

## Paired Comparison of following VTRA 2015 Cases:

1. '15 Base Case to USKCA1600 and
2. USKCA1600 to USKCA1600 - 5RMM



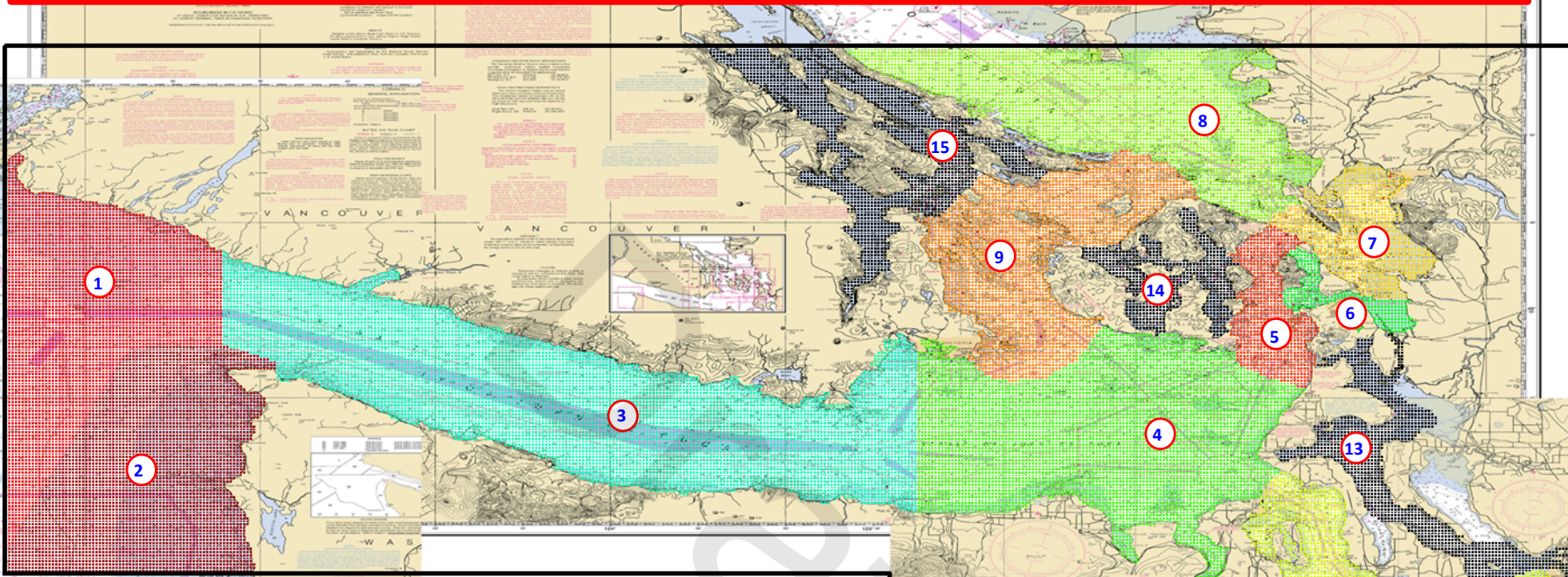
**Jason R.W. Merrick (VCU) and J. Rene van Dorp (GW)**

September, 2016

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

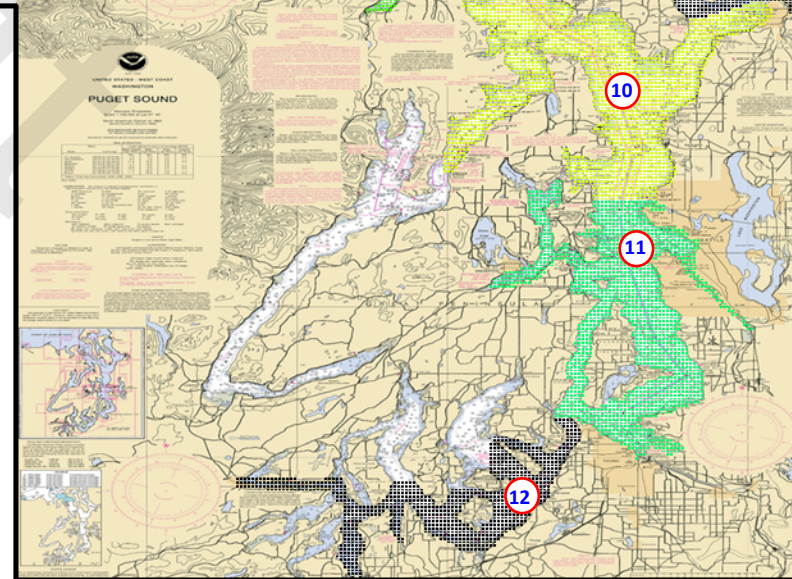


# DEFINITION OF 15 WATERWAY ZONES

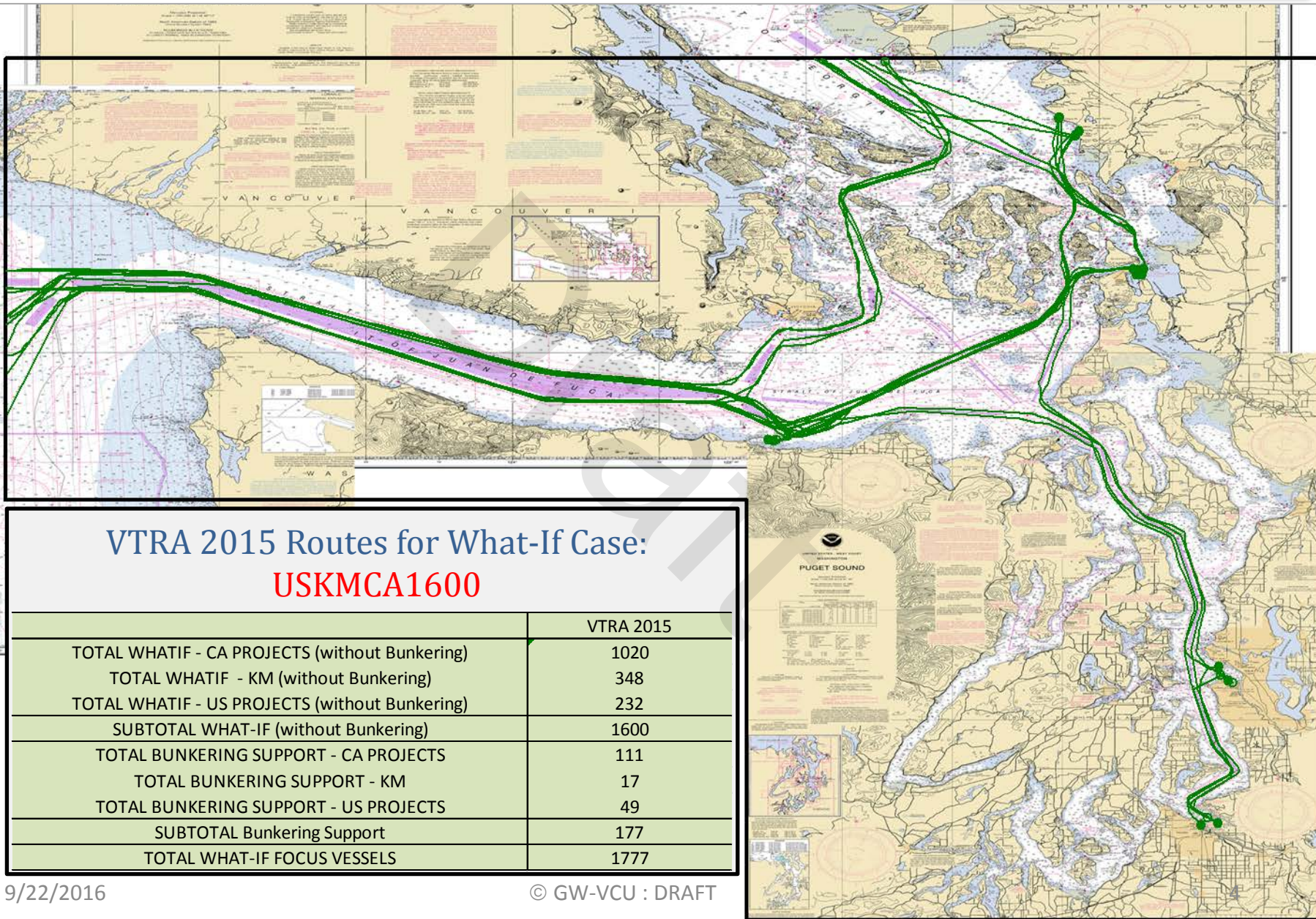


## VTRA 2015 Waterway Zones

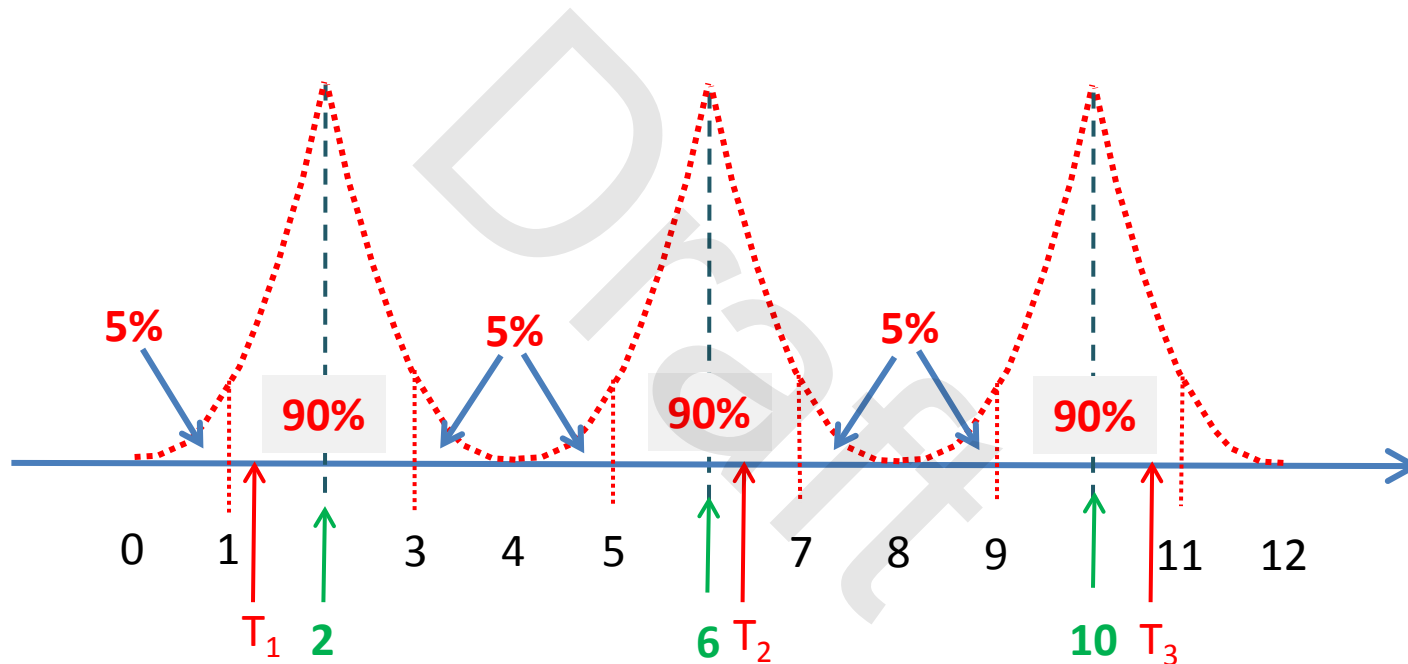
- |                 |                           |
|-----------------|---------------------------|
| 1. Buoy J       | 9. Haro/Boun.             |
| 2. ATBA         | 10. PS North              |
| 3. WSJF         | 11. PS South              |
| 4. ESJF         | 12. Tacoma                |
| 5. Rosario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



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



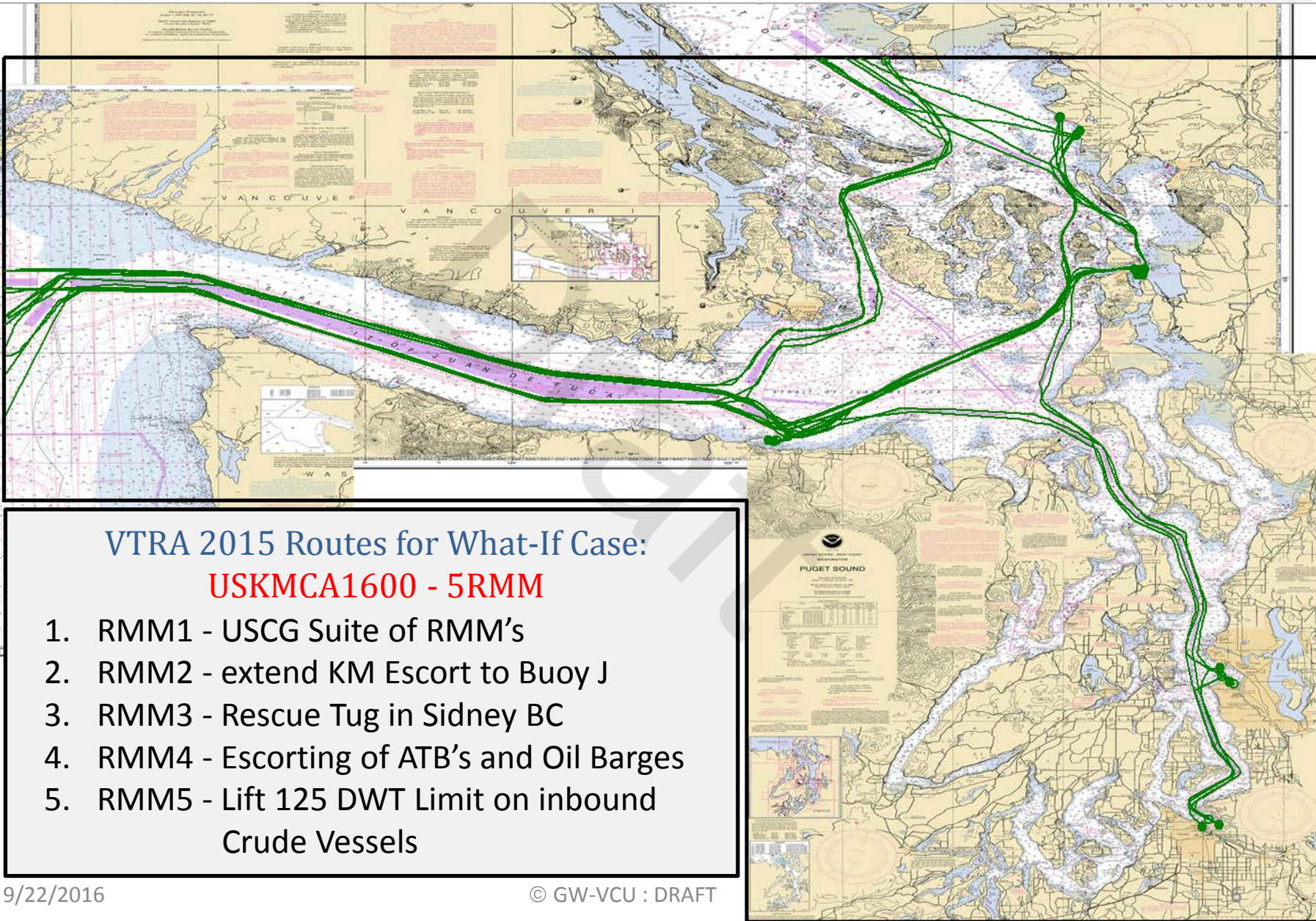
## VTRA 2015 – What If FV Scheduled Random Arrival Pattern Model (See Example Graph below)



VTRA 2010 Equidistant Fixed Arrival Pattern (one every 4 days)

VTRA 2015 Random Arrival Pattern ( 3 Random Times in 12 days)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



## VTRA 2015 Routes for What-If Case: **USKMCA1600 - 5RMM**

1. RMM1 - USCG Suite of RMM's
2. RMM2 - extend KM Escort to Buoy J
3. RMM3 - Rescue Tug in Sidney BC
4. RMM4 - Escorting of ATB's and Oil Barges
5. RMM5 - Lift 125 DWT Limit on inbound Crude Vessels

## RMM1 – USCG Suite of RMM's

- 1. 100% Double Hull Fuel Protection for CARGO Focus Vessels**
  - + Two additional pending RMM's making following assumptions regarding **their potential effectiveness** on VTRA 2015 Model input parameters
- 2. 50% Reduction of Human Error and Mechanical Failure on Tugs in the , VTRA 2015 Model, excluding Oil Barges.**
- 3. Remove from VTRA 2015 Model the implemented Special Events i.e.: Whale Watching, Regatta's and Commercial and Tribal Fishing Openers**

The effect of the last RMM in the VTRA 2015 Model analysis is two-fold, being:

- Exclude potential collisions of VTRA 2015 Focus Vessels with Special Event Vessels and
- Exclude the effect that Special Event Vessels may have on potential groundings of VTRA 2015 Focus Vessels.

# By Waterway Zone Risk Comparison

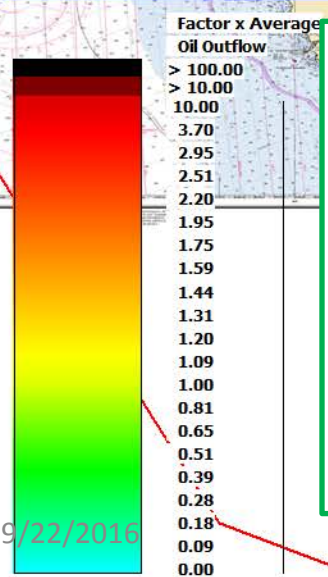
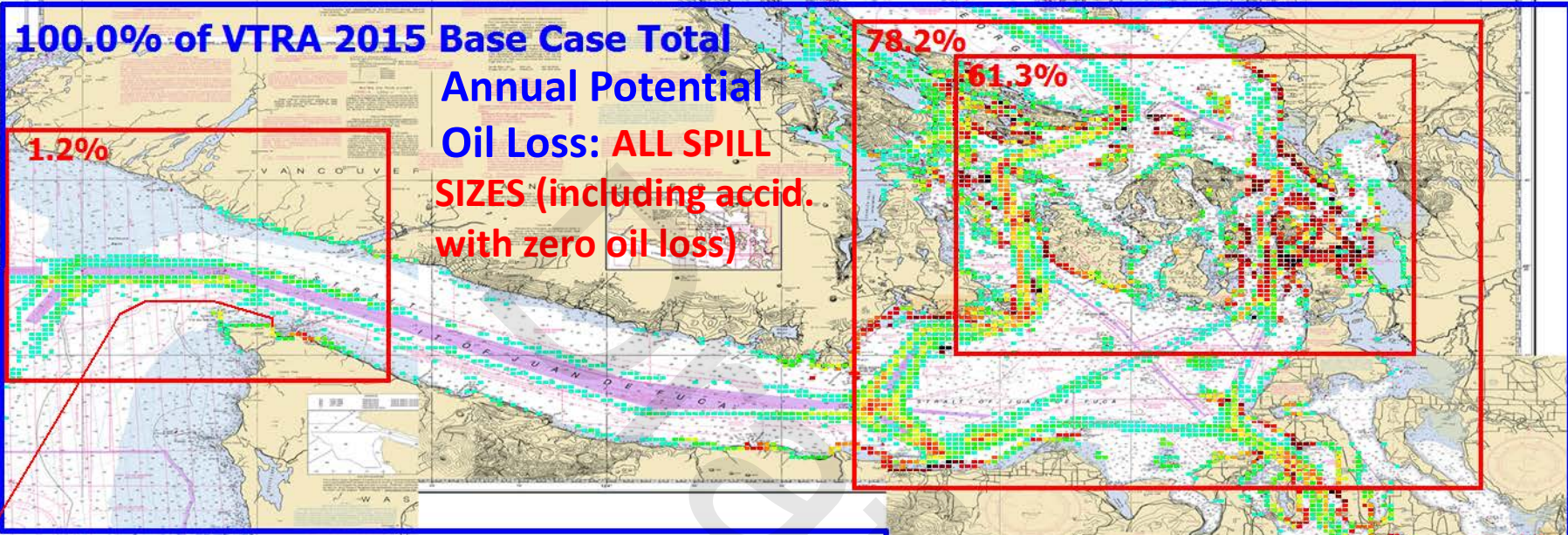
Oil Spill Size Category:

