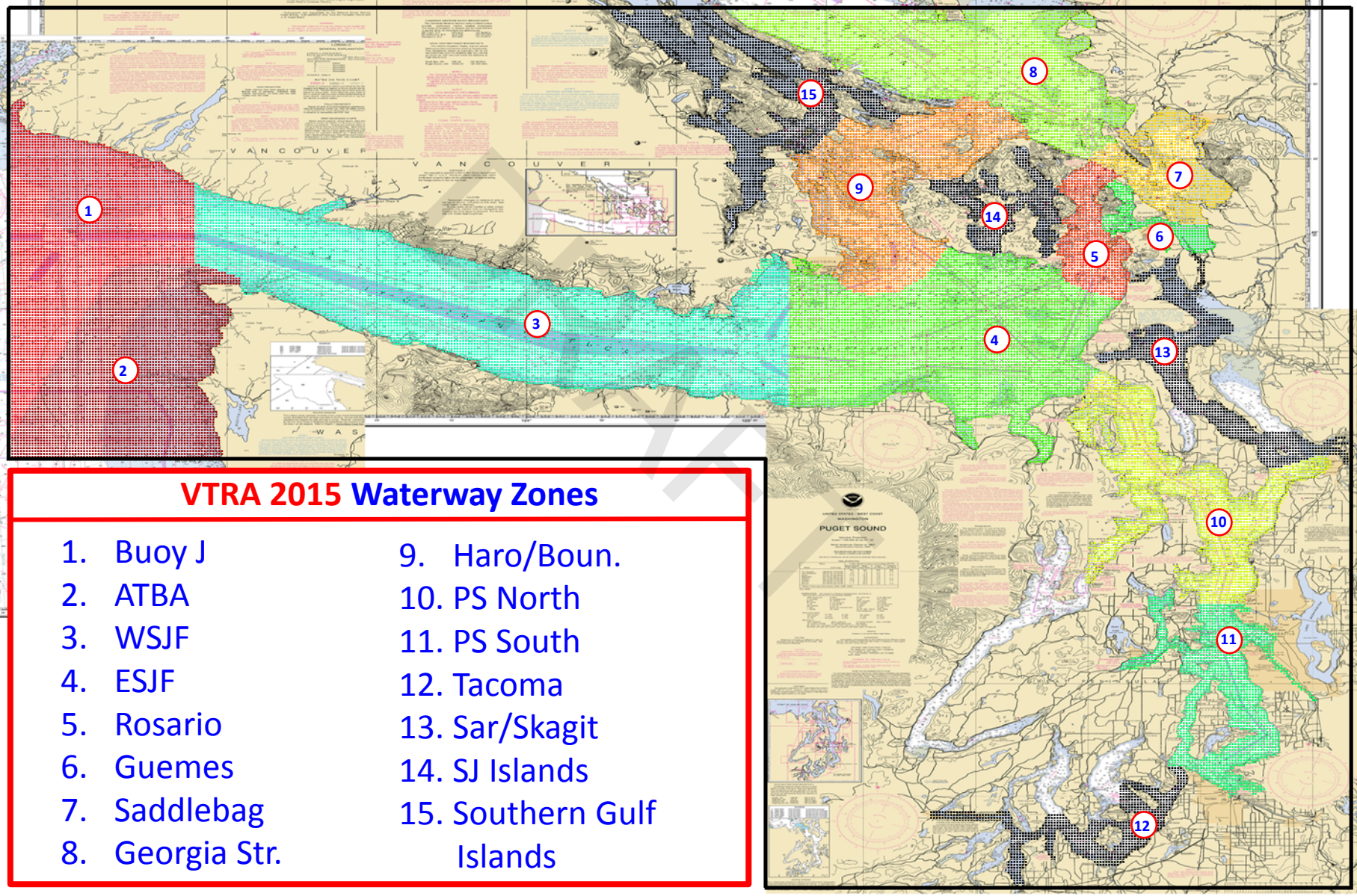
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

DEFINITION OF 15 WATERWAY ZONES



VTRA 2015 Waterway Zones

1. Buoy J
2. ATBA
3. WSJF
4. ESJF
5. Rosario
6. Guemes
7. Saddlebag
8. Georgia Str.
9. Haro/Boun.
10. PS North
11. PS South
12. Tacoma
13. Sar/Skagit
14. SJ Islands
15. Southern Gulf Islands

Four **Individual** VTRA 2015 RMM CASES evaluated using the VTRA 2015 model

1. **USKM1600-KME:** Continued escorting of outbound laden Kinder Morgan Tankers to Buoy J from current Canadian Pilot drop off point.

2. **USKM1600-SRT:** Pre- Stationed Sidney Rescue Tug (SRT) modelled after the Neah Bay Rescue Tug (NRT) in the VTRA 2015 model.

3. **USKM1600-OAE:** Escorting of Oil Barges and ATB's east of Port Angeles.