**ALL SPILL SIZES**



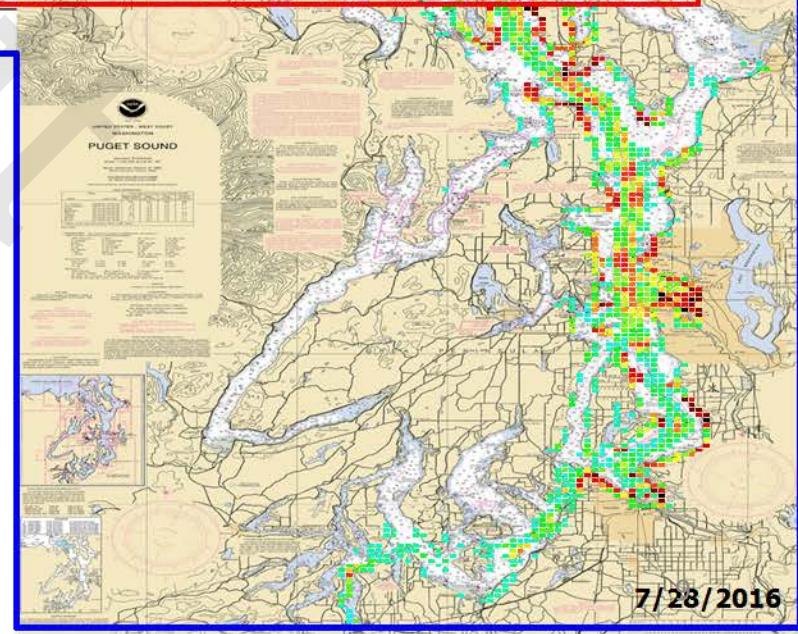
# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 BASE CASE - ALL FV



**VTRA '15 Case:  
BASE CASE**

GEOGRAPHIC PROFILE  
OF POTENTIAL ANNUAL  
OIL LOSS OF ACCIDENTS  
IN SPILL SIZE CATEGORY  
**ALL SPILL SIZES**

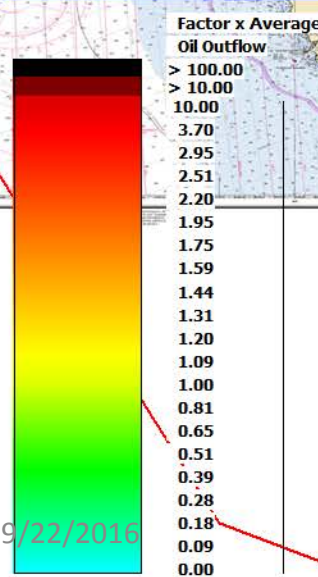
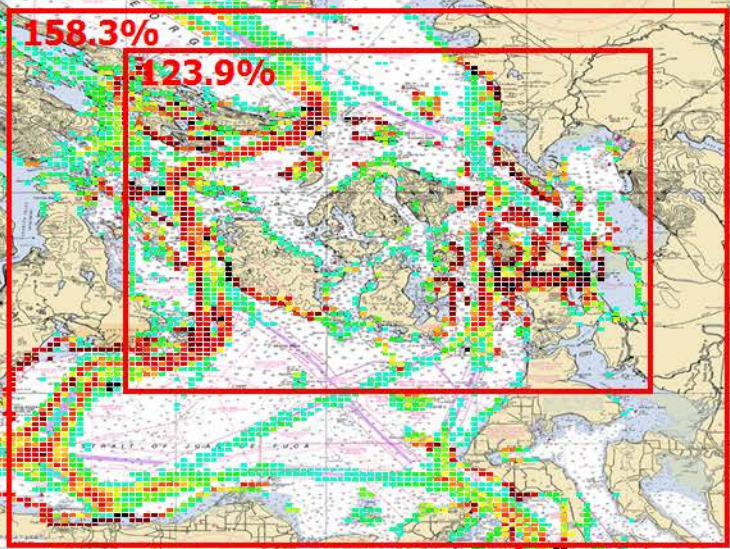
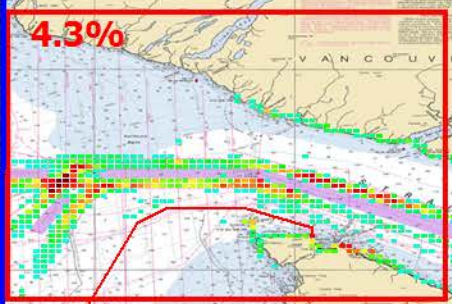


# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

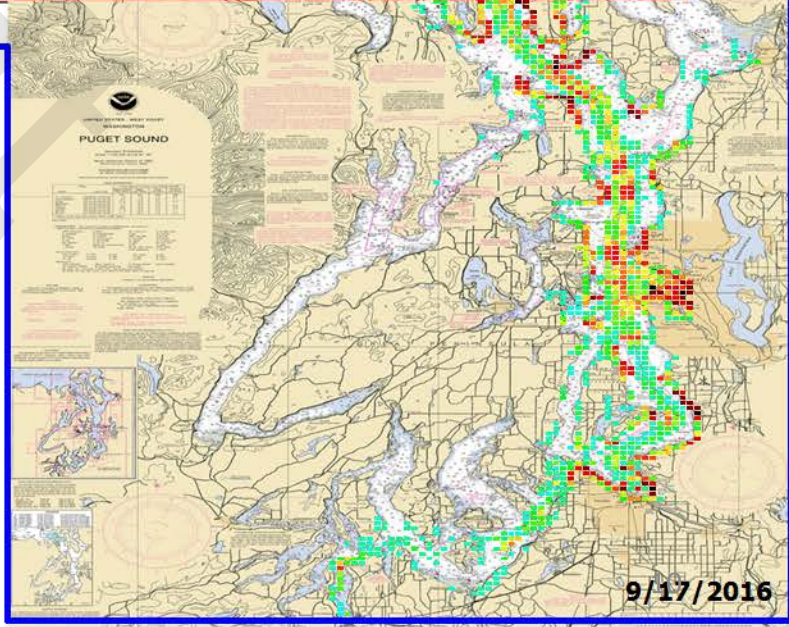


## VTRA 2015 Case: USKMCA1600 - ALL FV

**184.1% of VTRA 2015 Base Case Total Annual Potential Oil Loss: ALL SPILL SIZES (including accid. with zero oil loss)**



**VTRA '15 Case: USKMCA1600**  
GEOGRAPHIC PROFILE OF POTENTIAL ANNUAL OIL LOSS OF ACCIDENTS IN SPILL SIZE CATEGORY **ALL SPILL SIZES**



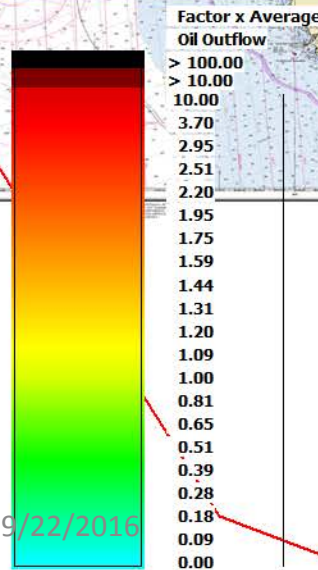
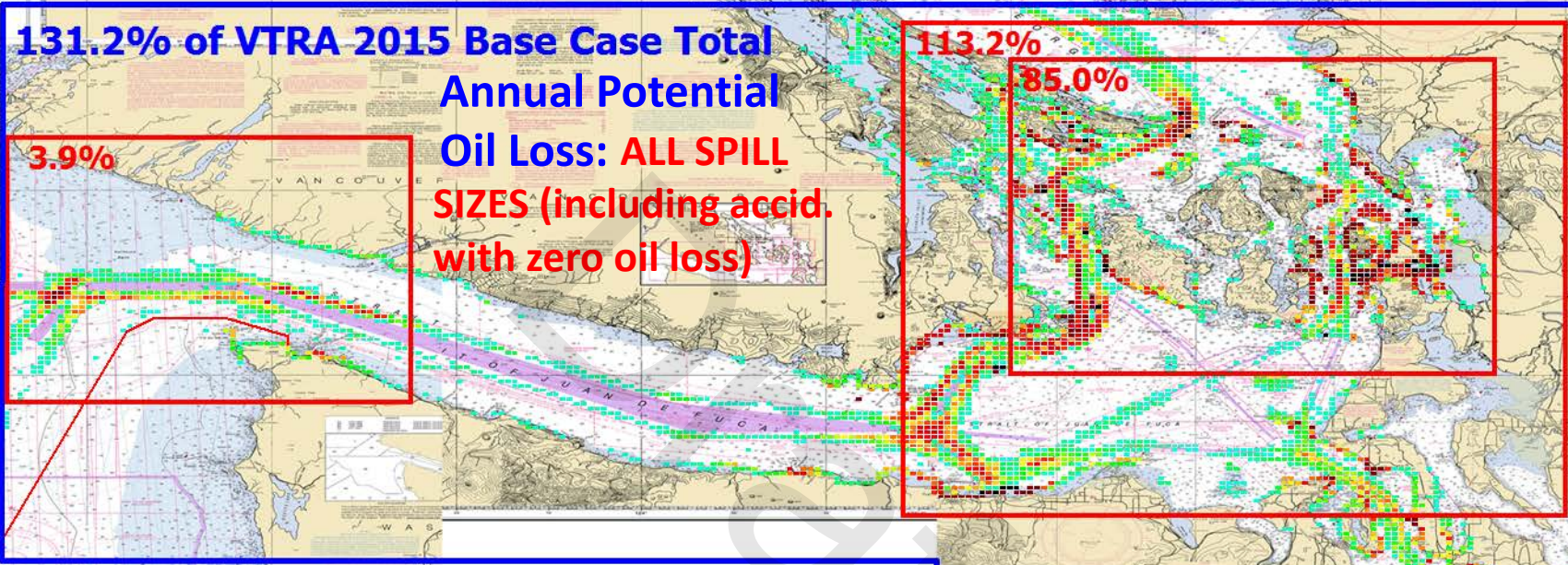
9/22/2016

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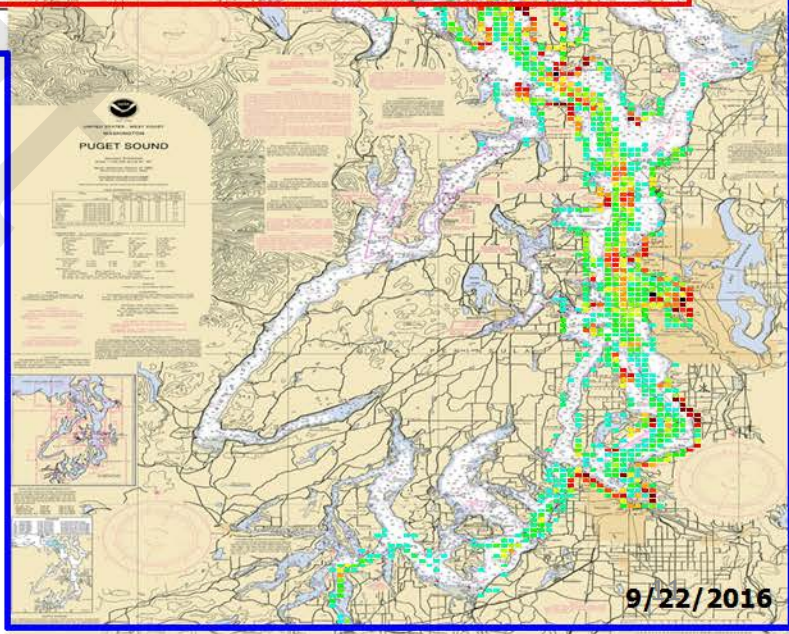
9/17/2016

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

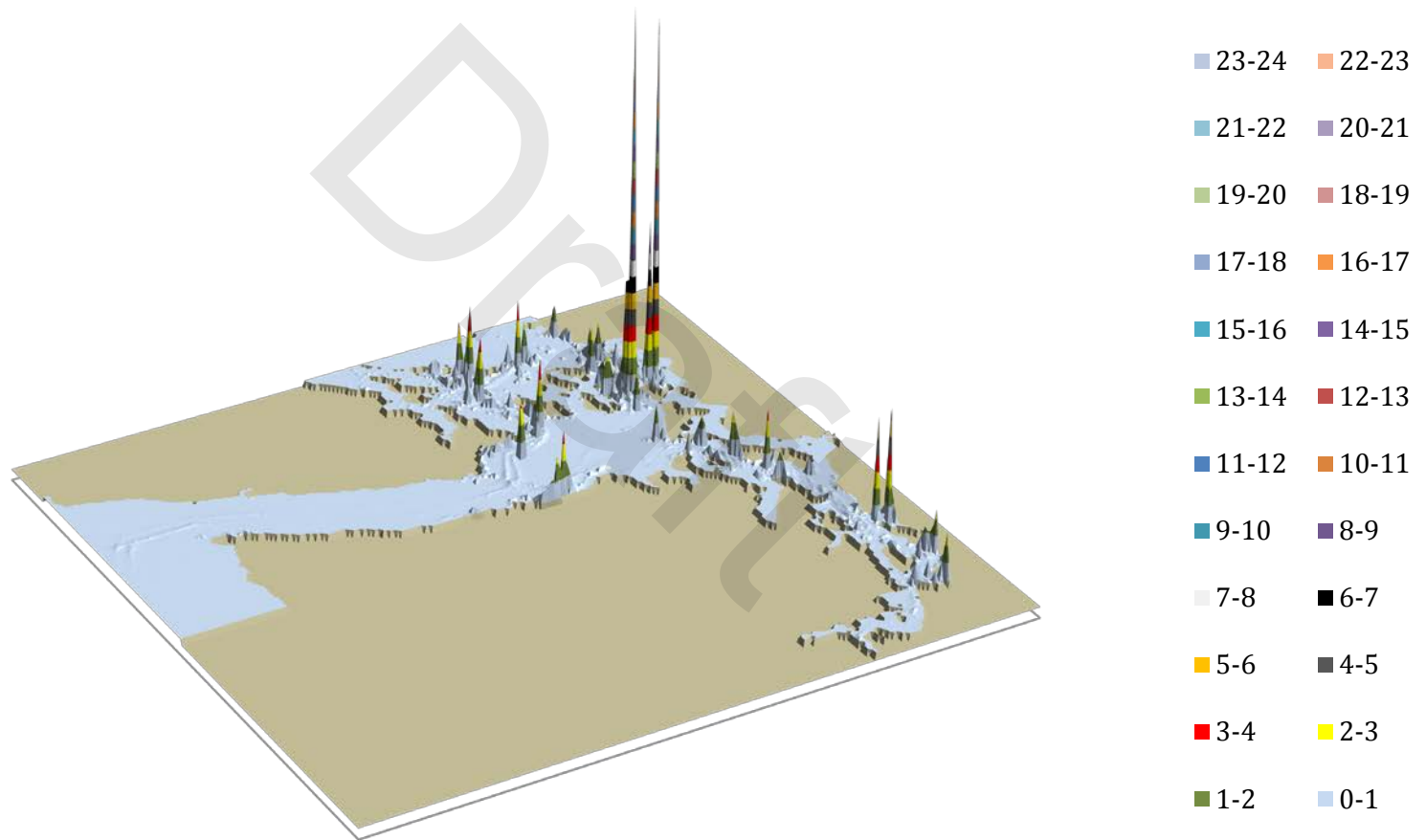
VTRA 2015 Case: USKMCA1600-5RMM - ALL FV



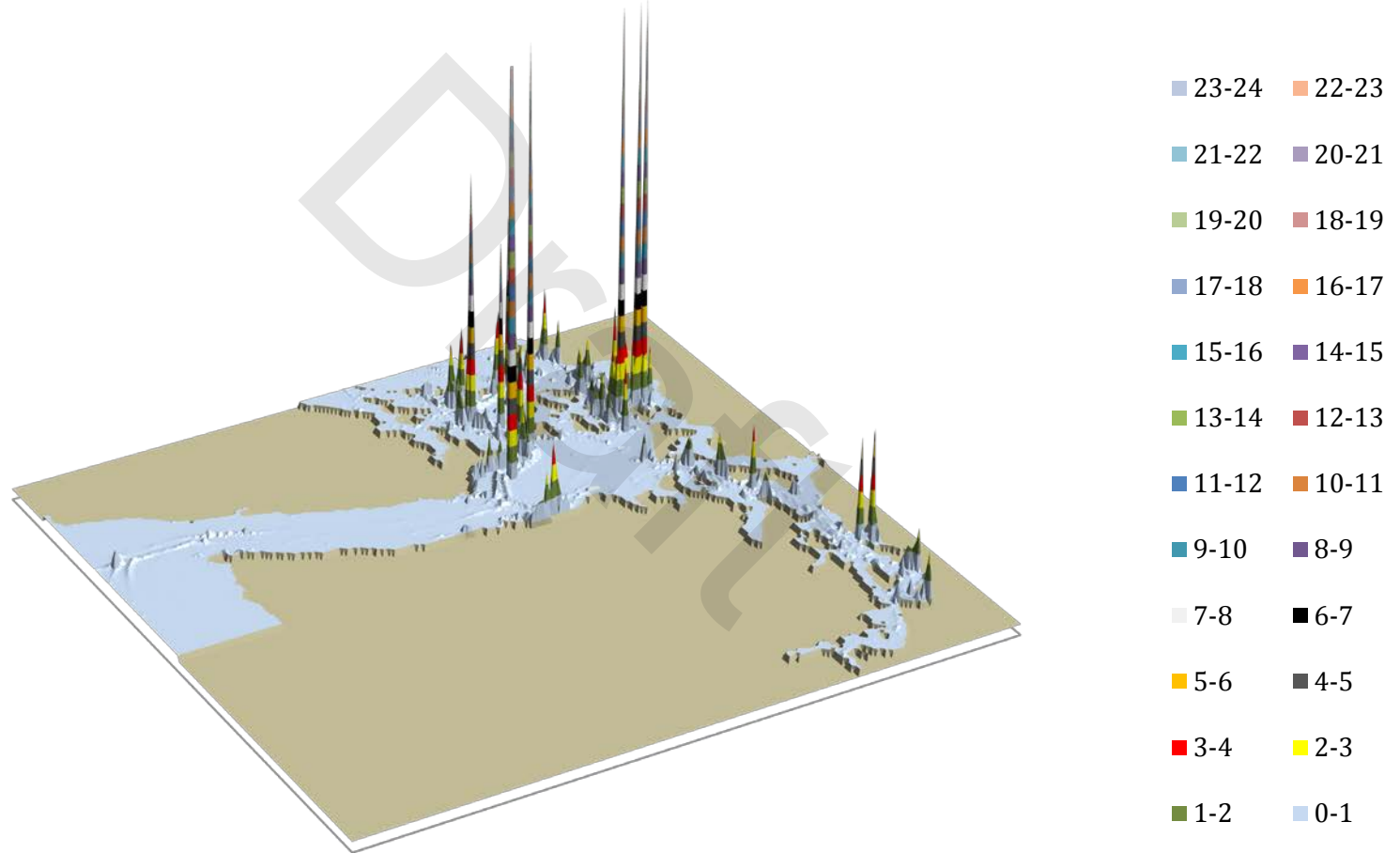
VTRA '15 Case:  
USKMCA1600 - 5RMM  
GEOGRAPHIC PROFILE  
OF POTENTIAL ANNUAL  
OIL LOSS OF ACCIDENTS  
IN SPILL SIZE CATEGORY  
ALL SPILL SIZES



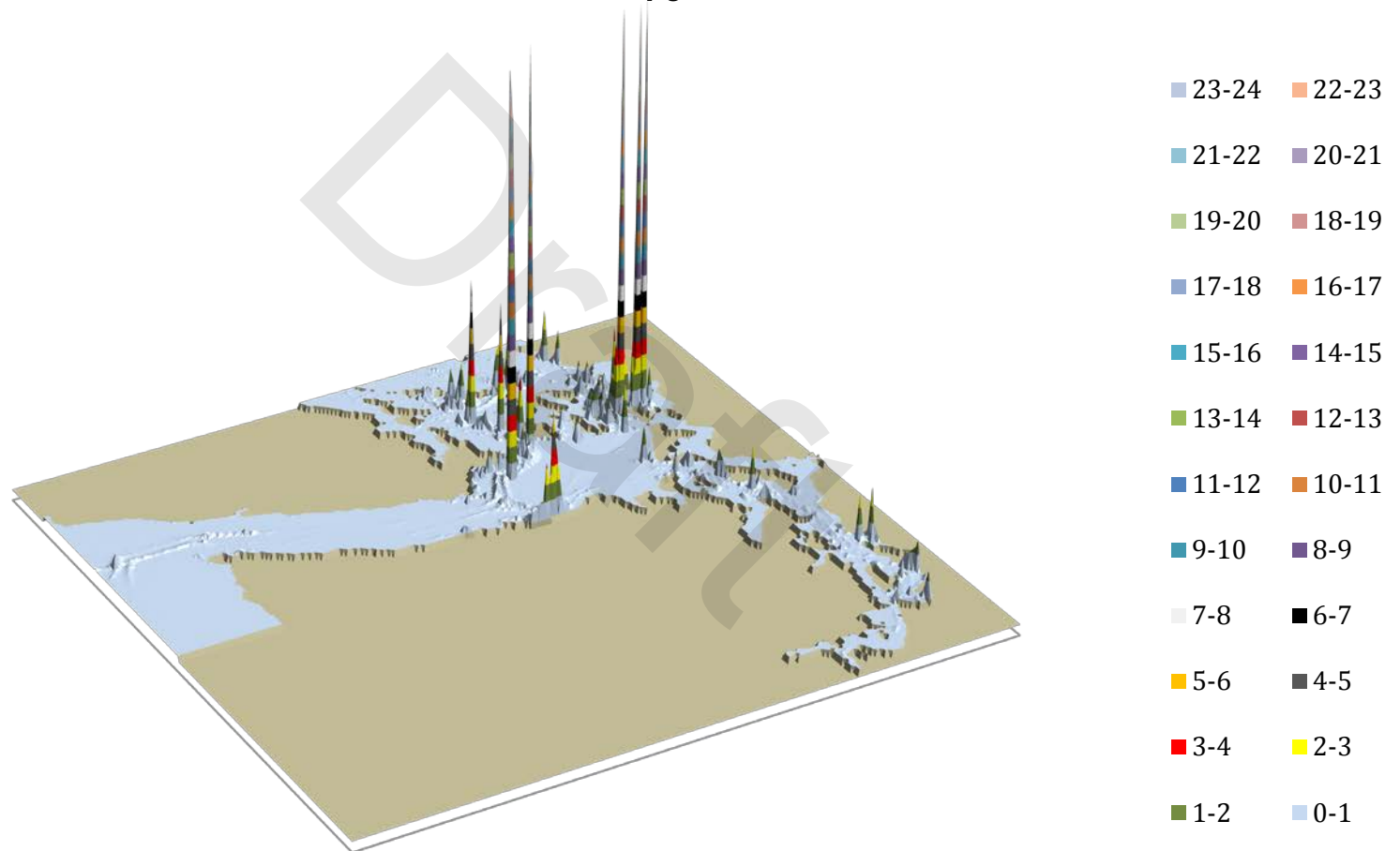
## VTRA '15: Base Case 3D Risk Profile All FV - Pot.C+G+A.Oil Loss: 100% of Base Case POL



## USKMCA1600 3D Risk Profile All FV - Pot.C+G+A.Oil Loss: 184% of Base Case POL

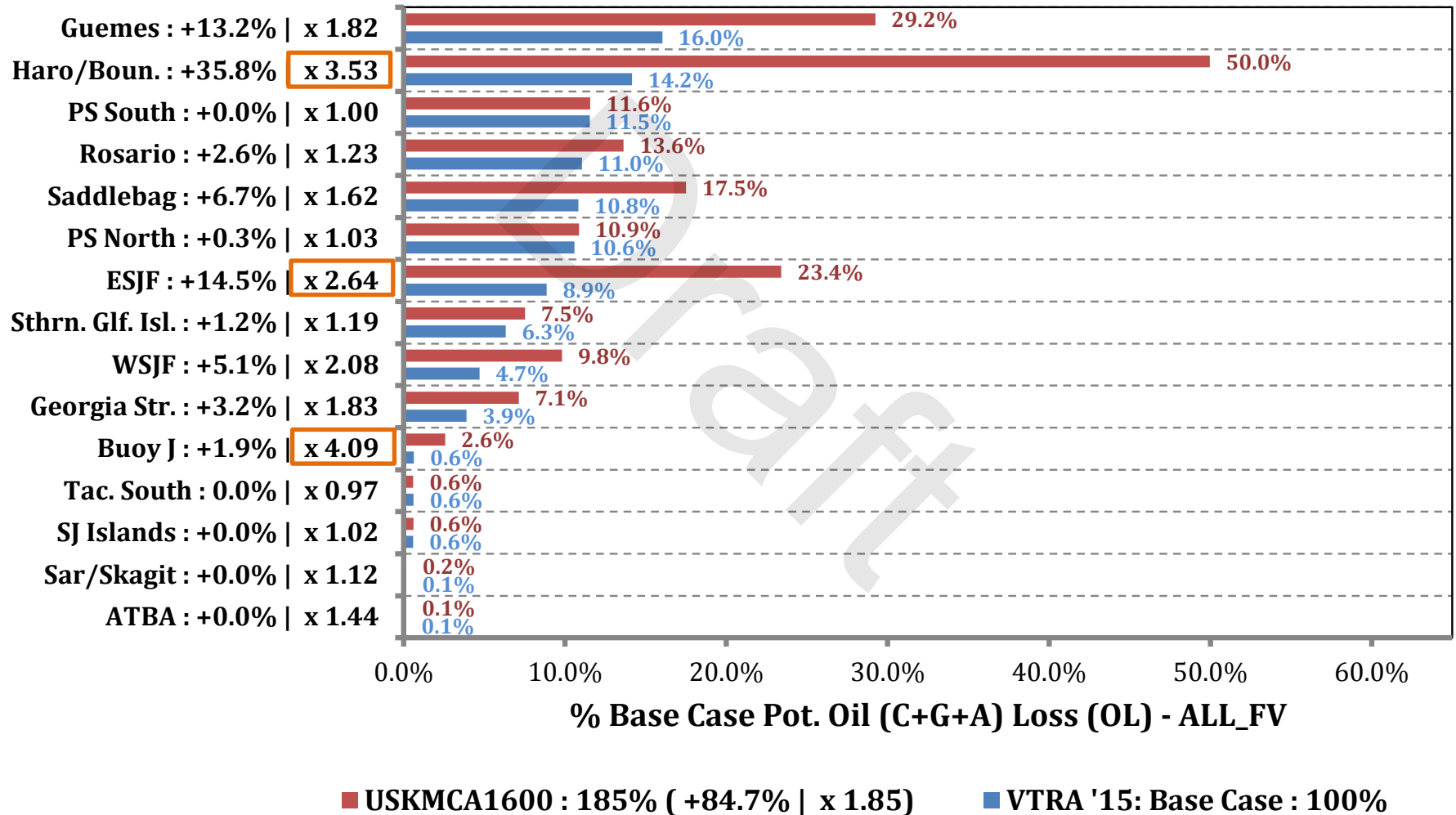


## USCAKM1600-5RMM 3D Risk Profile All FV - Pot.C+G+A.Oil Loss: 131% of Base Case POL



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

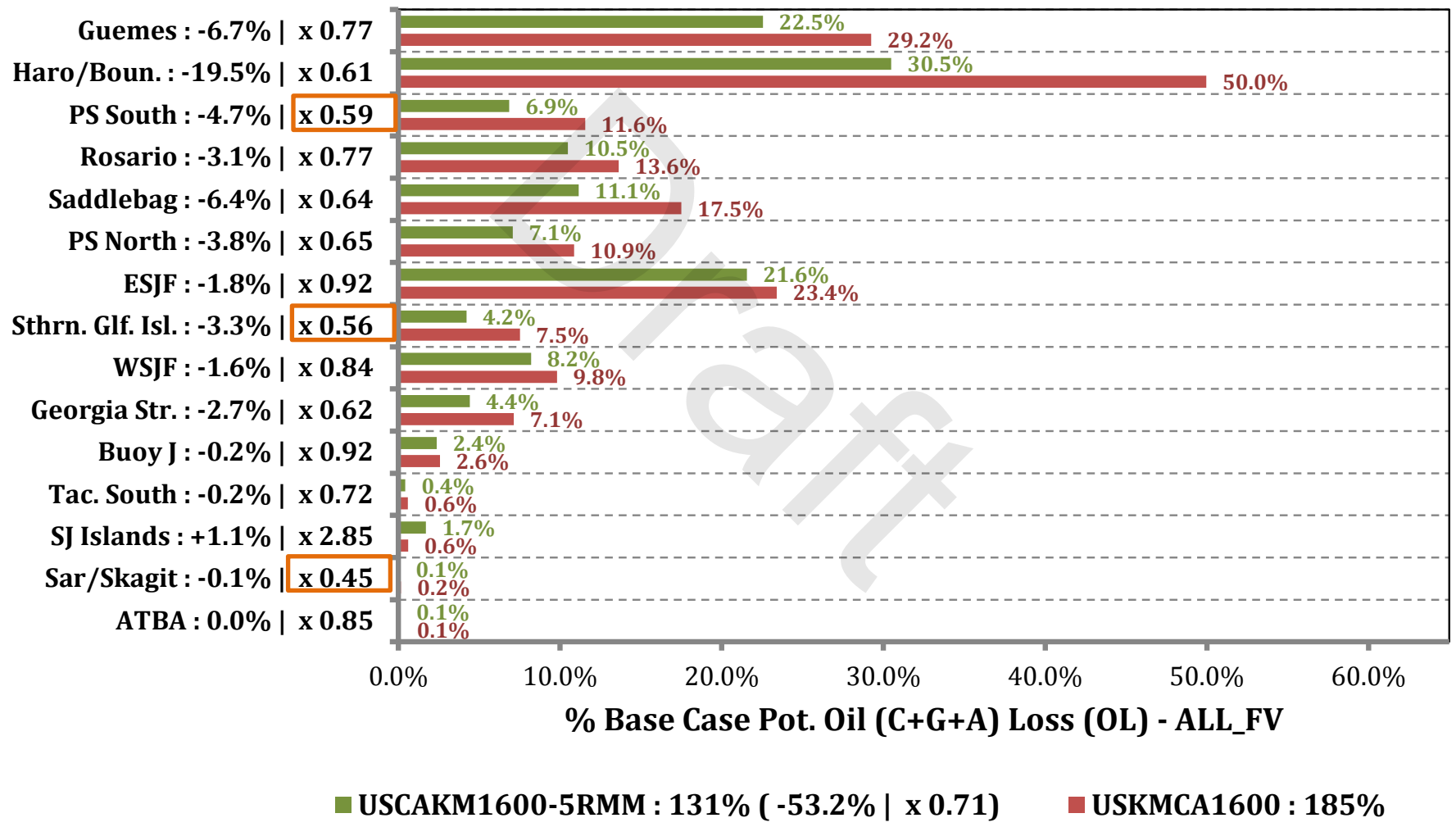
## % Base Case Pot. Oil (C + G + A) Loss - ALL\_FV



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



## % Base Case Pot. Oil (C + G + A) Loss - ALL\_FV

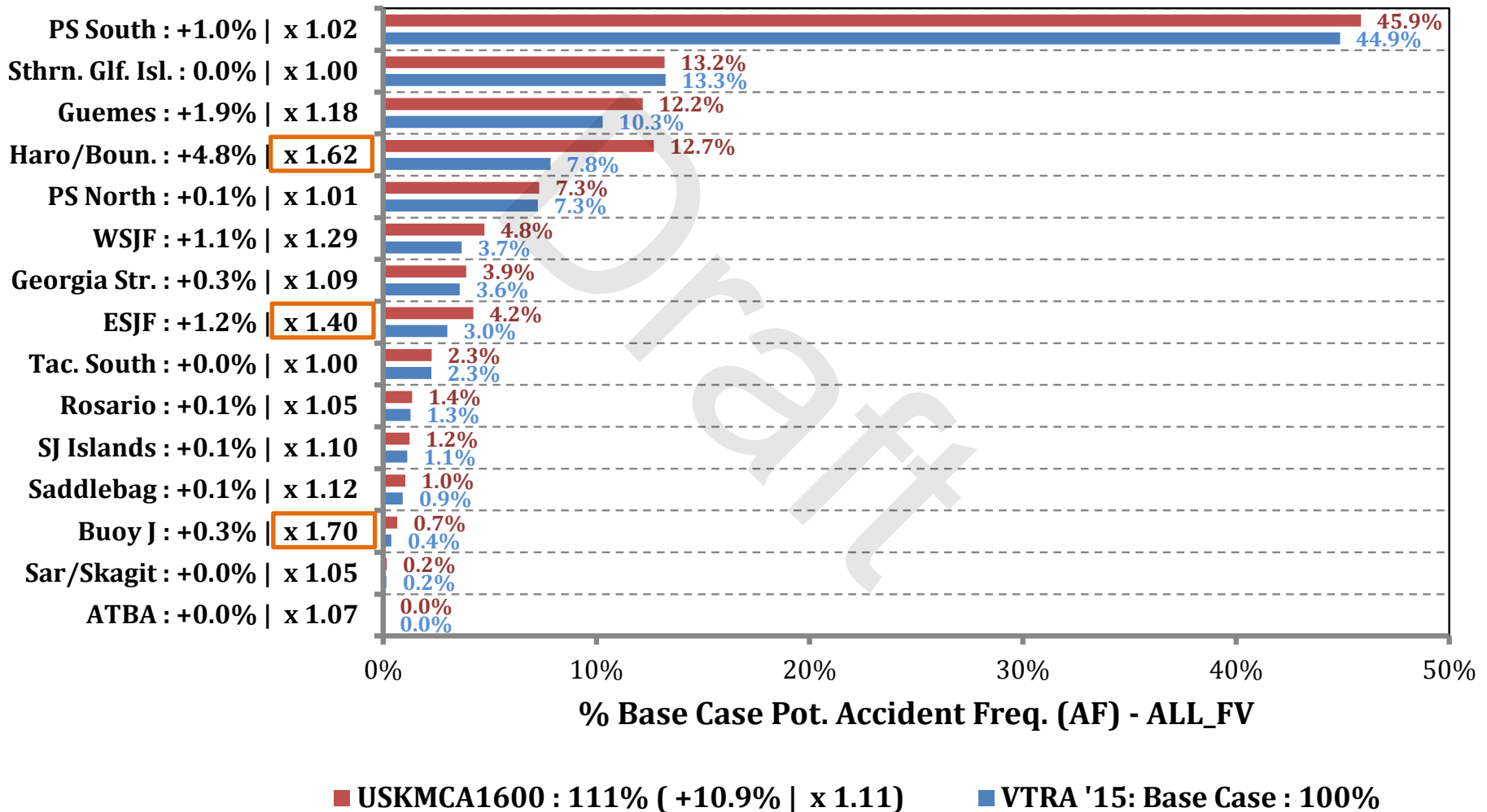




# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

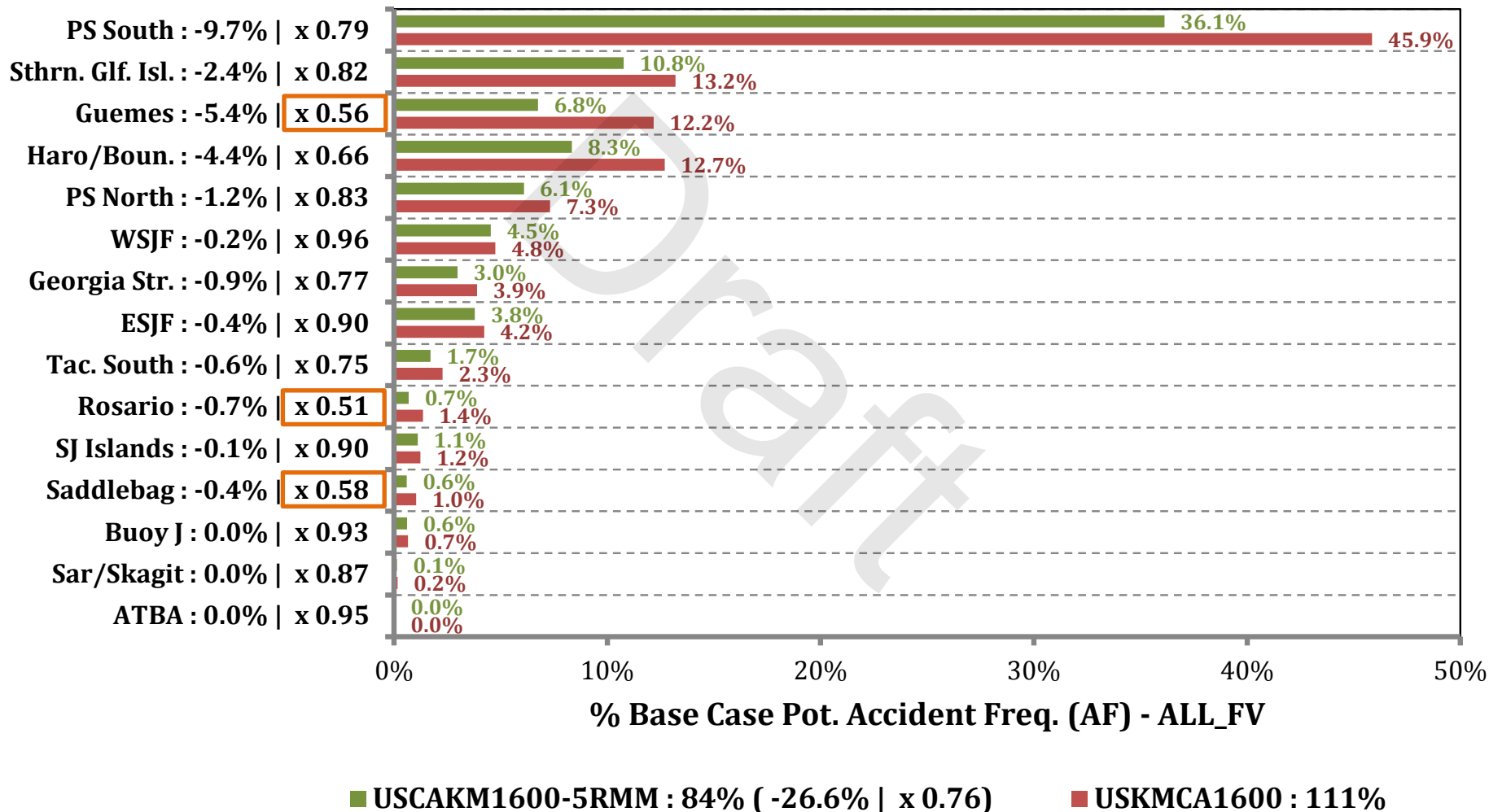


## % Base Case Pot. Accident (C+G+A) Frequency - ALL\_FV



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## % Base Case Pot. Accident (C+G+A) Frequency - ALL\_FV