4. **USKM1600-125:** Lift 125 DWT limit on crude inbound laden tankers and reduce number of crude tankers in VTRA 2015 model while keeping inbound crude oil transported approximately at the same levels.

Two **Portfolio** VTRA 2015 RMM CASES evaluated using the VTRA 2015 model

1. **USKM1600-5RMM:** KME, SRT, OAE, 125 RMM's combined + RMM 1

   RMM 1 combines three Components, i.e.:

   a. 100% Double Hull Fuel Protection of Cargo Focus Vessels
   b. 50% Reduction of Mechanical Failure and Human Error on Tugs (excluding those towing Oil Barges)
   c. Removal of Special Events from VTRA 2015 Simulation (i.e. modelled Whale Watching, Regatta's and commercial and tribal fishing openers in VTRA 2015 Model).

   Component a. in RMM 1 is being phased in by USCG, whereas Components b. and c. ought to be interpreted as asummed potential "positive to maximum benefit contributions" (Pos. to Max. Benefit) in the VTRA 2015 model of two pending USCG RMM's currently under consideration for implementation.

2. **USKM1600-3RMM:** 100% Double Hull Fuel Protection of Cargo Focus Vessels, Limit speed of Container Vessels to 17 knots throughout VTRA 2015 Study Area (in addition to the Puget Sound waterway zone) and pre-station two Rescue Tugs (RT's), one close to Victoria and one in Bedwell Harbor, modelled after the Neah Bay Rescue Tug (NRT) in the VTRA 2015 Model.

VTRA 2015 Study Area Risk Metric Comparison By RMM CASE and By Oil Spill Size Category

- By % Base Case Potential Oil Loss
- By % Base Case Potential Accident Frequency
- By Potential Oil Spill Size Per Pot. Accident

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Base Case % Potential Annual Oil Loss

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?	CASE NAME	OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A	BASE CASE	42.0%	12.3%	45.3%	0.46%	100.0%
N/A	UKMCA1600	91.1%	20.0%	72.8%	0.54%	184.4%
YES	UKMCA1600 - 5RMM	83.1%	12.9%	35.1%	0.12%	131.2%
NO	UKMCA1600 - 3RMM	91.4%	19.6%	37.1%	0.61%	148.7%
NO	UKMCA1600 - OAE	91.6%	17.6%	71.3%	0.45%	181.0%
NO	UKMCA1600 - SRT	91.6%	19.5%	71.3%	0.62%	183.0%
NO	UKMCA1600 - KME	91.3%	19.5%	72.6%	0.62%	184.1%
NO	UKMCA1600 - 125	106.4%	17.8%	72.2%	0.56%	197.0%

Base Case % Potential Accident Frequency

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?	CASE NAME	OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A		0.011%	0.014%	1.761%	98.2%	100.0%
N/A	UKMCA1600	0.031%	0.022%	1.919%	108.9%	110.9%
YES	UKMCA1600 - 5RMM	0.026%	0.014%	1.415%	82.9%	84.3%
NO	UKMCA1600 - 3RMM	0.030%	0.021%	1.596%	104.1%	105.7%
NO	UKMCA1600 - OAE	0.031%	0.019%	1.833%	94.3%	96.2%
NO	UKMCA1600 - SRT	0.031%	0.021%	1.915%	108.8%	110.7%
NO	UKMCA1600 - KME	0.031%	0.021%	1.929%	109.6%	111.6%
NO	UKMCA1600 - 125	0.032%	0.020%	1.906%	108.1%	110.1%

Averge Potential Spill Size per Accident in m^3

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?	CASE NAME	OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A	BASE CASE	6798	1619	47	0.0086	1.8
N/A	UKMCA1600	5413	1693	69	0.0091	3.0
YES	UKMCA1600 - 5RMM	5901	1646	45	0.0026	2.8
NO	UKMCA1600 - 3RMM	5519	1694	42	0.0106	2.6
NO	UKMCA1600 - OAE	5486	1680	71	0.0088	3.4
NO	UKMCA1600 - SRT	5453	1694	68	0.0104	3.0
NO	UKMCA1600 - KME	5454	1693	69	0.0104	3.0
NO	UKMCA1600 - 125	6063	1665	69	0.0094	3.3

% POT. OIL LOSS ANALYSIS OBSERVATIONS

1. **1 m^3 - 1000 m^3 category:** **Contributes ≈ 45% to '15 Base Case Pot. Oil Loss** and in **USKMCA1600 What-If Case** this increases to about 73% of Base Case Pot. Oil Loss (about a multiplicative factor of 1.6 in this category). None of the modelled RMM Cases is able to reduce Pot. Oil Loss in this category to below Base Case Levels, with the exception of the 5-RMM and the 3-RMM Cases. It should be noted that the 3-RMM Case does not make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluation, whereas the 5-RMM Case does. Moreover, the 5-RMM Case includes the 125-RMM Case that does not increase Pot. Oil Loss individually in this category relative to the USKMCA1600 What-If Case, as evaluated using the VTRA 2015 Model.