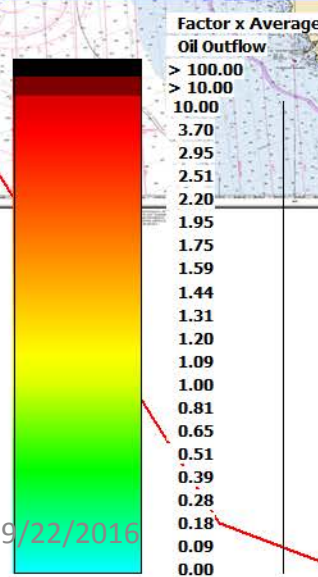
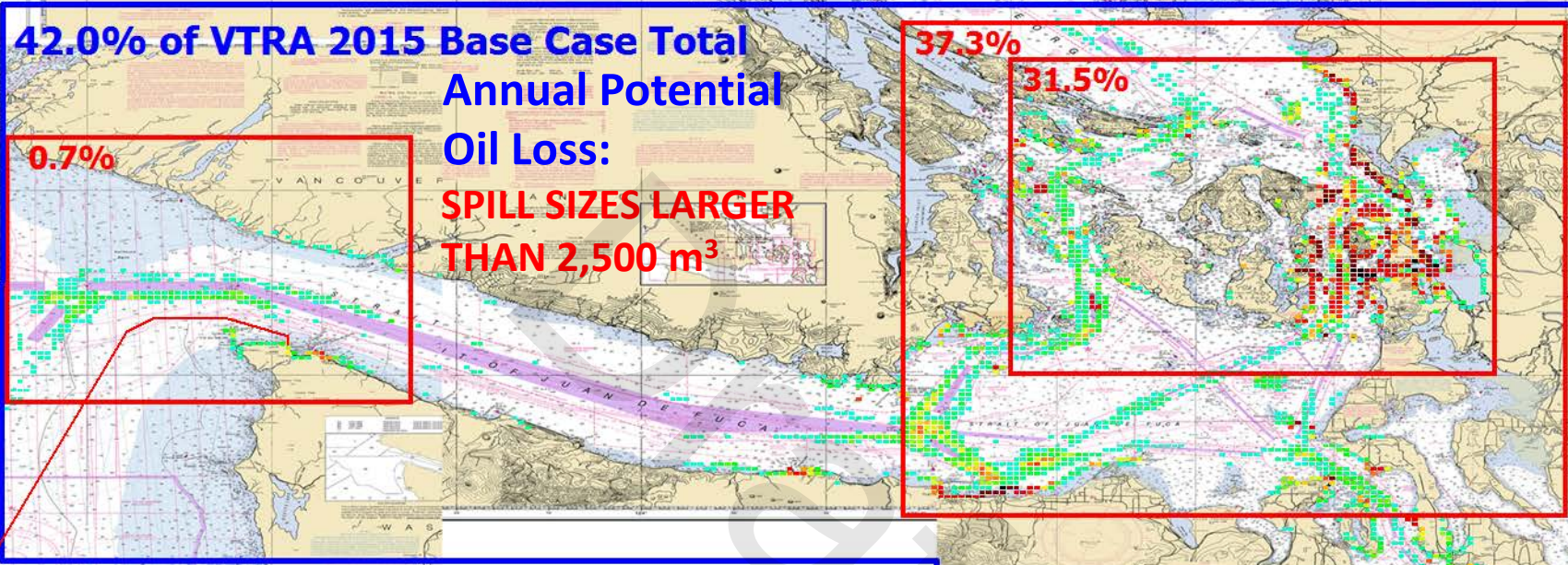


# By Waterway Zone Risk Comparison

Oil Spill Size Category:  
**2500 m<sup>3</sup> or more**

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 BASE CASE - ALL FV



**VTRA '15:**  
**BASE CASE**  
 GEOGRAPHIC PROFILE  
 OF POTENTIAL  
 ANNUAL OIL LOSS  
 OF ACCIDENTS  
 WITH SPILL SIZE  
**2,500 m<sup>3</sup> or more**

≈ 0.50% Probability  
 of Spill Occurrence  
 in 10 years

Average of ≈ 6,798 m<sup>3</sup>  
 Per Potential Spill  
 (≈ 5,846 Metric. Tons)

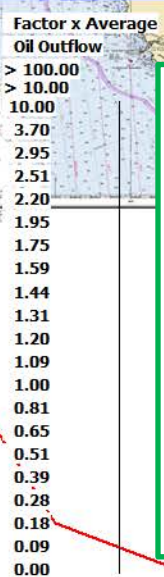
# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 Case: USKMCA1600 - ALL FV

**91.0% of VTRA 2015 Base Case Total Annual Potential Oil Loss:**  
**SPILL SIZES LARGER THAN 2,500 m<sup>3</sup>**

**83.1%**  
**67.7%**

**3.3%**



**VTRA '15 Case: USKMCA1600**  
GEOGRAPHIC PROFILE OF POTENTIAL ANNUAL OIL LOSS OF ACCIDENTS WITH SPILL SIZE **2,500 m<sup>3</sup> or more**

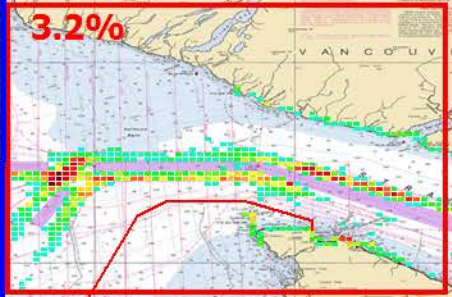
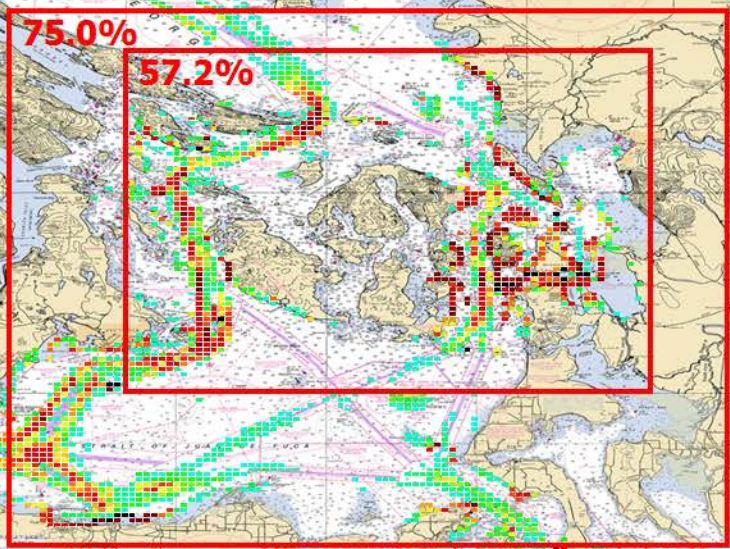
≈ 1.35% Probability of Spill Occurrence in 10 years

Average of ≈ 5,412 m<sup>3</sup> Per Potential Spill (≈ 4,654 Metric Tons)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 Case: USKMCA1600-5RMM - ALL FV

**83.1% of VTRA 2015 Base Case Total Annual Potential Oil Loss:**  
**SPILL SIZES LARGER THAN 2,500 m<sup>3</sup>**



**VTRA '15 Case:**  
**USKMCA1600 - 5RMM**  
GEOGRAPHIC PROFILE  
OF POTENTIAL  
ANNUAL OIL LOSS  
OF ACCIDENTS  
WITH SPILL SIZE  
**2,500 m<sup>3</sup> or more**

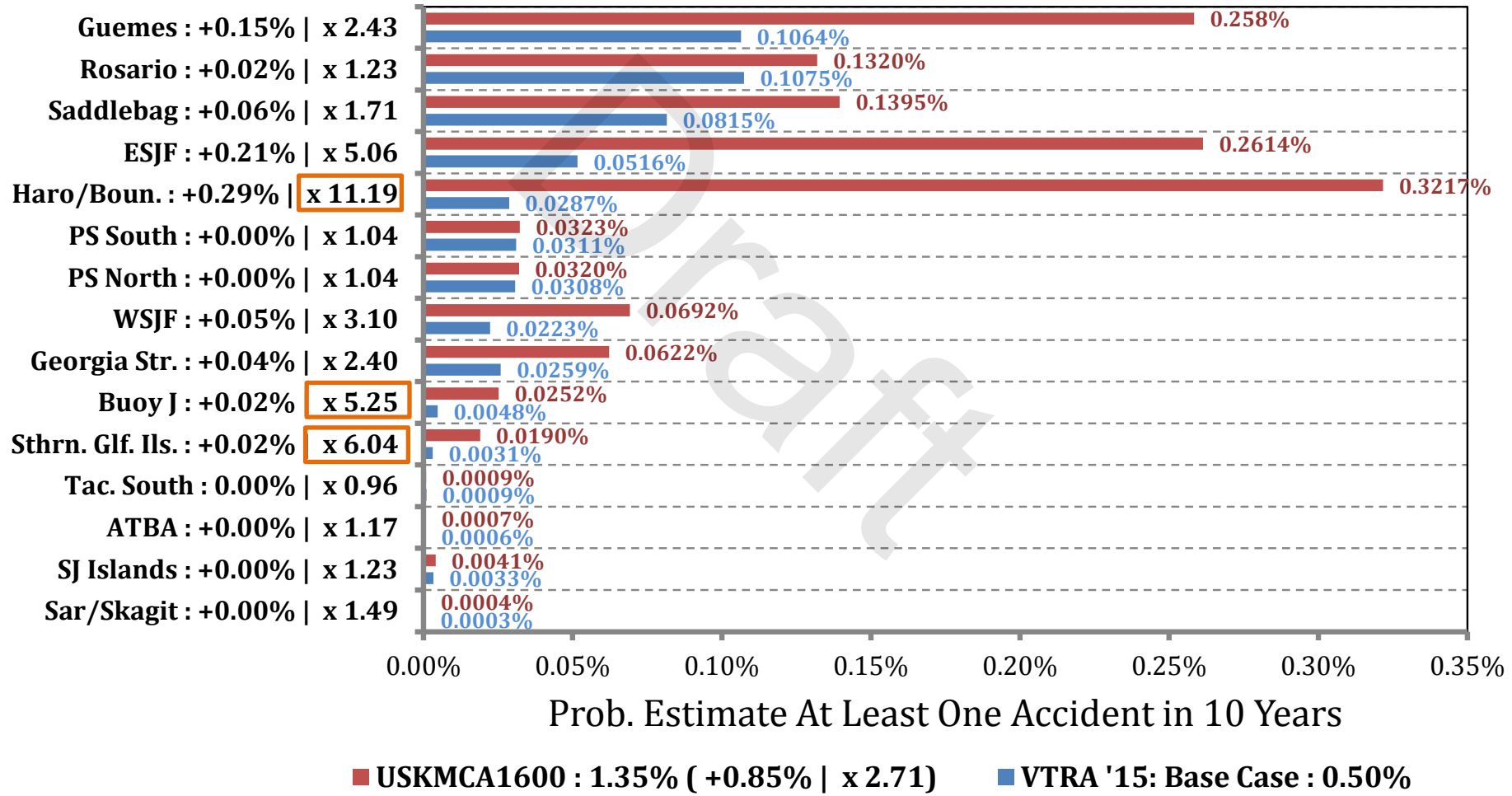
≈ 1.13% Probability  
of Spill Occurrence  
in 10 years

Average of ≈ 5,900 m<sup>3</sup>  
Per Potential Spill  
(≈ 5,074 Metric. Tons)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



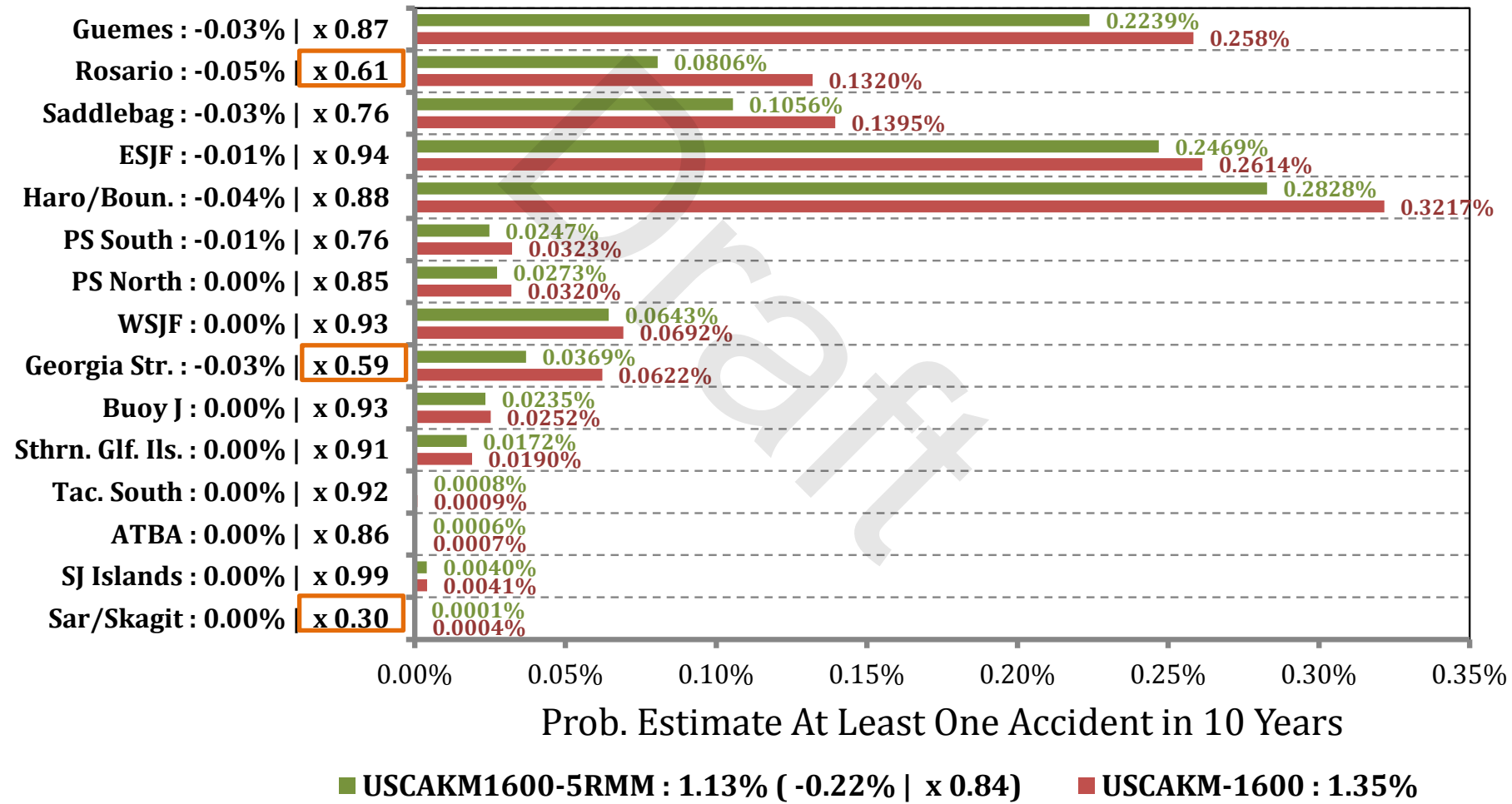
## Prob. Estimate At Least One Accident in 10 Years - ALL\_FV - Oil Spill Size Category: 2500 cubic meters or more



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



## Prob. Estimate At Least One Accident in 10 Years - ALL\_FV - Oil Spill Size Category: 2500 cubic meters or more

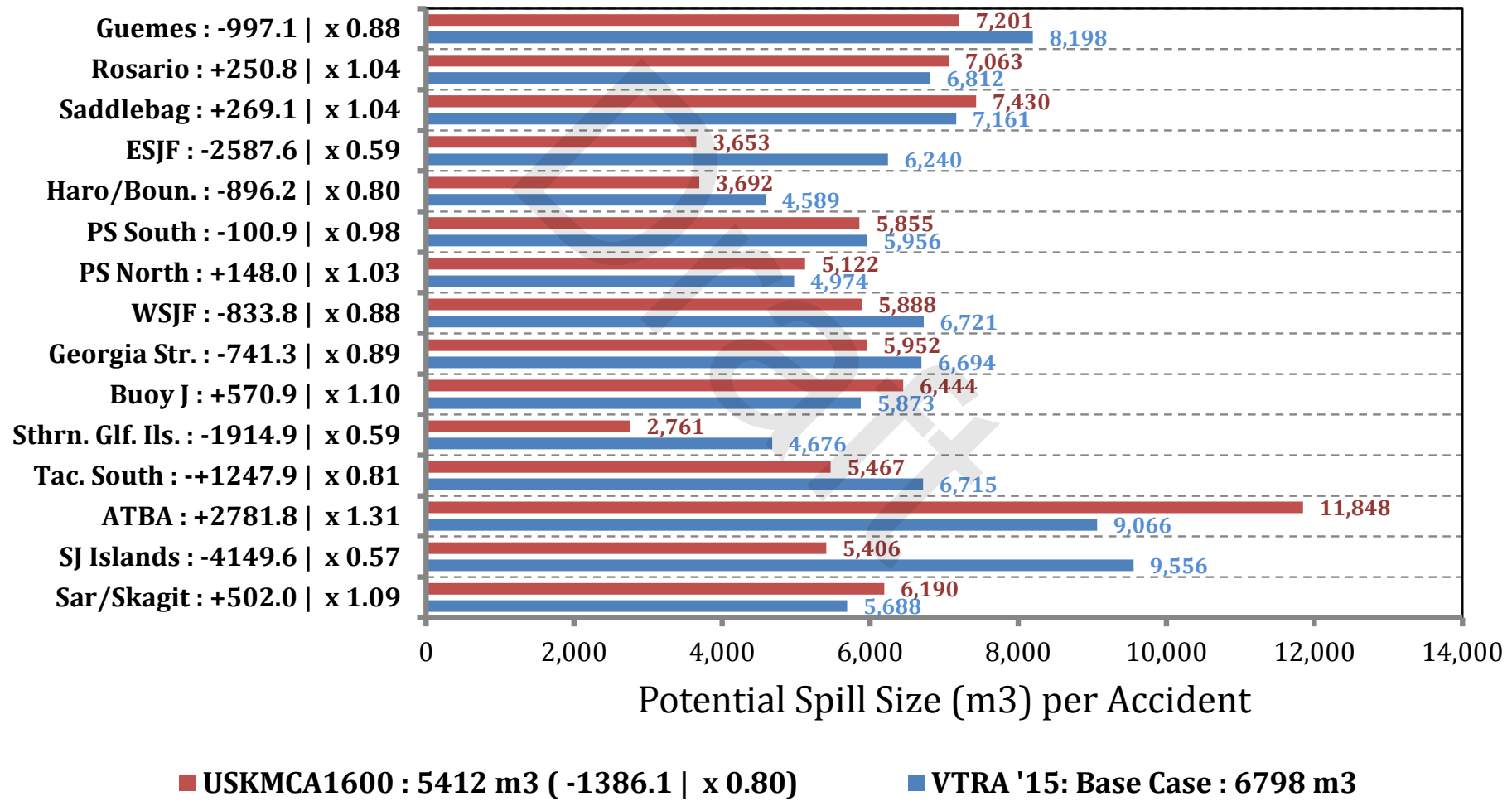




# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

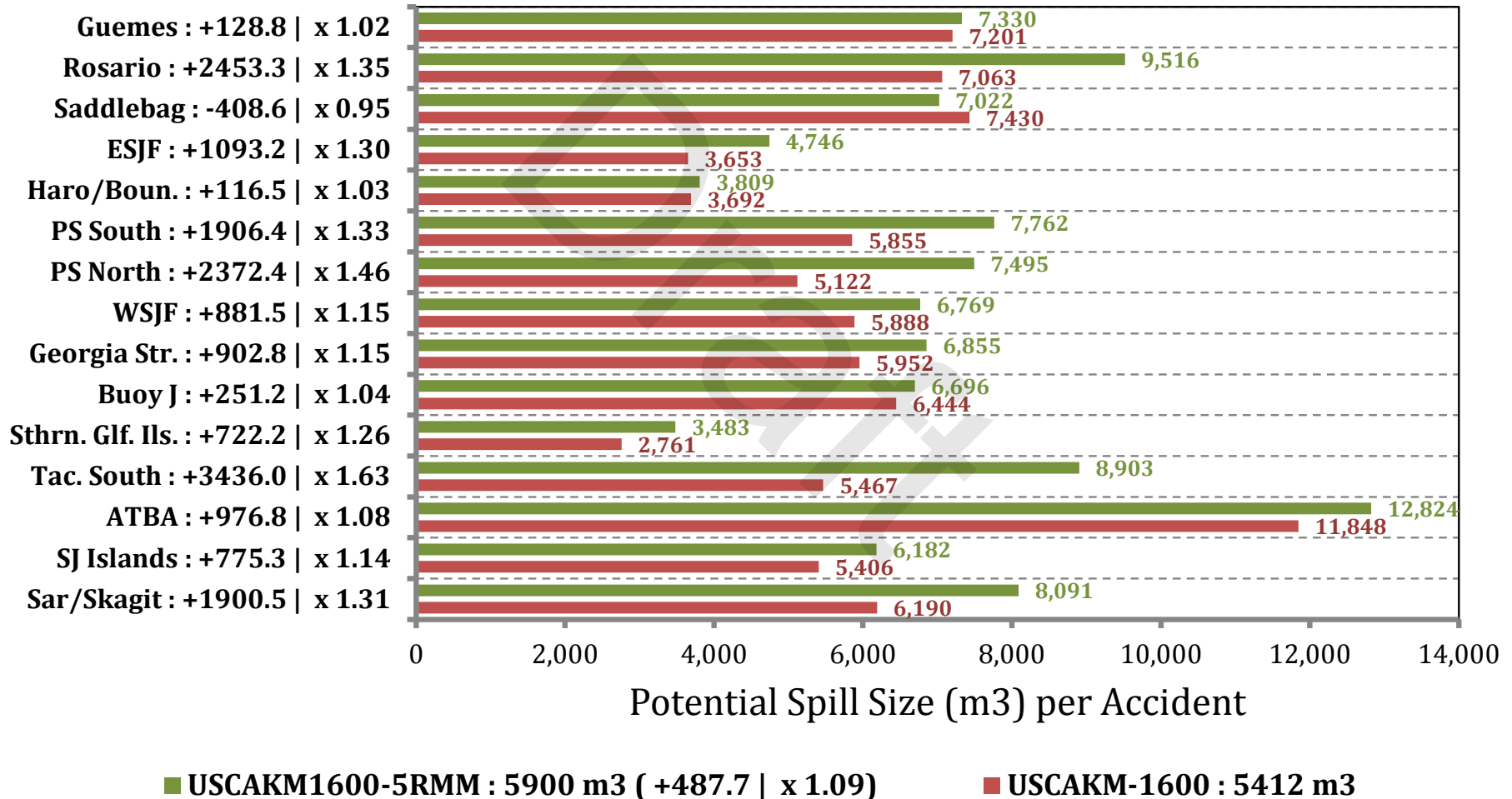


## Potential Spill Size (m3) per Accident - ALL\_FV - Oil Spill Size Category: 2500 cubic meters or more



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## Potential Spill Size (m<sup>3</sup>) per Accident - ALL\_FV - Oil Spill Size Category: 2500 cubic meters or more



# By Waterway Zone Risk Comparison

Oil Spill Size Category:

1000 m<sup>3</sup> - 2500 m<sup>3</sup>

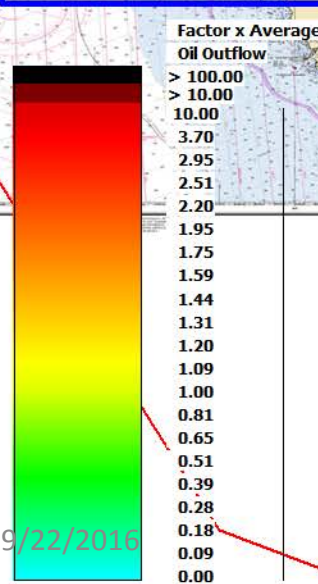
# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 BASE CASE - ALL FV

**12.3%** of VTRA 2015 Base Case Total Annual Potential Oil Loss:  
**SPILL SIZES BETWEEN 1,000 m<sup>3</sup> - 2,500 m<sup>3</sup>**

**0.1%**

**10.7%**  
**9.1%**



**VTRA '15:**  
**BASE CASE**  
GEOGRAPHIC PROFILE OF POTENTIAL ANNUAL OIL LOSS OF ACCIDENTS WITH SPILL SIZE **BETWEEN 1,000 m<sup>3</sup> - 2,500 m<sup>3</sup>**

≈ 0.61% Probability of Spill Occurrence in 10 years

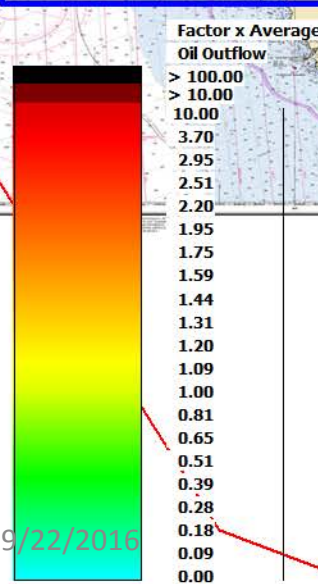
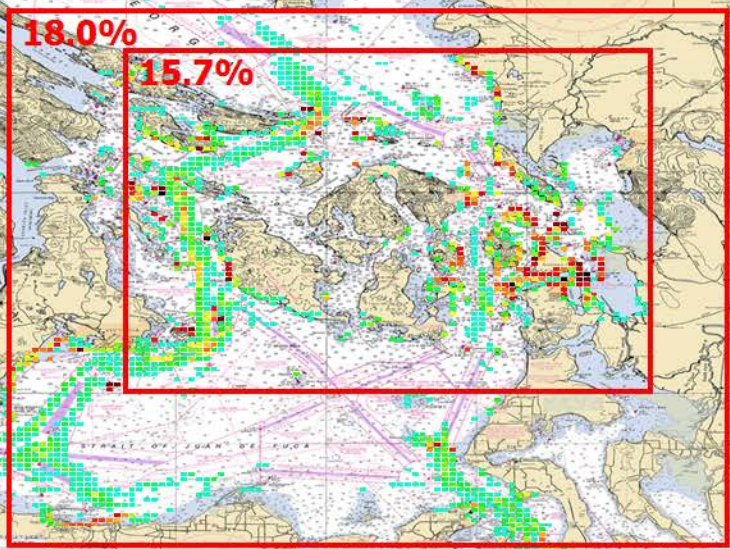
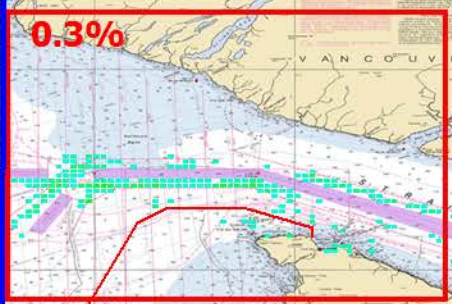
Average of ≈ 1,619 m<sup>3</sup> Per Potential Spill (≈ 1,392 Metric Tons)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



## VTRA 2015 Case: USKMCA1600 - ALL FV

**19.9% of VTRA 2015 Base Case Total Annual Potential Oil Loss:**  
**SPILL SIZES BETWEEN 1,000 m<sup>3</sup> - 2,500 m<sup>3</sup>**



**VTRA '15 Case: USKMCA - 1600**  
**GEOGRAPHIC PROFILE OF POTENTIAL ANNUAL OIL LOSS OF ACCIDENTS WITH SPILL SIZE BETWEEN 1,000 m<sup>3</sup> - 2,500 m<sup>3</sup>**

≈ 0.95% Probability of Spill Occurrence in 10 years

Average of ≈ 1,694 m<sup>3</sup> Per Potential Spill (≈ 1,457 Metric Tons)

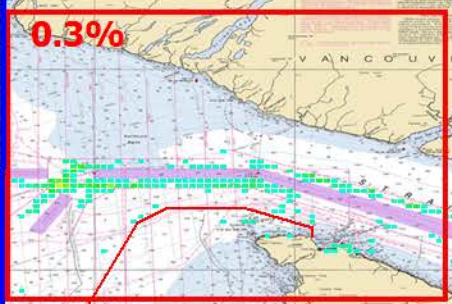
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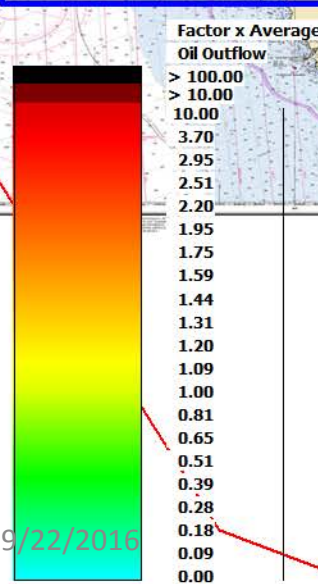
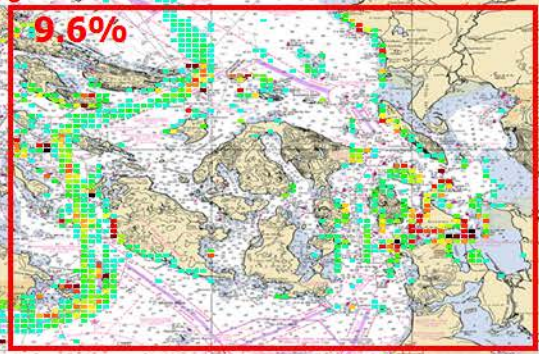
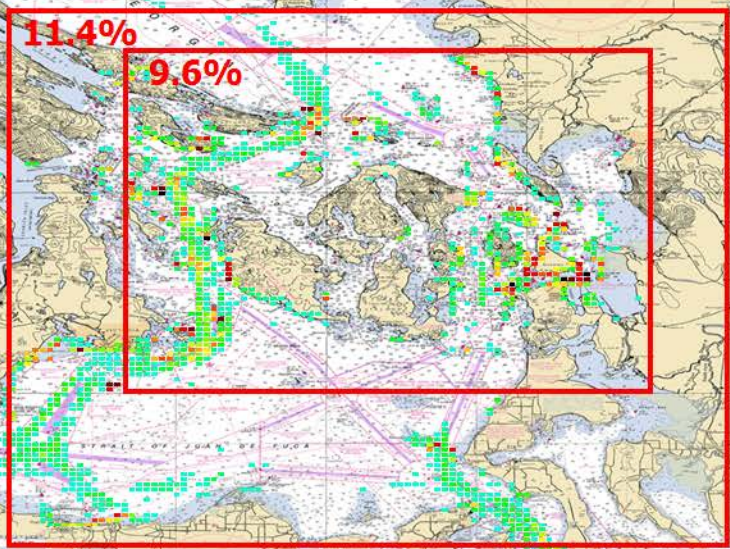
# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 Case: USKMCA1600-5RMM - ALL FV

12.9% of VTRA 2015 Base Case Total Annual Potential Oil Loss:



**Oil Loss:**  
**SPILL SIZES BETWEEN**  
**1,000 m<sup>3</sup> - 2,500 m<sup>3</sup>**



**VTRA '15 Case:**  
**USKMCA1600 - 5RMM**  
GEOGRAPHIC PROFILE  
OF POTENTIAL  
ANNUAL OIL LOSS  
OF ACCIDENTS  
WITH SPILL SIZE **BETWEEN**  
**1,000 m<sup>3</sup> - 2,500 m<sup>3</sup>**

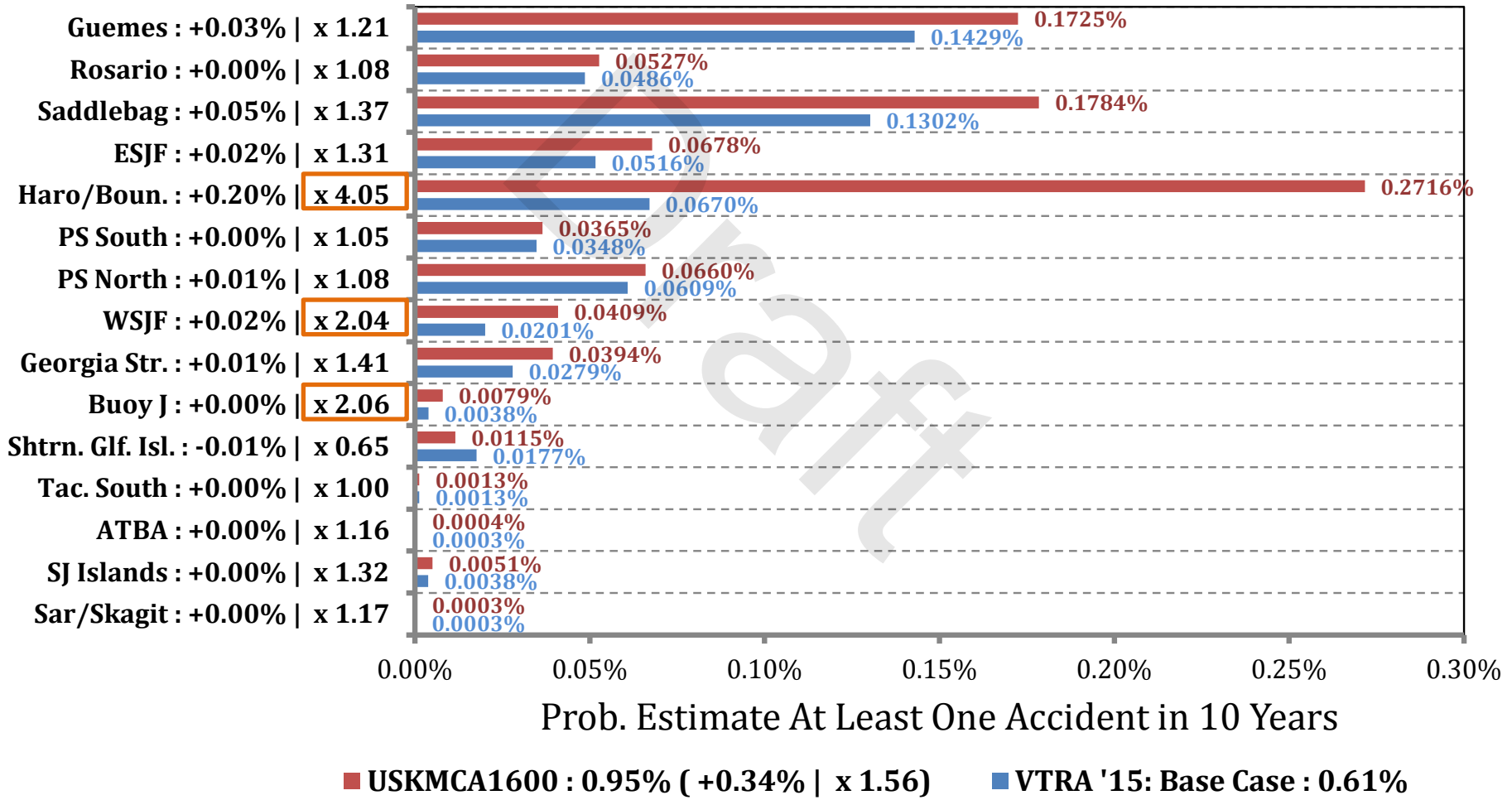
≈ 0.63% Probability  
of Spill Occurrence  
in 10 years

Average of ≈ 1,646 m<sup>3</sup>  
Per Potential Spill  
(≈ 1,416 Metric Tons)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



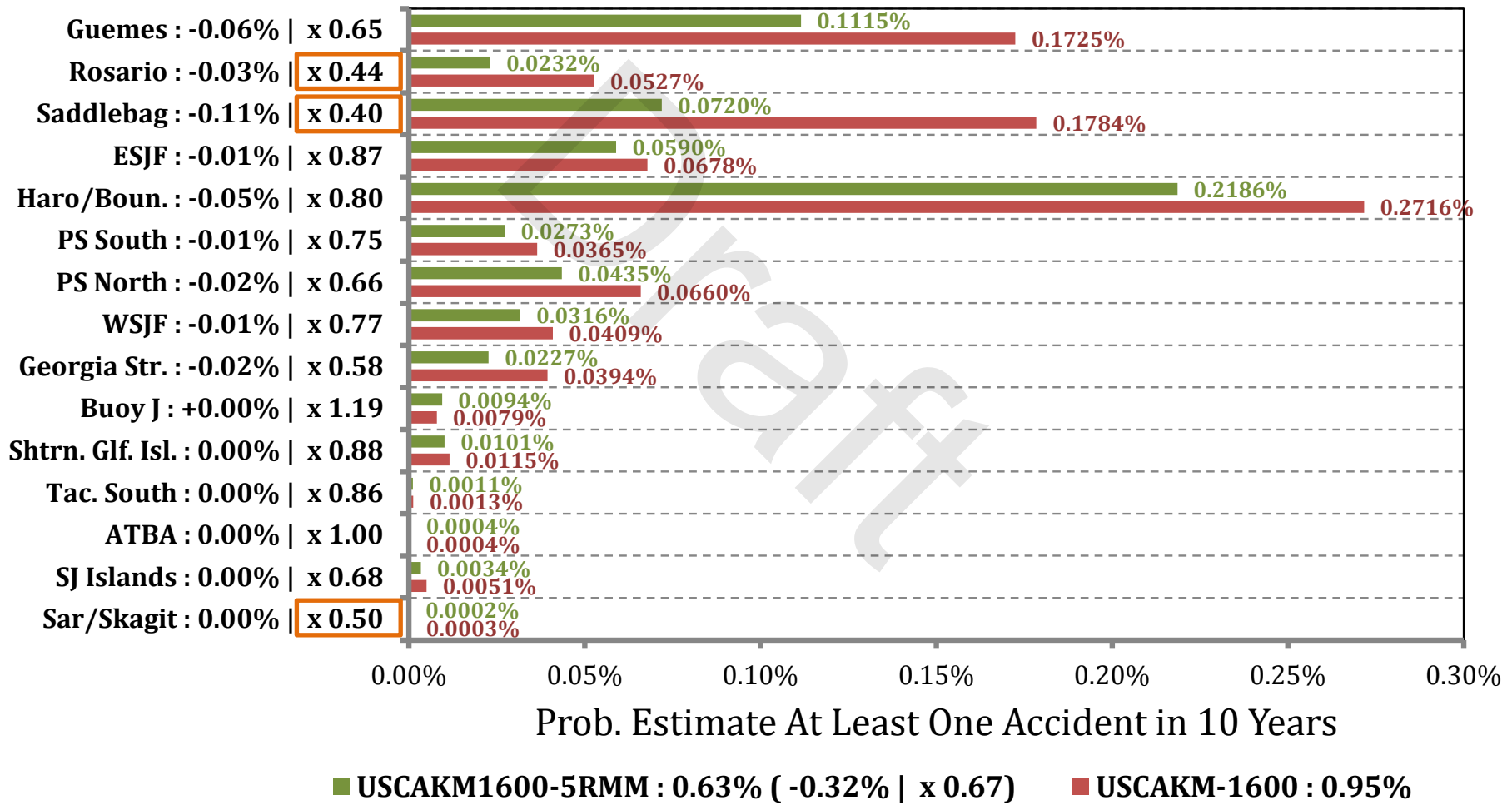
## Prob. Estimate At Least One Accident in 10 Years - ALL\_FV - Oil Spill Size Category: 1000 - 2500 m3