2. **2500 m^3 or more category:** **Contributes ≈ 42% to '15 Base Case Pot. Oil Loss** and in **USKMCA1600 What-If Case** and all six modelled **USKMCA1600 RMM Cases** this increases to over 83% of Base Case Pot. Oil Loss, thus about doubling Pot. Oil Loss or more in this loss category, regardless of the RMM's evaluated in the VTRA 2015 Study using the VTRA 2015 Model.

3. **1000 m^3 - 2500 m^3 category:** **Contributes ≈ 12% to '15 Base Case Pot. Oil Loss** and in **USKMCA1600 What-If Case** and in three of the six modelled **USKMCA1600 RMM Cases** this increases to about 20% of Base Case Pot. Oil Loss (approx. a multiplicative factor of 1.5 in this loss category). The 5-RMM Case reduces this to about Base Case Pot. Oil Loss levels in this loss category, but it should be noted that Pos. to Max. Benefit assumptions are made for RMM effectiveness evaluation of the 5-RMM Case**.** The next best reductions are observed in this loss category for the OAE-RMM Case and the 125-RMM Cases. However, neither of these RMM Cases is able to reduce Pot. Oil Loss individually to Base Case Pot. Oil Loss levels in this loss category, as evaluated by the VTRA 2015 Model.

4. **0 m^3 - 1 m^3 category:** **Contributes ≈ 0.5% to '15 Base Case Pot. Oil Loss** and this remains about the same for the **USKM1600 What-If Case** and the modelled **USKMCA1600 RMM Cases**, with the exception of the 5-RMM Case that reduces Base Case Pot. Oil Loss in this category by about a factor of four, but it should be noted that Pos. to Max. Benefit assumptions are made for RMM effectiveness evaluation of the 5-RMM Case**.**

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Base Case % Potential Annual Oil Loss

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?	CASE NAME	OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A	BASE CASE	42.0%	12.3%	45.3%	0.46%	100.0%
N/A	UKMCA1600	91.1%	20.0%	72.8%	0.54%	184.4%
YES	UKMCA1600 - 5RMM	83.1%	12.9%	35.1%	0.12%	131.2%
NO	UKMCA1600 - 3RMM	91.4%	19.6%	37.1%	0.61%	148.7%
NO	UKMCA1600 - OAE	91.6%	17.6%	71.3%	0.45%	181.0%
NO	UKMCA1600 - SRT	91.6%	19.5%	71.3%	0.62%	183.0%
NO	UKMCA1600 - KME	91.3%	19.5%	72.6%	0.62%	184.1%
NO	UKMCA1600 - 125	106.4%	17.8%	72.2%	0.56%	197.0%

Base Case % Potential Accident Frequency

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?	CASE NAME	OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A		0.011%	0.014%	1.761%	98.2%	100.0%
N/A	UKMCA1600	0.031%	0.022%	1.919%	108.9%	110.9%
YES	UKMCA1600 - 5RMM	0.026%	0.014%	1.415%	82.9%	84.3%
NO	UKMCA1600 - 3RMM	0.030%	0.021%	1.596%	104.1%	105.7%
NO	UKMCA1600 - OAE	0.031%	0.019%	1.833%	94.3%	96.2%
NO	UKMCA1600 - SRT	0.031%	0.021%	1.915%	108.8%	110.7%
NO	UKMCA1600 - KME	0.031%	0.021%	1.929%	109.6%	111.6%
NO	UKMCA1600 - 125	0.032%	0.020%	1.906%	108.1%	110.1%

Averge Potential Spill Size per Accident in m^3

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?	CASE NAME	OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A	BASE CASE	6798	1619	47	0.0086	1.8
N/A	UKMCA1600	5413	1693	69	0.0091	3.0
YES	UKMCA1600 - 5RMM	5901	1646	45	0.0026	2.8
NO	UKMCA1600 - 3RMM	5519	1694	42	0.0106	2.6
NO	UKMCA1600 - OAE	5486	1680	71	0.0088	3.4
NO	UKMCA1600 - SRT	5453	1694	68	0.0104	3.0
NO	UKMCA1600 - KME	5454	1693	69	0.0104	3.0
NO	UKMCA1600 - 125	6063	1665	69	0.0094	3.3

% POT. ACC. FREQ. ANALYSIS OBSERVATIONS

1. **0 m^3 - 1 m^3 category:** **Contributes ≈ 98% to '15 Base Case Pot. Acc. Freq.** and this increases to above 100% Base Case Levels for the **USKM1600 What-If Case** and four of the six modelled **USKMCA1600 RMM Cases (**by a factor of about 1.1). Both the 5-RMM Case and the OAE-RMM Case reduce Pot. Acc. Freq. in this loss category to below Base Case Levels (a factor of 0.84 and a factor 0.96, respectively). However, it should be noted that the 5-RMM Case does make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluation, whereas the OAE-RMM Case does not.