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



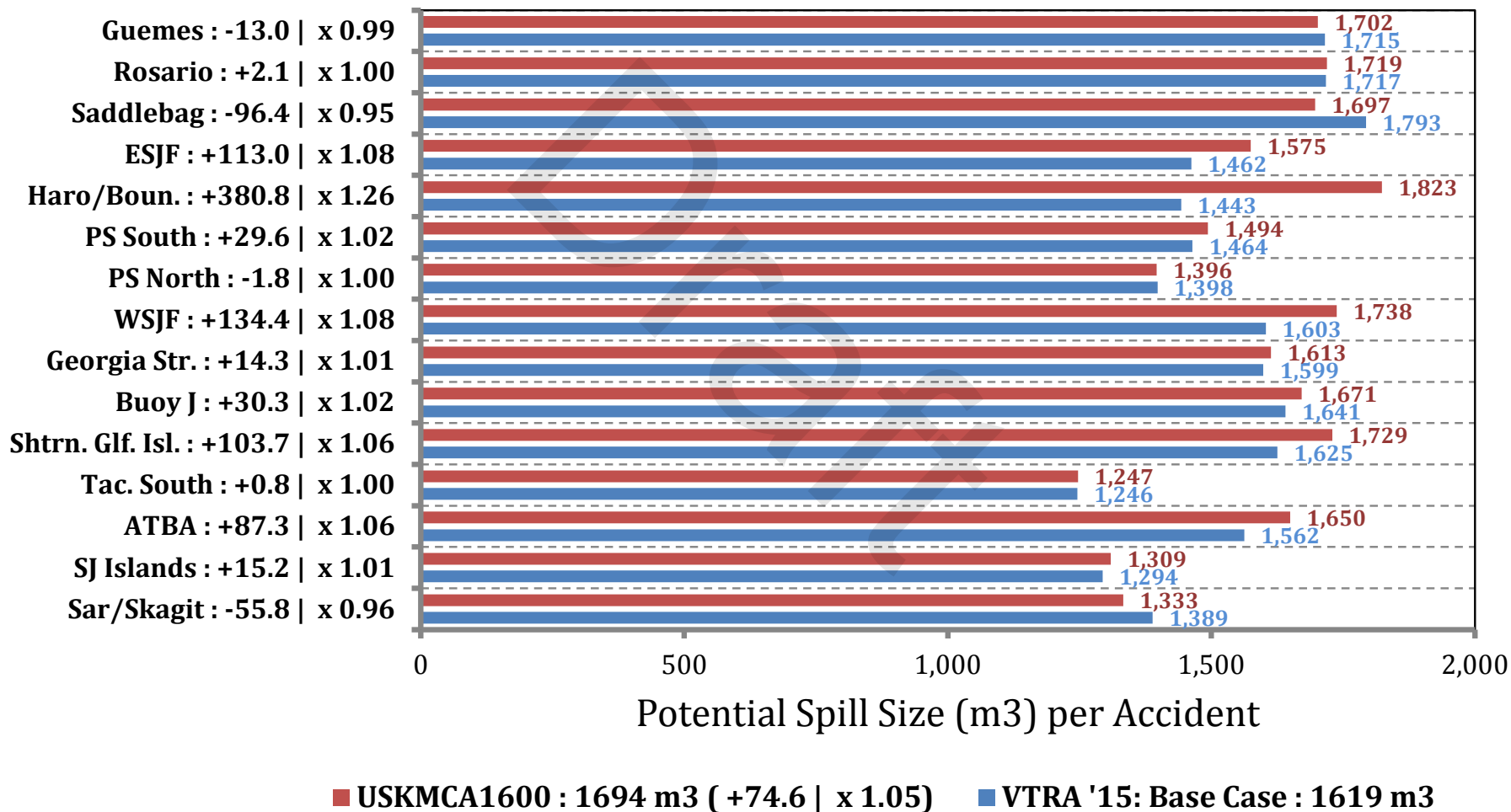
## Prob. Estimate At Least One Accident in 10 Years - ALL\_FV - Oil Spill Size Category: 1000 - 2500 m3





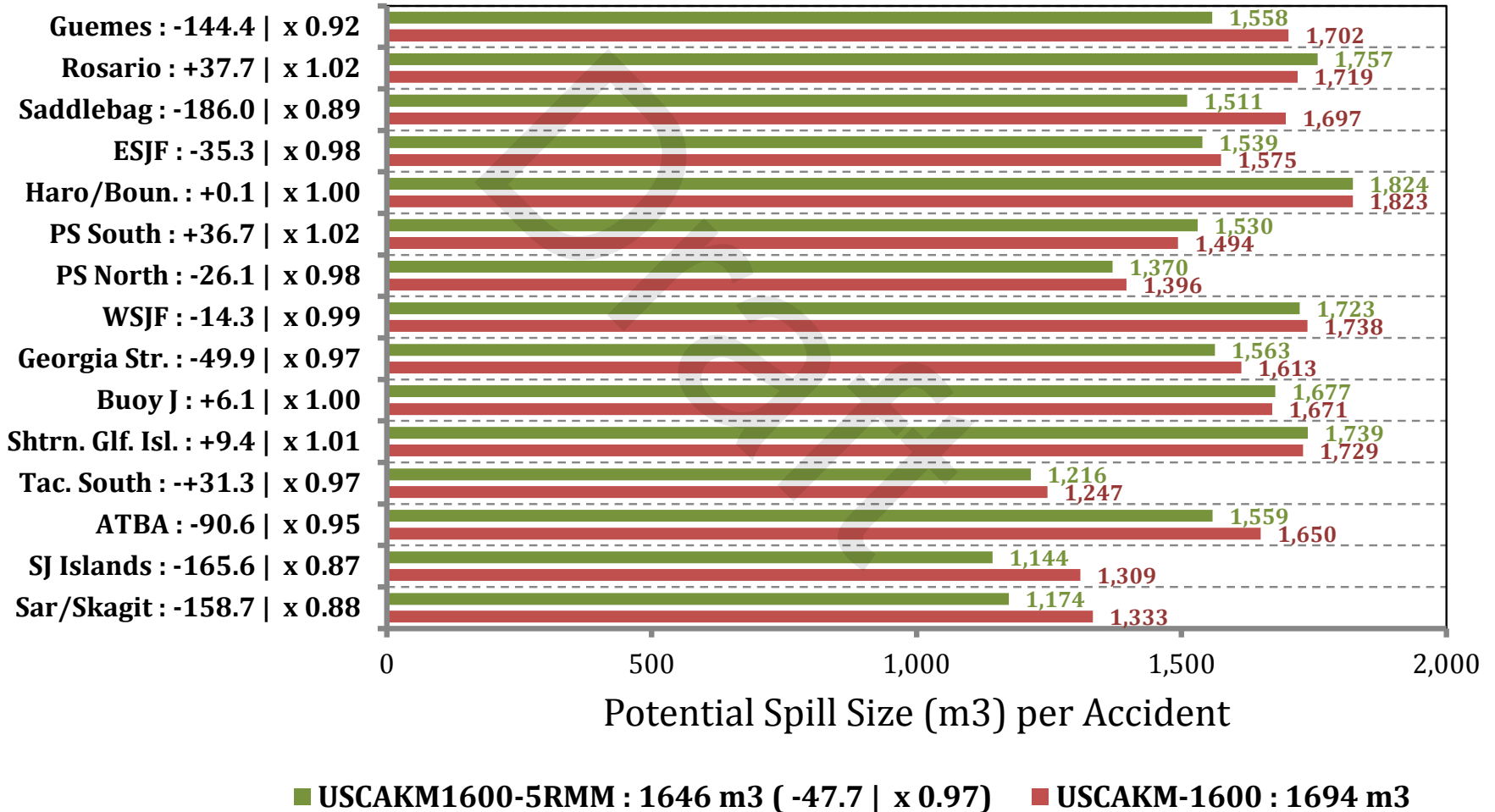
# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## Potential Spill Size (m<sup>3</sup>) per Accident - ALL\_FV - Oil Spill Size Category: 1000 - 2500 m<sup>3</sup>



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## Potential Spill Size (m<sup>3</sup>) per Accident - ALL\_FV - Oil Spill Size Category: 1000 - 2500 m<sup>3</sup>



# By Waterway Zone Risk Comparison

Oil Spill Size Category:

**$1 \text{ m}^3 - 1000 \text{ m}^3$**

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 BASE CASE - ALL FV

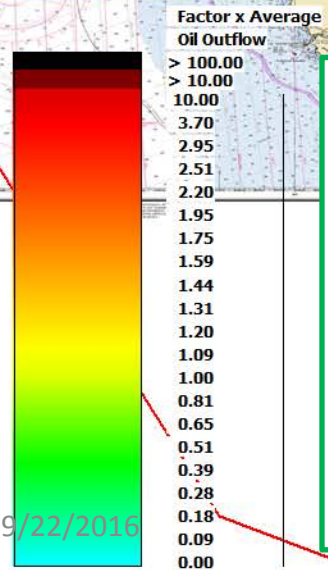
**45.3% of VTRA 2015 Base Case Total Annual Potential Oil Loss:**

**0.4%**

**Oil Loss:  
SPILL SIZES BETWEEN  
1 m<sup>3</sup> - 1,000 m<sup>3</sup>**

**29.8%**

**20.3%**



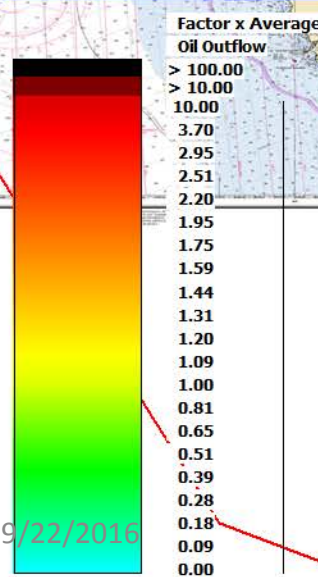
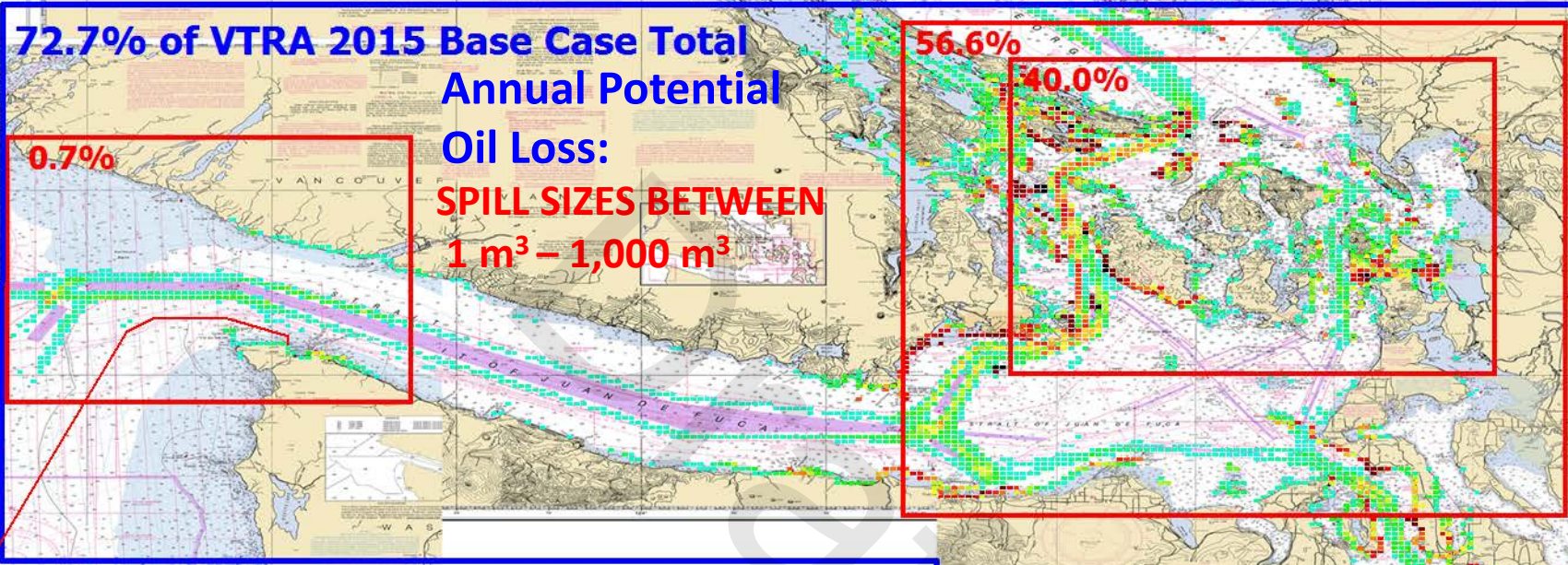
**VTRA '15:  
BASE CASE**  
GEOGRAPHIC PROFILE  
OF ANNUAL  
POTENTIAL OIL LOSS  
OF ACCIDENTS  
WITH SPILL SIZE  
**BETWEEN 1 m<sup>3</sup> - 1000 m<sup>3</sup>**

≈ 54.2% Probability  
of Spill Occurrence  
in 10 years

Average of ≈ 47 m<sup>3</sup>  
Per Potential Spill  
(≈ 295 Barrels)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 Case: USKMCA1600 - ALL FV



**VTRA '15 Case: USKMCA - 1600**

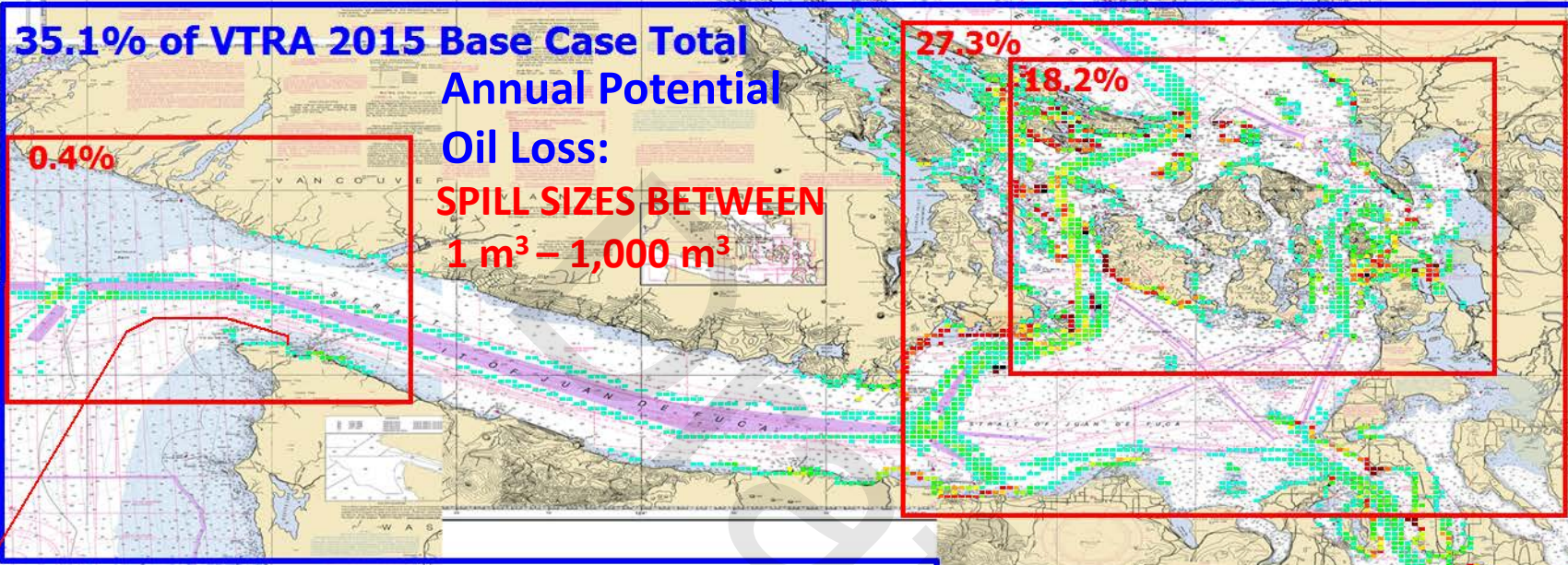
GEOGRAPHIC PROFILE OF ANNUAL POTENTIAL OIL LOSS OF ACCIDENTS WITH SPILL SIZE BETWEEN 1 m<sup>3</sup> - 1000 m<sup>3</sup>

≈ 57.2% Probability of Spill Occurrence in 10 years

Average of ≈ 69 m<sup>3</sup> Per Potential Spill (≈ 436 Barrels)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 Case: USKMCA1600-5RMM - ALL FV



**VTRA '15 Case:**  
**USKMCA1600 - 5RMM**  
GEOGRAPHIC PROFILE  
OF ANNUAL  
POTENTIAL OIL LOSS  
OF ACCIDENTS  
WITH SPILL SIZE  
**BETWEEN 1 m<sup>3</sup> - 1000 m<sup>3</sup>**

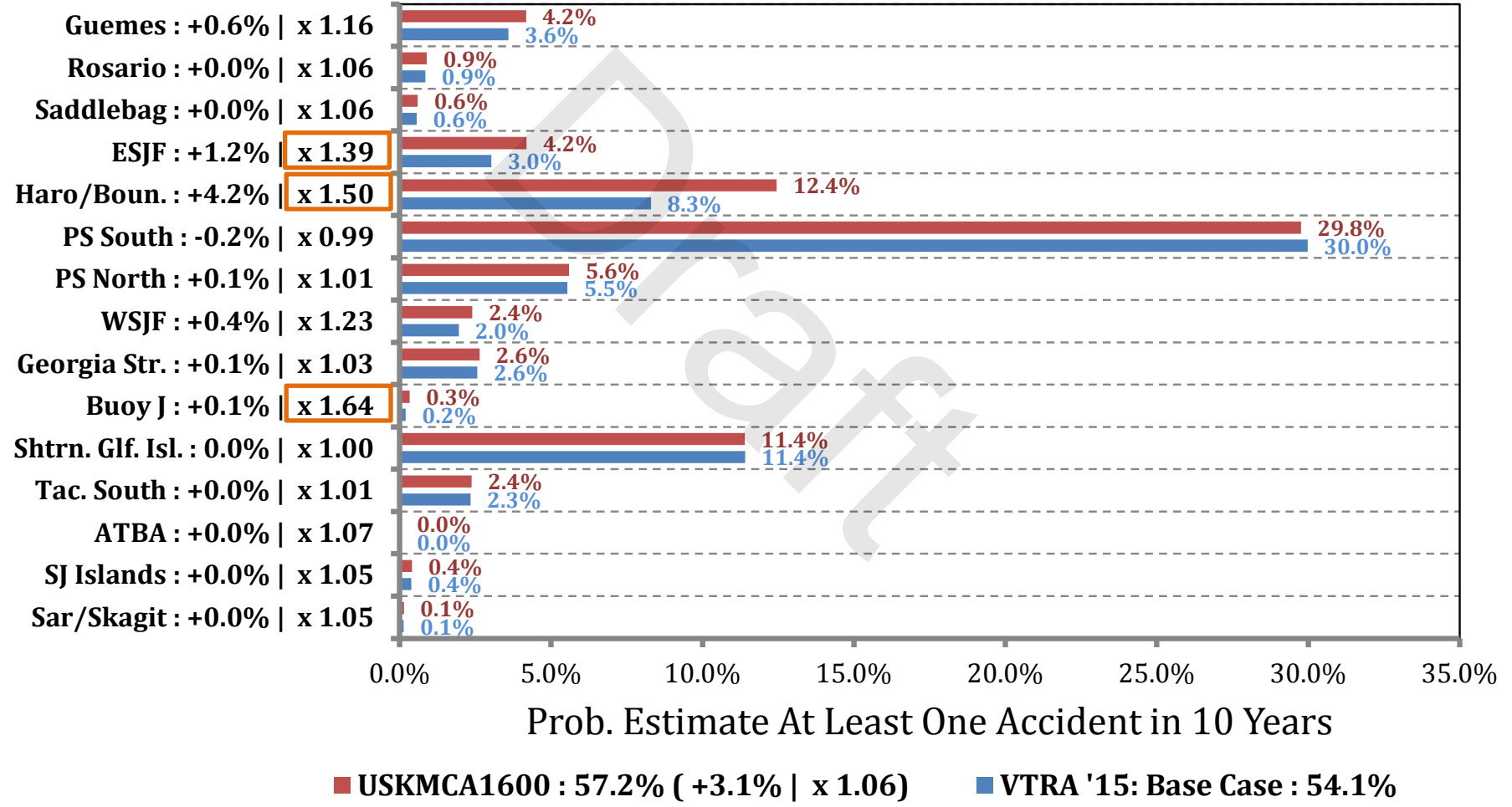
≈ 46.5% Probability  
of Spill Occurrence  
in 10 years