2. **1 m^3 - 1000 m^3 category:** **Contributes ≈ 1.8% to Base Case Pot. Acc. Freq.** and in **USKM1600 What-If Case** this increases to above 1.9% of Base Case Pot. Oil Loss (about a multiplicative factor of 1.1 in this category). None of the modelled RMM Cases is able to reduce Pot. Acc. Freq. in this category to below Base Case Levels, with the exception of the 5-RMM Case and the 3-RMM Case. It should be noted that the 3-RMM Case does not make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluations, whereas the 5-RMM Case does. Moreover, the 5-RMM Case includes the 125-RMM Case that does not increase Pot. Acc. Freq. in this category individually relative to the USKM1600 What-If Case, as evaluated using the VTRA 2015 Model.

3. **1000 m^3 - 2500 m^3 category:** **Contributes ≈ 0.014% to Base Case Pot. Acc. Freq.** and in **USKM1600 What-If Case** and in modelled **USKMCA1600 RMM Cases** this increases to over 0.020% of Base Case Pot. Acc. Freq. (about a multiplicative factor of 1.5 in this category), with the exception of 5-RMM Case that reduces Pot. Acc. Freq. to about Base Case levels in this loss category. However, it should be noted that the 5-RMM Case does make Pos. to Max. Benefit assumptions for RMM effectiveness evaluations**.** The next best reduction in Acc. Freq. is observed in this loss category for the OAE-RMM and 125-RMM Cases. However, neither of these RMM Cases is able to reduce Pot. Acc. Freq. individually to Base Case Acc. Freq. levels in this loss category, as evaluated by the VTRA 2015 Model.

4. **2500 m^3 or more category:** **Contributes ≈ 0.011% to Base Case Pot. Acc. Freq** and in **USKM1600 What-If Case** and the **USKMCA1600 RMM Cases** this increases to over 0.030% of Base Case Pot. Acc. Freq. (about a multiplicative factor of 2.7 in this loss category), with the exception of the 5RMM-Case (where a multiplicative factor of about 2.3 applies). However, it should be note that the 5RMM-Case does make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluations.

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Base Case % Potential Annual Oil Loss

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?	CASE NAME	OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A	BASE CASE	42.0%	12.3%	45.3%	0.46%	100.0%
N/A	UKMCA1600	91.1%	20.0%	72.8%	0.54%	184.4%
YES	UKMCA1600 - 5RMM	83.1%	12.9%	35.1%	0.12%	131.2%
NO	UKMCA1600 - 3RMM	91.4%	19.6%	37.1%	0.61%	148.7%
NO	UKMCA1600 - OAE	91.6%	17.6%	71.3%	0.45%	181.0%
NO	UKMCA1600 - SRT	91.6%	19.5%	71.3%	0.62%	183.0%
NO	UKMCA1600 - KME	91.3%	19.5%	72.6%	0.62%	184.1%
NO	UKMCA1600 - 125	106.4%	17.8%	72.2%	0.56%	197.0%

Base Case % Potential Accident Frequency

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?	CASE NAME	OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A		0.011%	0.014%	1.761%	98.2%	100.0%
N/A	UKMCA1600	0.031%	0.022%	1.919%	108.9%	110.9%
YES	UKMCA1600 - 5RMM	0.026%	0.014%	1.415%	82.9%	84.3%
NO	UKMCA1600 - 3RMM	0.030%	0.021%	1.596%	104.1%	105.7%
NO	UKMCA1600 - OAE	0.031%	0.019%	1.833%	94.3%	96.2%
NO	UKMCA1600 - SRT	0.031%	0.021%	1.915%	108.8%	110.7%
NO	UKMCA1600 - KME	0.031%	0.021%	1.929%	109.6%	111.6%
NO	UKMCA1600 - 125	0.032%	0.020%	1.906%	108.1%	110.1%

Averge Potential Spill Size per Accident in m^3

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?	CASE NAME	OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A	BASE CASE	6798	1619	47	0.0086	1.8
N/A	UKMCA1600	5413	1693	69	0.0091	3.0
YES	UKMCA1600 - 5RMM	5901	1646	45	0.0026	2.8
NO	UKMCA1600 - 3RMM	5519	1694	42	0.0106	2.6
NO	UKMCA1600 - OAE	5486	1680	71	0.0088	3.4
NO	UKMCA1600 - SRT	5453	1694	68	0.0104	3.0
NO	UKMCA1600 - KME	5454	1693	69	0.0104	3.0
NO	UKMCA1600 - 125	6063	1665	69	0.0094	3.3

AVERAGE SPILL SIZE ANALYSIS OBSERVATIONS

1. **2500 m^3 or more category:** **The average potential spill size evaluated** over this loss category by the VTRA 2015 Model **ranges from about 5400 m^3 to 6800 m^3** (4644 metric tons to 5848 metric tons). However, it should be noted that these averages are evaluated over a large number of potential spill sizes in this loss category. Therefore, spill size per potential accident in this loss category can be higher or less than the range evaluated above.