Average of ≈ 45 m<sup>3</sup>  
Per Potential Spill  
(≈ 283 Barrels)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



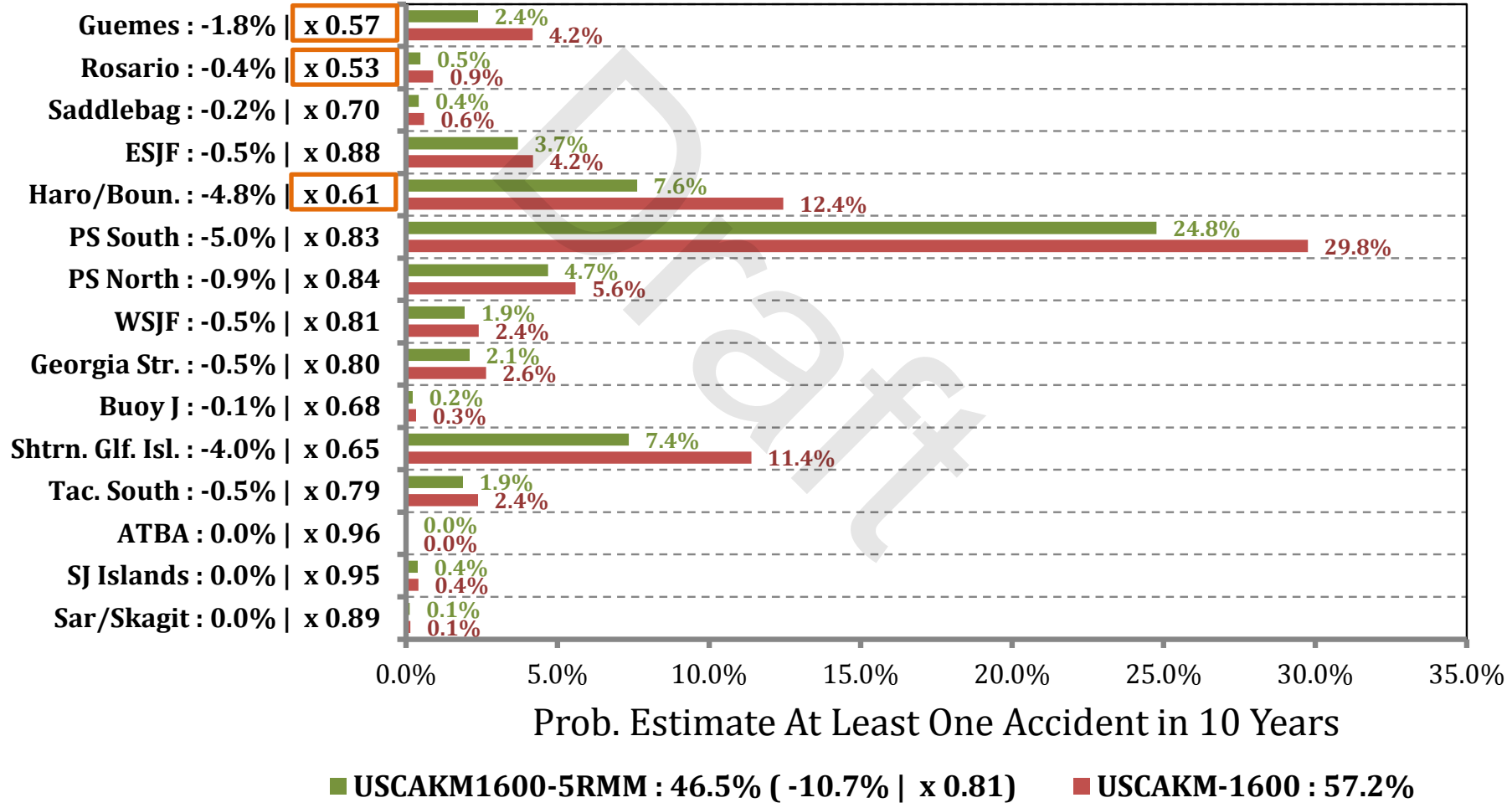
## Prob. Estimate At Least One Accident in 10 Years - ALL\_FV - Oil Spill Size Category: 1 - 1000 m3



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



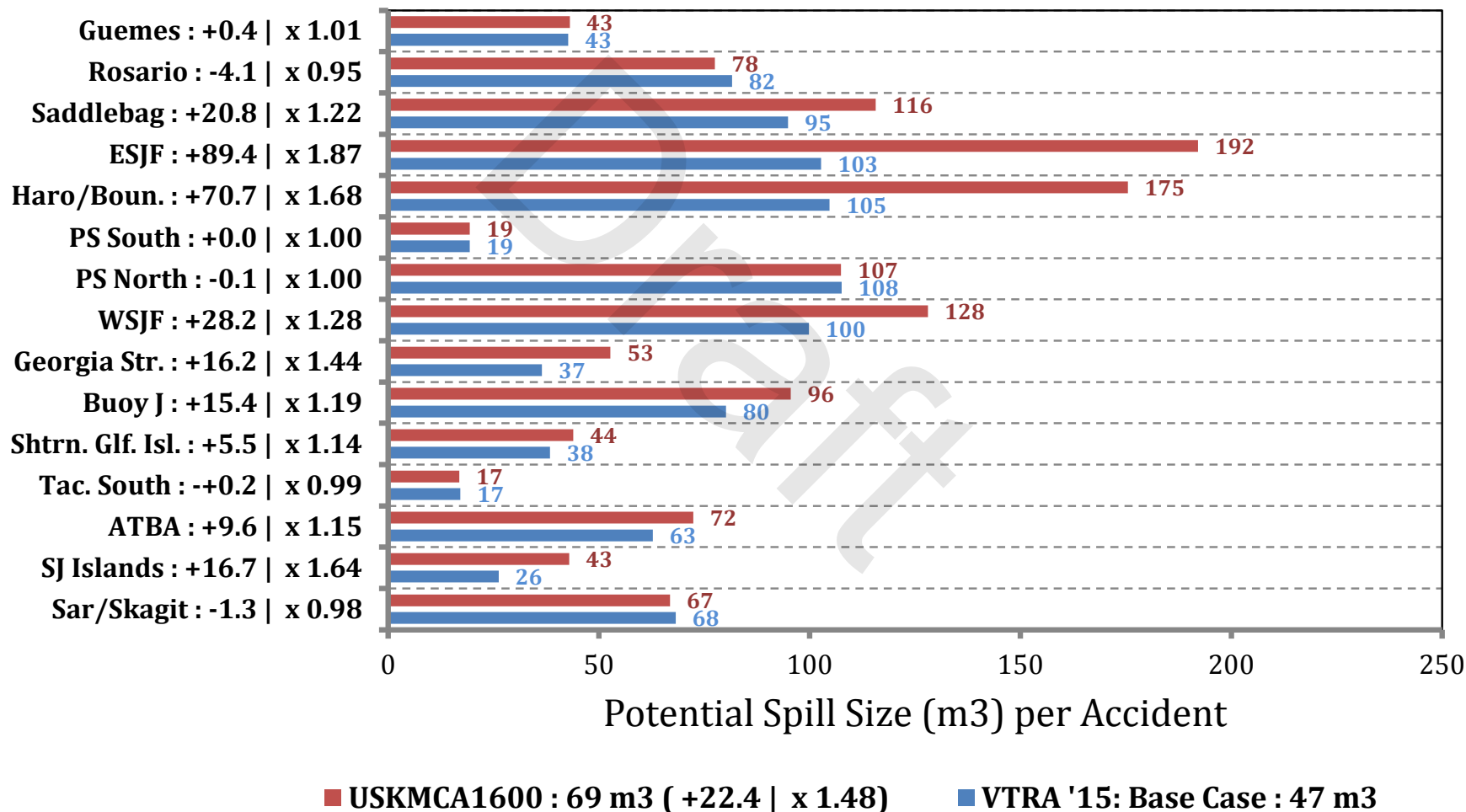
## Prob. Estimate At Least One Accident in 10 Years - ALL\_FV - Oil Spill Size Category: 1 - 1000 m3





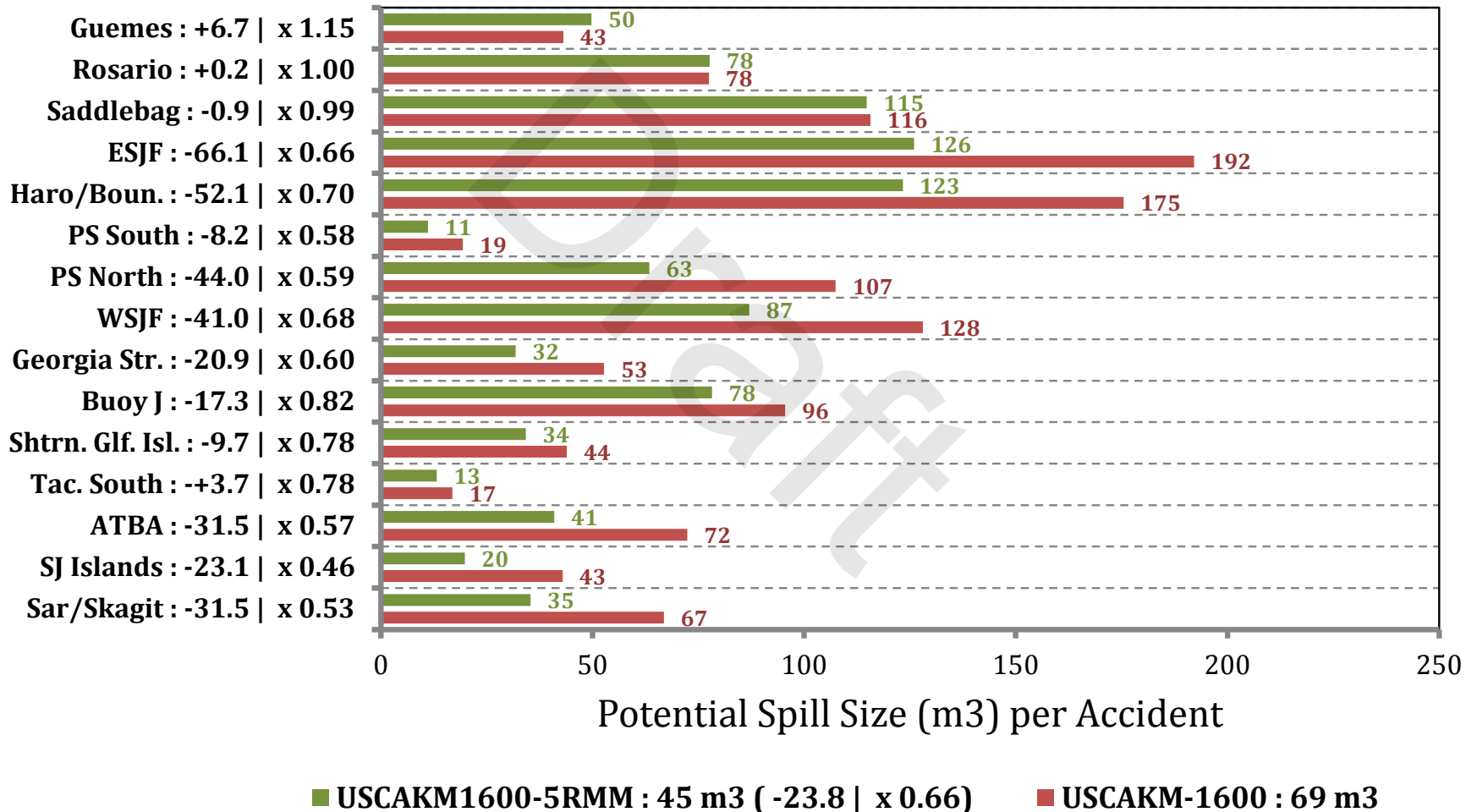
# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## Potential Spill Size (m<sup>3</sup>) per Accident - ALL\_FV - Oil Spill Size Category: 1 - 1000 m<sup>3</sup>



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## Potential Spill Size (m<sup>3</sup>) per Accident - ALL\_FV - Oil Spill Size Category: 1 - 1000 m<sup>3</sup>



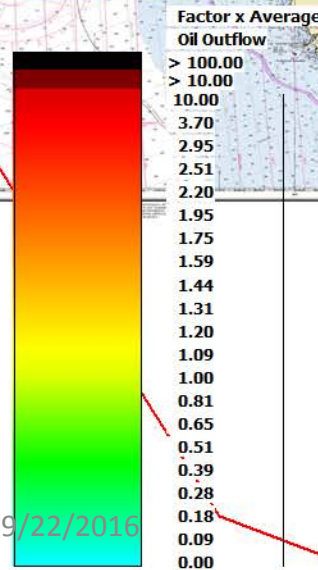
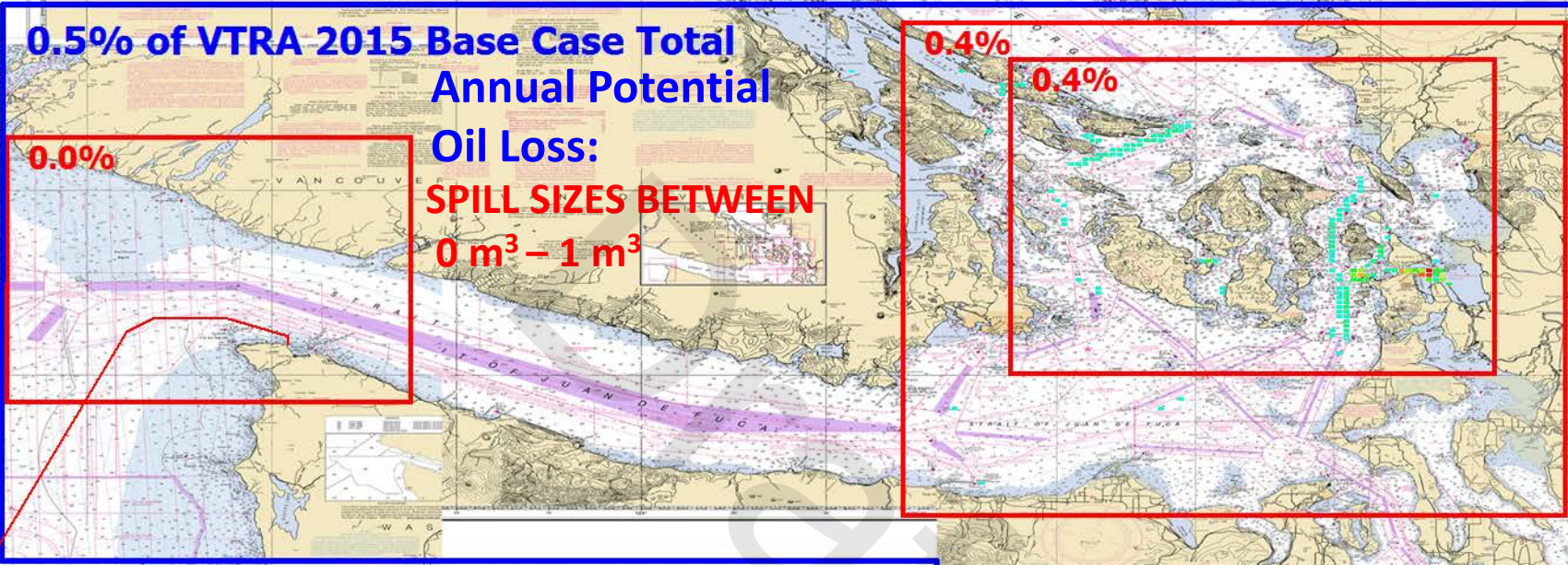
# By Waterway Zone Risk Comparison

Oil Spill Size Category:

$0 \text{ m}^3 - 1 \text{ m}^3$

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 BASE CASE - ALL FV



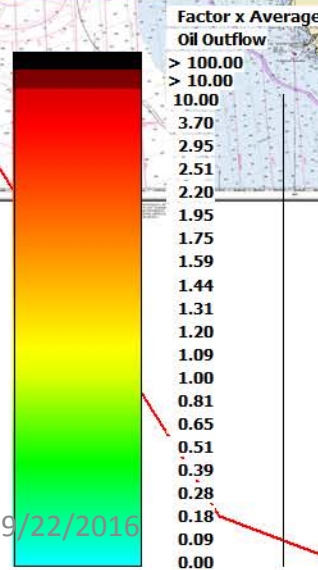
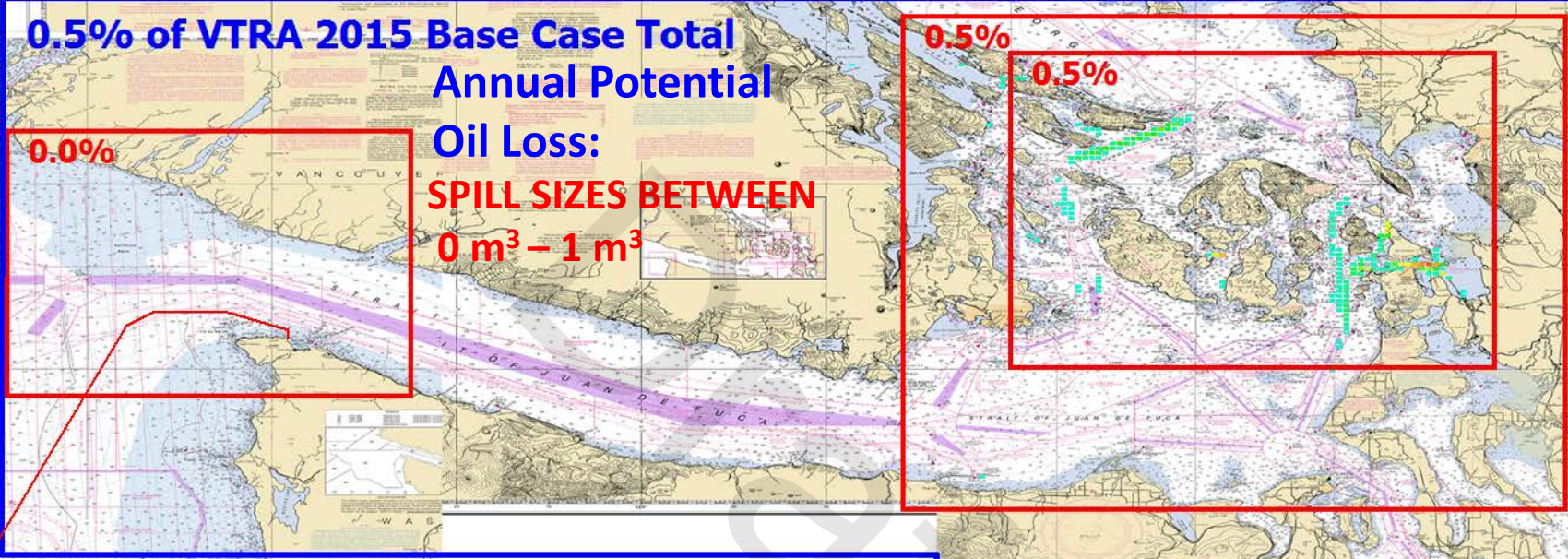
**VTRA '15:**  
**BASE CASE**  
GEOGRAPHIC PROFILE  
OF ANNUAL  
POTENTIAL OIL LOSS  
OF ACCIDENTS  
WITH SPILL SIZE  
**BETWEEN  $0\text{ m}^3 - 1\text{ m}^3$**

≈ 100% Probability  
of Spill Occurrence  
in 10 years

Average of ≈  $0.01\text{ m}^3$   
Per Potential Spill  
(≈ 2.3 gallons)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 Case: USKMCA1600 - ALL FV



**VTRA '15 Case:**  
**USKMCA1600**  
GEOGRAPHIC PROFILE  
OF ANNUAL  
POTENTIAL OIL LOSS  
OF ACCIDENTS  
WITH SPILL SIZE  
**BETWEEN 0 m<sup>3</sup> - 1 m<sup>3</sup>**