2. **1000 m^3 - 2500 m^3 category:** **The average potential spill size evaluated** over this loss category by the VTRA 2015 Model **ranges from about 1600 m^3 to 1700 m^3** (1376 metric tons to 1462 metric tons). However, it should be noted that these averages are evaluated over a large number of potential spill sizes in this loss category. Therefore, spill size per potential accident in this loss category can be higher or less than the range evaluated above.

3. **1 m^3 - 1000 m^3 category:** **The average potential spill size evaluated** over this loss category by the VTRA 2015 Model **ranges from about 40 m^3 to 70 m^3** (252 barrels to 441 barrels). However, it should be noted that these averages are evaluated over a large number of potential spill sizes in this loss category. Therefore, spill size per potential accident in this loss category can be higher or less than the range evaluated above.

4. **0 m^3 - 1 m^3 or more category:** **The average potential spill size evaluated** over this loss category by the VTRA 2015 Model **ranges from 0.003 m^3 to 0.01 m^3** (0.7 gallons to 2.8 gallons). However, it should be noted that these averages are evaluated over a large number of potential spill size in this loss category. Therefore, spill size per potential accident in this loss category can be higher or less than the range evaluated above.

VTRA 2015 Study Area Risk Metric Comparison By RMM CASE and By Oil Spill Size Category

- By Relative Multiplier per Category

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Base Case % Potential Annual Oil Loss Relative Multipliers

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?		OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A	BASE CASE	1.00	1.00	1.00	1.00	1.00
N/A	UKMCA1600	2.17	1.63	1.61	1.17	1.84
YES	UKMCA1600 - 5RMM	1.98	1.05	0.78	0.25	1.31
NO	UKMCA1600 - 3RMM	2.18	1.60	0.82	1.31	1.49
NO	UKMCA1600 - OAE	2.18	1.43	1.58	0.98	1.81
NO	UKMCA1600 - SRT	2.18	1.59	1.57	1.34	1.83
NO	UKMCA1600 - KME	2.17	1.59	1.60	1.34	1.84
NO	UKMCA1600 - 125	2.53	1.45	1.60	1.21	1.97

Base Case % Potential Accident Frequency Relative Multipliers

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?		OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A	BASE CASE	1.00	1.00	1.00	1.00	1.00
N/A	UKMCA1600	2.72	1.56	1.09	1.11	1.11
YES	UKMCA1600 - 5RMM	2.28	1.04	0.80	0.84	0.84
NO	UKMCA1600 - 3RMM	2.69	1.53	0.91	1.06	1.06
NO	UKMCA1600 - OAE	2.71	1.38	1.04	0.96	0.96
NO	UKMCA1600 - SRT	2.72	1.52	1.09	1.11	1.11
NO	UKMCA1600 - KME	2.72	1.52	1.10	1.12	1.12
NO	UKMCA1600 - 125	2.85	1.41	1.08	1.10	1.10

Average Potential Spill Size per Accident in m^3 Relative Multipliers

POSITIVE TO MAX. BENEFIT ASSUMPTIONS?		OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
N/A	BASE CASE	1.00	1.00	1.00	1.00	1.00
N/A	UKMCA1600	0.80	1.05	1.48	1.06	1.66
YES	UKMCA1600 - 5RMM	0.87	1.02	0.97	0.30	1.56
NO	UKMCA1600 - 3RMM	0.81	1.05	0.91	1.24	1.41
NO	UKMCA1600 - OAE	0.81	1.04	1.52	1.02	1.89
NO	UKMCA1600 - SRT	0.80	1.05	1.45	1.22	1.65
NO	UKMCA1600 - KME	0.80	1.05	1.47	1.21	1.65
NO	UKMCA1600 - 125	0.89	1.03	1.48	1.10	1.79

By Waterway Zone Risk Comparison

Base Case Relative Multipliers By Oil Spill Size

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Multipliers: Probability of One or More Accident in 10 years

Multipliers Relative To The 2015 Base Case by What-If Case and Potential Oil Spill Size Category

VTRA Study Area	USKMCA1600 5 RMM'S	USKMCA1600 3 RMM's	USKMCA1600 OAE - RMM	USKMCA1600 SRT - RMM	USKMCA1600 KME - RMM	USKMCA1600 125 - RMM	USKMCA1600 NO RMM
2500 m3 or More	2.28	2.68	2.70	2.71	2.70	2.83	2.71
1000 m3 - 2500 m3	1.04	1.53	1.38	1.52	1.52	1.41	1.56
1 m3 - 1000 m3	0.86	0.94	1.03	1.06	1.06	1.05	1.06
0 gallons - 264 gallons	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Potential Spill Size: 2500 m^3 or more

2500 m3 or More	USKMCA1600 5 RMM'S	USKMCA1600 3 RMM's	USKMCA1600 OAE - RMM	USKMCA1600 SRT - RMM	USKMCA1600 KME - RMM	USKMCA1600 125 - RMM	USKMCA1600 NO RMM
Haro/Boun.	9.84	10.53	11.37	11.00	11.19	11.08	11.19
Sthrn. Glf. Ils.	5.49	1.88	6.39	5.82	6.04	6.76	6.04
Buoy J	4.89	5.24	5.35	5.23	4.88	6.03	5.25
ESJF	4.78	4.92	4.96	5.07	5.01	4.97	5.06
WSJF	2.89	2.89	2.83	3.14	3.05	3.23	3.10
Guemes	2.10	2.67	2.65	2.42	2.42	2.72	2.43
Georgia Str.	1.43	2.27	2.07	2.40	2.40	2.17	2.40
Saddlebag	1.29	1.76	1.63	1.73	1.71	2.26	1.71
Sar/Skagit	0.44	1.43	1.51	1.49	1.49	1.49	1.49
SJ Islands	1.22	1.56	2.08	1.23	1.23	1.41	1.23
Rosario	0.75	1.24	1.10	1.23	1.23	1.17	1.23
ATBA	1.00	1.21	1.26	1.16	1.17	1.21	1.17
PS North	0.89	0.92	0.98	1.04	1.04	1.01	1.04
PS South	0.79	1.02	1.02	1.03	1.04	0.91	1.04
Tac. South	0.88	1.07	0.82	0.96	0.96	0.76	0.96

RMM ANALYSIS OBSERVATIONS BASE CASE RELATIVE MULTIPLIERS

1. **2500 m^3 or more category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the VTRA Study Area**, **increases by a factor ranging from about two (5 RMM Case) to three (125-RMM Case)**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model.

2. **2500 m^3 or more category:** Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the Haro Strait - Boundary Pass Waterway Zone**, **increases by about factor ranging from about 10 (5 RMM Case) to about 11 (OAE-RMM Case)**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model.

3. **2500 m^3 or more category:** Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the waterway zones Southern Gulf Islands, Buoy J and Eastern Strait of Juan de Fuca**, **increases by a factor ranging from about five (5 RMM Case) to 7 (OAE-RMM Case)**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model (with the exception of the 3-RMM case where this relative factor equals about two for the Southern Gulf Islands waterway zone).

4. **2500 m^3 or more category:** Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the waterway zones West Strait of Juan, Georgia Strait, Guemes and Saddlebag** , **increases by a factor ranging from about two to three**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model (with the exception of the 5-RMM case where this relative factor equals about 1.3 to 1.4 for the Guemes and Saddlebag Waterway Zones.

5. **2500 m^3 or more category:** Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **is reduced by a factor less than one for some waterway zones** and for some risk mitigation measures evaluated, most notably the 5-RMM Case. However, it should be noted that the 5-RMM Case does make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluation

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

Multipliers: Probability of One or More Accident in 10 years

Multipliers Relative To The 2015 Base Case by What-If Case and Potential Oil Spill Size Category

VTRA Study Area	USKMCA1600 5 RMM'S	USKMCA1600 3 RMM's	USKMCA1600 OAE - RMM	USKMCA1600 SRT - RMM	USKMCA1600 KME - RMM	USKMCA1600 125 - RMM	USKMCA1600 NO RMM
2500 m3 or More	2.28	2.68	2.70	2.71	2.70	2.83	2.71
1000 m3 - 2500 m3	1.04	1.53	1.38	1.52	1.52	1.41	1.56
1 m3 - 1000 m3	0.86	0.94	1.03	1.06	1.06	1.05	1.06
0 gallons - 264 gallons	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Potential Spill Size: 1000 m^3 - 2500 m^3

1000 m3 - 2500 m3	USKMCA1600 5 RMM'S	USKMCA1600 3 RMM's	USKMCA1600 OAE - RMM	USKMCA1600 SRT - RMM	USKMCA1600 KME - RMM	USKMCA1600 125 - RMM	USKMCA1600 NO RMM
Haro/Boun.	3.26	3.81	4.09	3.98	4.06	4.00	4.05
Sthrn. Glf. Ils.	0.57	0.38	0.59	0.63	0.65	0.66	0.65
Buoy J	2.46	1.81	2.46	2.10	1.93	2.17	2.06
ESJF	1.14	1.25	1.24	1.31	1.31	1.28	1.31
WSJF	1.58	1.89	1.91	2.05	1.85	1.96	2.04
Guemes	0.78	1.45	1.05	1.17	1.17	1.24	1.21
Georgia Str.	0.81	1.25	1.09	1.41	1.41	1.29	1.41
Saddlebag	0.55	1.32	1.19	1.30	1.34	0.83	1.37
Sar/Skagit	0.59	0.97	1.14	1.20	1.17	1.21	1.17
SJ Islands	0.89	0.43	0.92	1.36	1.31	1.03	1.32
Rosario	0.48	1.09	0.62	1.02	1.07	0.90	1.08
ATBA	1.16	0.98	1.02	1.19	1.16	0.98	1.16
PS North	0.71	0.92	0.79	1.08	1.08	1.05	1.08
PS South	0.78	1.09	0.92	1.05	1.05	0.97	1.05
Tac. South	0.86	0.86	0.88	1.00	1.00	1.02	1.00

RMM ANALYSIS OBSERVATIONS BASE CASE RELATIVE MULTIPLIERS

1. **1000 m^3 - 2500 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the VTRA Study Area**, **increases by a factor ranging from about 1.03 (OAE- RMM Case) to 1.5 (USKMCA1600 Case)**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model, with the exception of the 5-RMM Case where a factor of about one is observed. However, it should be noted that the 5-RMM Case does make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluation.

2. **1000 m^3 - 2500 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the Haro Strait - Boundary Pass Waterway Zone**, **increases by about factor ranging from about .3 (5 RMM Case) to about 4**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model.

3. **1000 m^3 - 2500 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period reduction in this loss category **for the Southern Gulf Islands**, **by a factor ranging from about 0.4 (3-RMM) to 0.75 (USKMCA1600),** is largely attributed to risk migration from the **the Southern Gulf Islands** waterway zone to its bordering Haro-Strait Boundary Pass waterway zone due to timing changes as a result of the implementation of the RMM Cases in the VTRA 2015 model.

4. **1000 m^3 - 2500 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the waterway zones Eastern and Westerns Strait of Juan de Fuca**, **increases by a factor ranging from about 1.1 (5 RMM Case) to two,** regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model.

5. **1000 m^3 - 2500 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **is reduced by a factor less than one for some waterway zones** and for some risk mitigation measures evaluated, most notably the 5-RMM, the 3-RMM and the OAE-RMM Cases. However, it should be noted that the 5-RMM Case does make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluation, whereas the 3-RMM and OAE-RMM Case do not.

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

THE GEORGE WASHINGTON UNIVERSITY WASHINGTON, DC VCU

Multipliers: Probability of One or More Accident in 10 years

Multipliers Relative To The 2015 Base Case by What-If Case and Potential Oil Spill Size Category

VTRA Study Area	USKMCA1600 5 RMM'S	USKMCA1600 3 RMM's	USKMCA1600 OAE - RMM	USKMCA1600 SRT - RMM	USKMCA1600 KME - RMM	USKMCA1600 125 - RMM	USKMCA1600 NO RMM
2500 m3 or More	2.28	2.68	2.70	2.71	2.70	2.83	2.71
1000 m3 - 2500 m3	1.04	1.53	1.38	1.52	1.52	1.41	1.56
1 m3 - 1000 m3	0.86	0.94	1.03	1.06	1.06	1.05	1.06
0 gallons - 264 gallons	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Potential Spill Size: 1 m^3 - 1000 m^3

1 m3 - 1000 m3	USKMCA1600 5 RMM'S	USKMCA1600 3 RMM's	USKMCA1600 OAE - RMM	USKMCA1600 SRT - RMM	USKMCA1600 KME - RMM	USKMCA1600 125 - RMM	USKMCA1600 NO RMM
Haro/Boun.	0.92	1.29	1.50	1.46	1.50	1.51	1.50
Sthrn. Glf. Ils.	0.64	0.68	0.87	0.97	1.01	1.01	1.00
Buoy J	1.11	1.16	1.64	1.62	1.62	1.60	1.64
ESJF	1.22	1.27	1.36	1.38	1.38	1.36	1.39
WSJF	0.99	0.93	1.24	1.23	1.23	1.20	1.23
Guemes	0.66	1.13	0.79	1.21	1.21	1.09	1.16
Georgia Str.	0.82	0.99	1.06	1.09	1.09	0.99	1.03
Saddlebag	0.74	1.03	0.94	1.09	1.09	0.99	1.06
Sar/Skagit	0.93	0.84	1.13	1.07	1.07	1.15	1.05
SJ Islands	0.99	1.03	1.04	1.06	1.13	1.04	1.05
Rosario	0.56	1.14	0.82	1.12	1.12	1.12	1.06
ATBA	1.02	1.02	1.04	1.08	1.07	1.05	1.07
PS North	0.85	0.82	0.96	1.01	1.01	1.01	1.01
PS South	0.83	0.85	1.00	0.99	0.99	0.99	0.99
Tac. South	0.80	0.99	0.84	0.99	0.99	0.98	1.01

RMM ANALYSIS OBSERVATIONS BASE CASE RELATIVE MULTIPLIERS

1. **1 m^3 - 1000 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the VTRA Study Area**, **increases by a factor ranging from about 1.4 (OAE- RMM Case) to 1.06 (USKMCA1600 Case)**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model, with the exception of the 5-RMM and 3-RMM Case where reduction factors of 0.86 and 0.94 are observed, respectively. It should be noted that the 5-RMM Case does make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluation, whereas the 3-RRM Case does not.

2. **1 m^3 - 1000 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the Buoy J Waterway Zone**, **increases by about factor ranging from about 1.1 (5-RMM Case) to about 1.6 (USKMCA1600)**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model.

3. **1 m^3 - 1000 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the Haro Strait - Boundary Pass Waterway Zone**, **increases by about factor ranging from about 1.3 (3-RMM Case) to about 1.5 (USKMCA1600)**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model, with the exception of the 5-RMM Case where reduction factors of 0.92 is observed. However, it should be noted that the 5-RMM Case does make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluation.

4. **1 m^3 - 1000 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **is reduced by a factor less than one for some waterway zones** and for some risk mitigation measures evaluated, most notably the 5-RMM, the 3-RMM and the OAE-RMM Cases. However, it should be noted that the 5-RMM Case does make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluation, whereas the 3-RMM and OAE-RMM Case do not.

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

THE GEORGE WASHINGTON UNIVERSITY WASHINGTON, DC VCU

Multipliers: Probability of One or More Accident in 10 years

Multipliers Relative To The 2015 Base Case by What-If Case and Potential Oil Spill Size Category

VTRA Study Area	USKMCA1600 5 RMM'S	USKMCA1600 3 RMM's	USKMCA1600 OAE - RMM	USKMCA1600 SRT - RMM	USKMCA1600 KME - RMM	USKMCA1600 125 - RMM	USKMCA1600 NO RMM
2500 m3 or More	2.28	2.68	2.70	2.71	2.70	2.83	2.71
1000 m3 - 2500 m3	1.04	1.53	1.38	1.52	1.52	1.41	1.56
1 m3 - 1000 m3	0.86	0.94	1.03	1.06	1.06	1.05	1.06
0 gallons - 264 gallons	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Potential Spill Size: 0 m^3 - 1 m^3

0 gallons - 264 gallons	USKMCA1600 5 RMM'S	USKMCA1600 3 RMM's	USKMCA1600 OAE - RMM	USKMCA1600 SRT - RMM	USKMCA1600 KME - RMM	USKMCA1600 125 - RMM	USKMCA1600 NO RMM
Haro/Boun.	1.01	1.03	1.03	1.03	1.03	1.03	1.03
Sthrn. Glf. Ils.	0.99	1.00	1.00	1.00	1.00	1.00	1.00
Buoy J	1.51	1.68	1.64	1.59	1.57	1.58	1.60
ESJF	1.11	1.14	1.13	1.15	1.15	1.14	1.15
WSJF	1.08	1.09	1.09	1.09	1.09	1.09	1.09
Guemes	0.96	1.01	0.99	1.01	1.01	1.01	1.01
Georgia Str.	0.92	1.02	1.00	1.04	1.04	1.02	1.03
Saddlebag	0.69	1.10	0.90	1.09	1.09	1.08	1.09
Sar/Skagit	0.92	0.91	1.05	1.05	1.05	1.12	1.05
SJ Islands	0.99	1.02	1.01	1.06	1.06	1.01	1.07
Rosario	0.61	1.13	0.87	1.11	1.11	1.10	1.04
ATBA	1.01	1.03	1.04	1.07	1.07	1.04	1.07
PS North	0.97	0.99	0.98	1.00	1.00	1.00	1.00
PS South	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Tac. South	0.84	0.99	0.86	0.99	0.99	0.98	1.00

RMM ANALYSIS OBSERVATIONS BASE CASE RELATIVE MULTIPLIERS

1. **0 m^3 - 1 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the VTRA Study Area**, **remains about the same**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model.

2. **0 m^3 - 1 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the Buoy J Waterway Zone**, **increases by about factor ranging from about 1.5 (5-RMM Case) to about 1.7 (3-RMM Case)**, regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model.

3. **1 m^3 - 1000 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **over the waterway zones Eastern and Westerns Strait of Juan de Fuca**, **increases by a factor ranging from about 1.08 (5 RMM Case) to 1.15 (USKMCA1600 Case),** regardless of the evaluated RMM Cases as modeled in the VTRA 2015 model.

4. **1 m^3 - 1000 m^3 Category**: Should all the terminal projects represented in the USKMCA1600 What-If Case come to fruition, the base case probability of one or more accidents over a 10 year period in this loss category **is reduced by a factor less than one for some waterway zones** and for some risk mitigation measures evaluated, most notably the 5-RMM and the OAE-RMM Cases. However, it should be noted that the 5-RMM Case does make Pos. to Max. Benefit Assumptions for RMM effectiveness evaluation, whereas OAE-RMM Case do not.