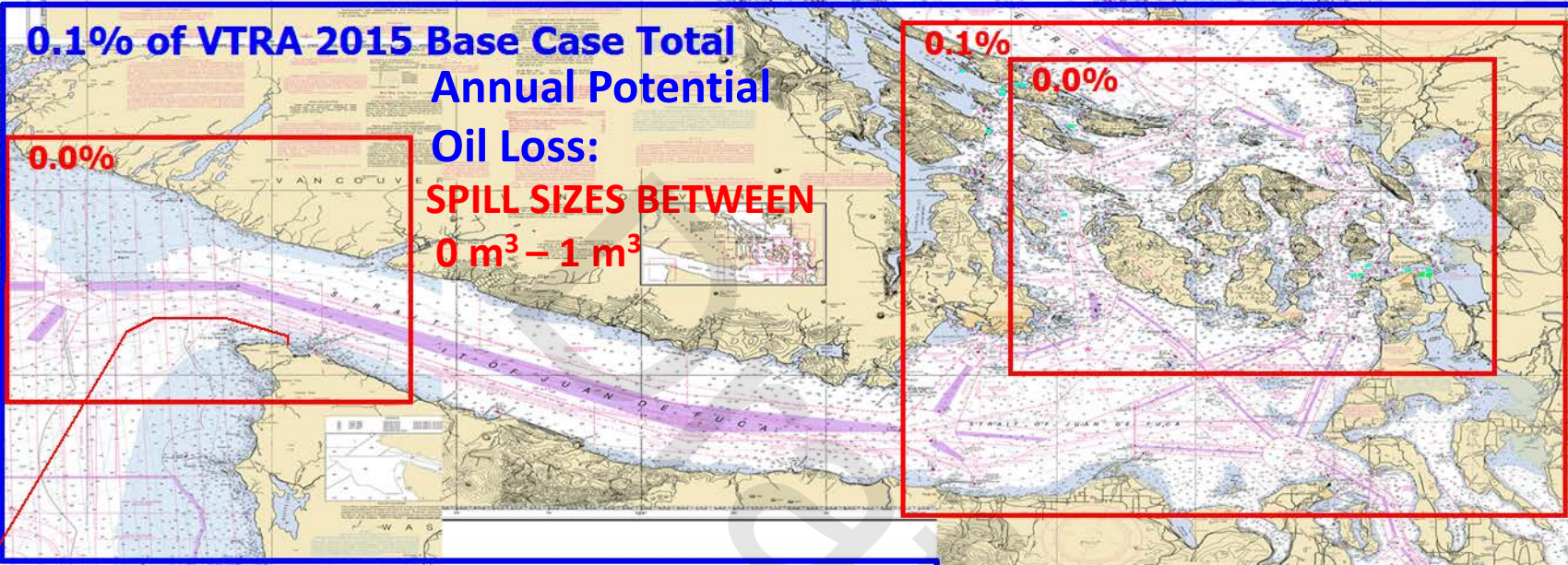
≈ 100% Probability  
of Spill Occurrence  
in 10 years

Average of ≈ 0.01 m<sup>3</sup>  
Per Potential Spill  
( ≈ 2.4 gallons)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

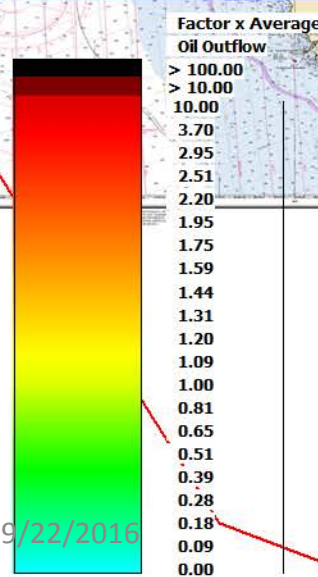


## VTRA 2015 Case: USKMCA1600-5RMM - ALL FV



**0.1% of VTRA 2015 Base Case Total Annual Potential Oil Loss:**  
**SPILL SIZES BETWEEN**  
**0 m<sup>3</sup> - 1 m<sup>3</sup>**

**0.1%**  
**0.0%**



**VTRA '15 Case:**  
**USKMCA1600 - 5RMM**  
GEOGRAPHIC PROFILE  
OF ANNUAL  
POTENTIAL OIL LOSS  
OF ACCIDENTS  
WITH SPILL SIZE  
**BETWEEN 0 m<sup>3</sup> - 1 m<sup>3</sup>**

≈ 100% Probability  
of Spill Occurrence  
in 10 years

Average of ≈ 0.01 m<sup>3</sup>  
Per Potential Spill  
(≈ 2.3 gallons)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

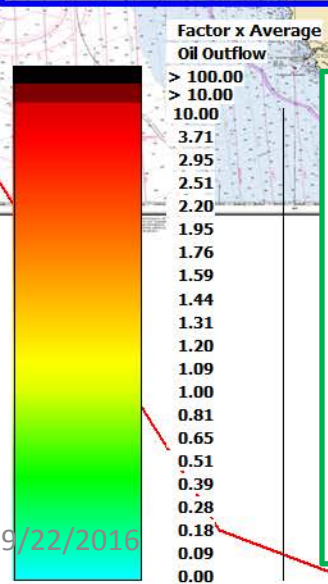
## VTRA 2015 BASE CASE - ALL FV

**98.2% of VTRA 2015 Base Case Total Potential Annual # Accidents:**

**0.8%**

**# Accidents:  
SPILL SIZES BETWEEN  
 $0\text{ m}^3 - 1\text{ m}^3$**

**39.2%**  
**29.5%**



**VTRA '15 Case:  
BASE CASE  
GEOGRAPHIC PROFILE  
OF POTENTIAL ANNUAL  
# ACCIDENTS  
WITH SPILL SIZE  
BETWEEN  $0\text{ m}^3 - 1\text{ m}^3$**

≈ 100% Probability  
of Spill Occurrence  
in 10 years

Average of ≈  $0.01\text{ m}^3$   
Per Potential Spill  
(≈ 2.3 gallons)

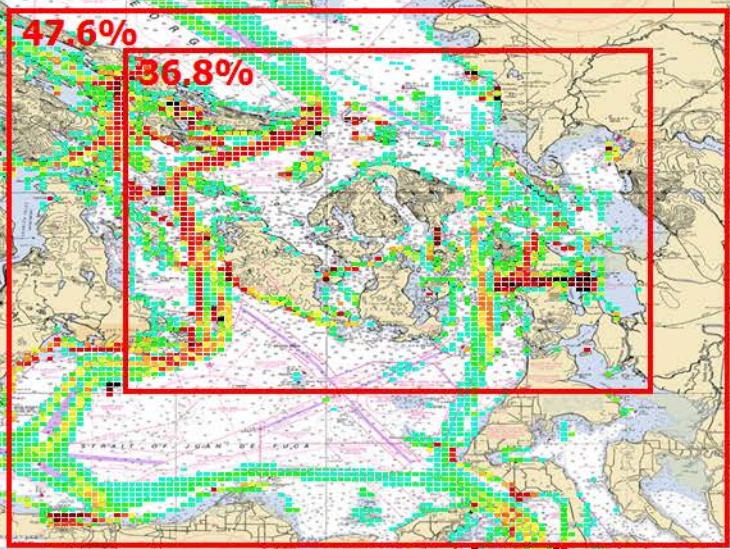
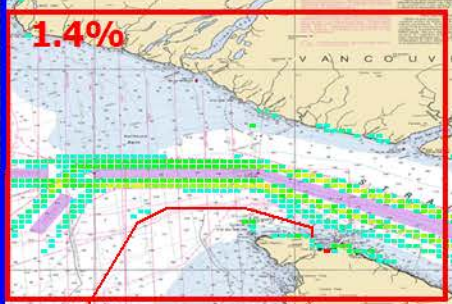
# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



## VTRA 2015 Case: USKMCA1600 - ALL FV

109.0% of VTRA 2015 Base Case Total Potential Annual # Accidents:

SPILL SIZES BETWEEN  $0 \text{ m}^3 - 1 \text{ m}^3$



VTRA '15 Case: USKMCA1600  
GEOGRAPHIC PROFILE OF POTENTIAL ANNUAL # ACCIDENTS WITH SPILL SIZE BETWEEN  $0 \text{ m}^3 - 1 \text{ m}^3$

≈ 100% Probability of Spill Occurrence in 10 years

Average of ≈  $0.01 \text{ m}^3$  Per Potential Spill (= 2.4 gallons)

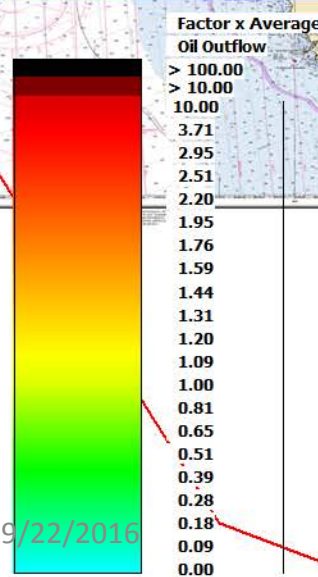
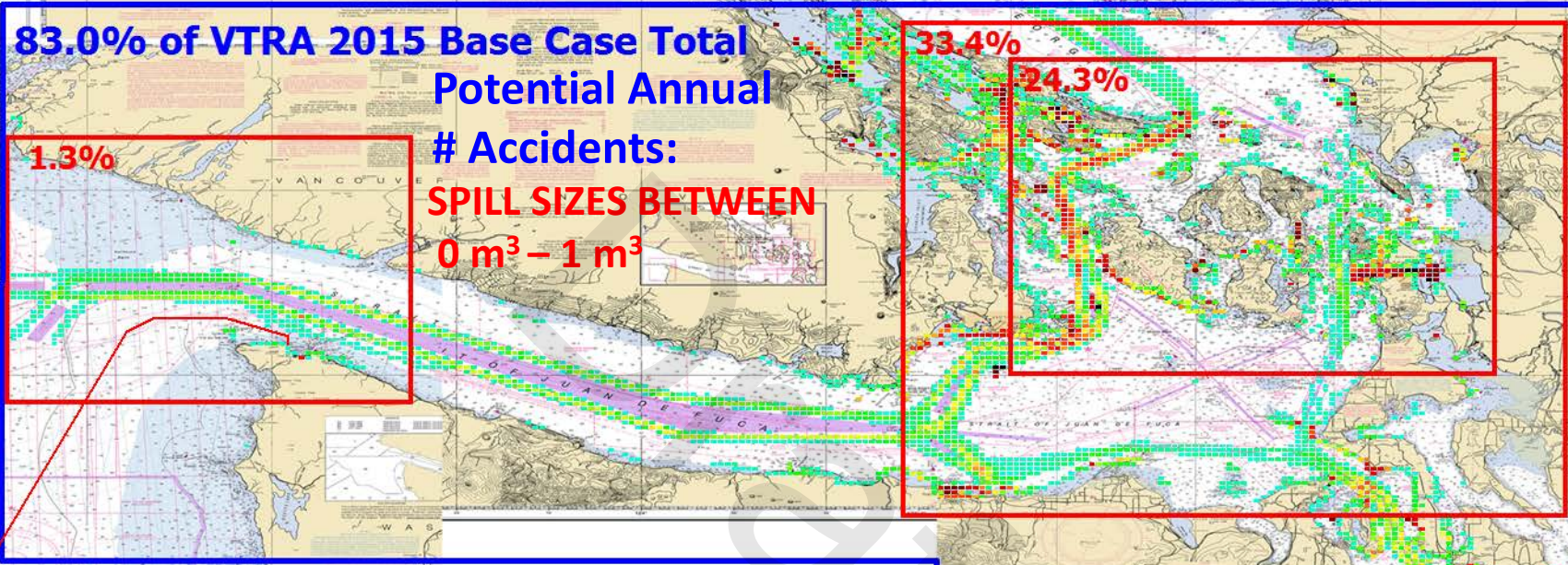
9/22/2016

9/17/2016



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## VTRA 2015 Case: USKMCA1600-5RMM - ALL FV



**VTRA '15 Case:**  
**USKMCA1600 - 5RMM**  
GEOGRAPHIC PROFILE  
OF POTENTIAL ANNUAL  
# ACCIDENTS  
WITH SPILL SIZE  
**BETWEEN 0 m<sup>3</sup> - 1 m<sup>3</sup>**

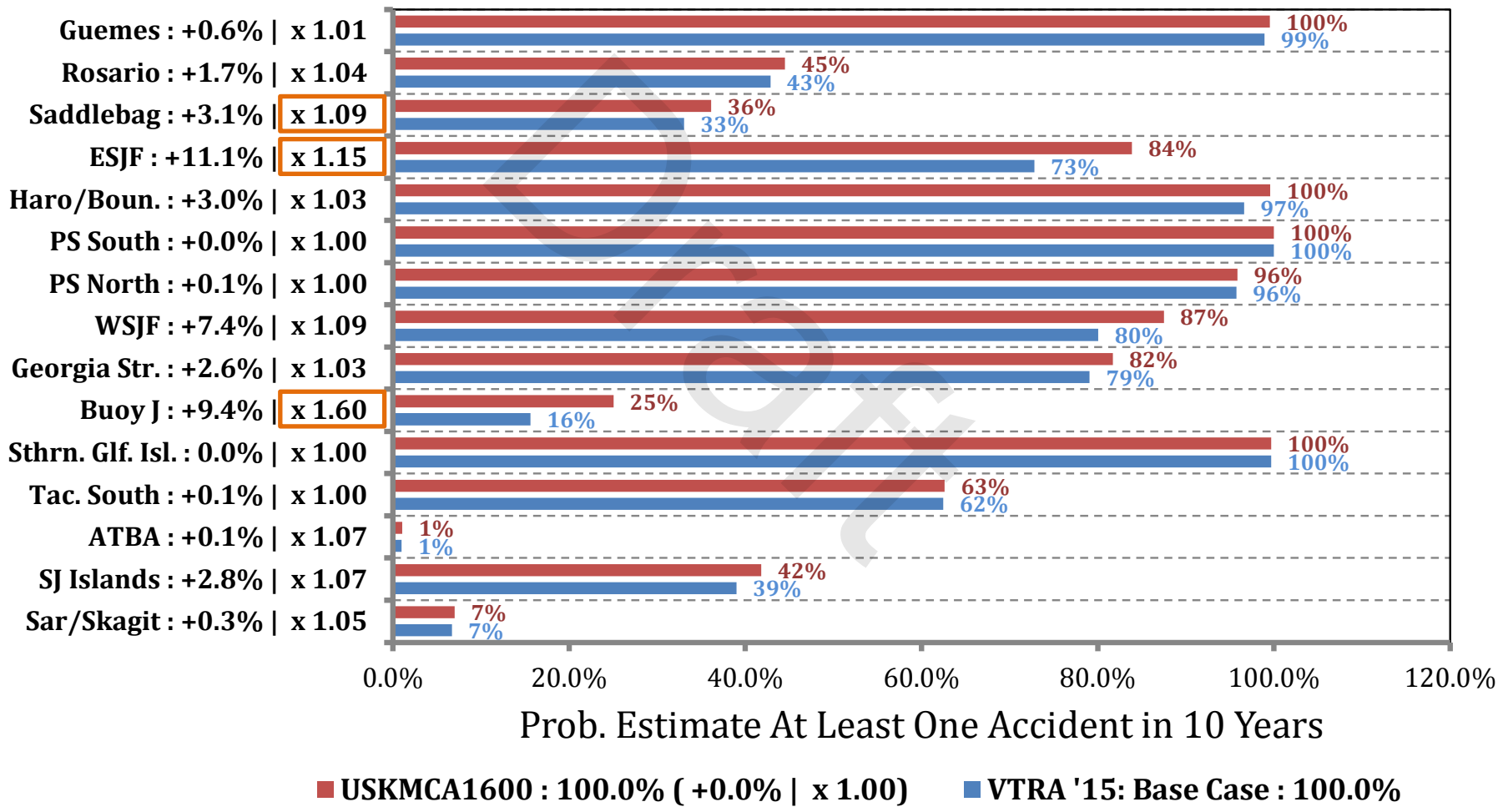
≈ 100% Probability  
of Spill Occurrence  
in 10 years

Average of ≈ 0.003 m<sup>3</sup>  
Per Potential Spill  
(≈ 0.7 gallons)

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



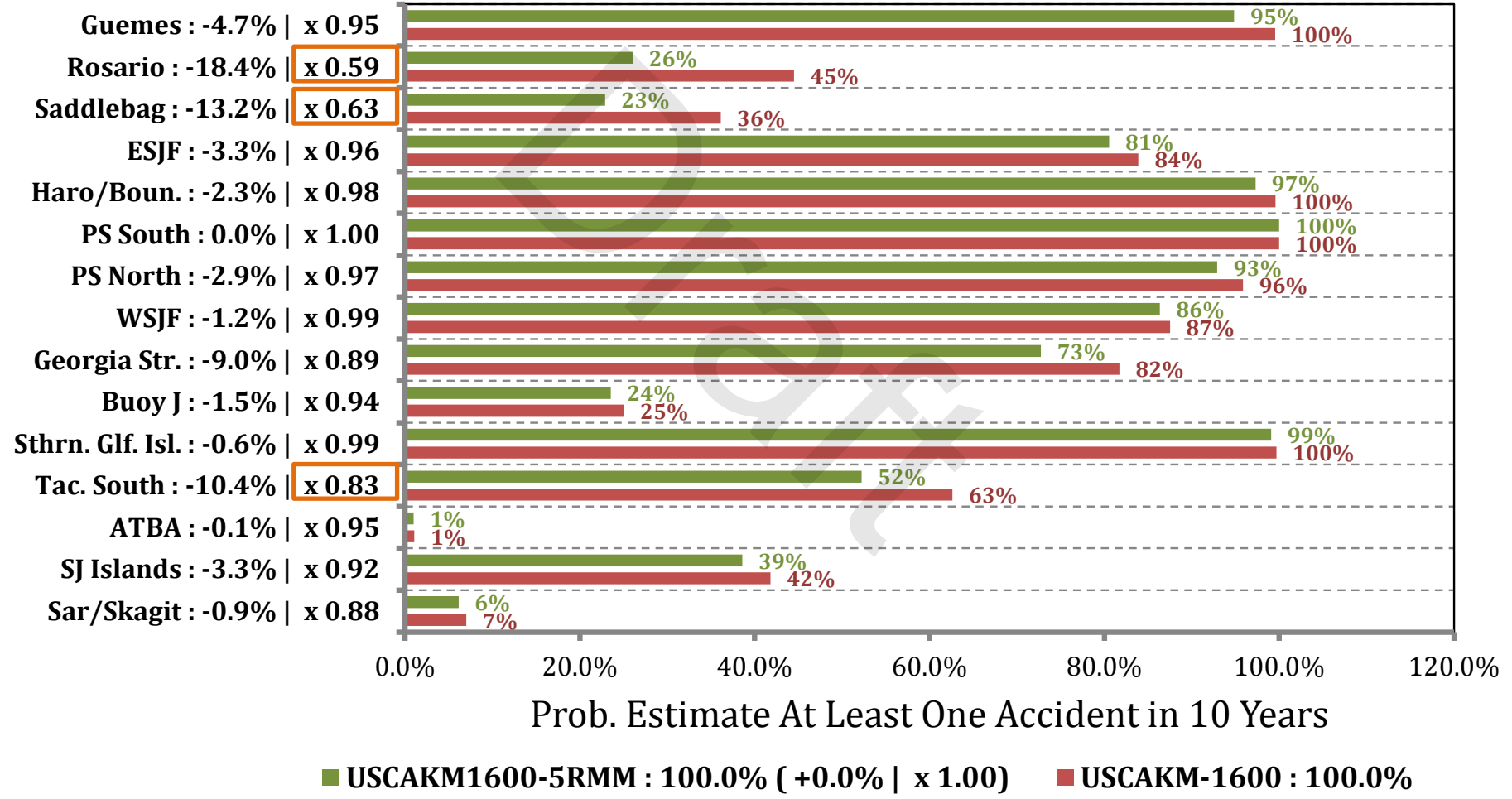
## Prob. Estimate At Least One Accident in 10 Years - ALL\_FV - Oil Spill Size Category: 0 - 264 Gallons



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

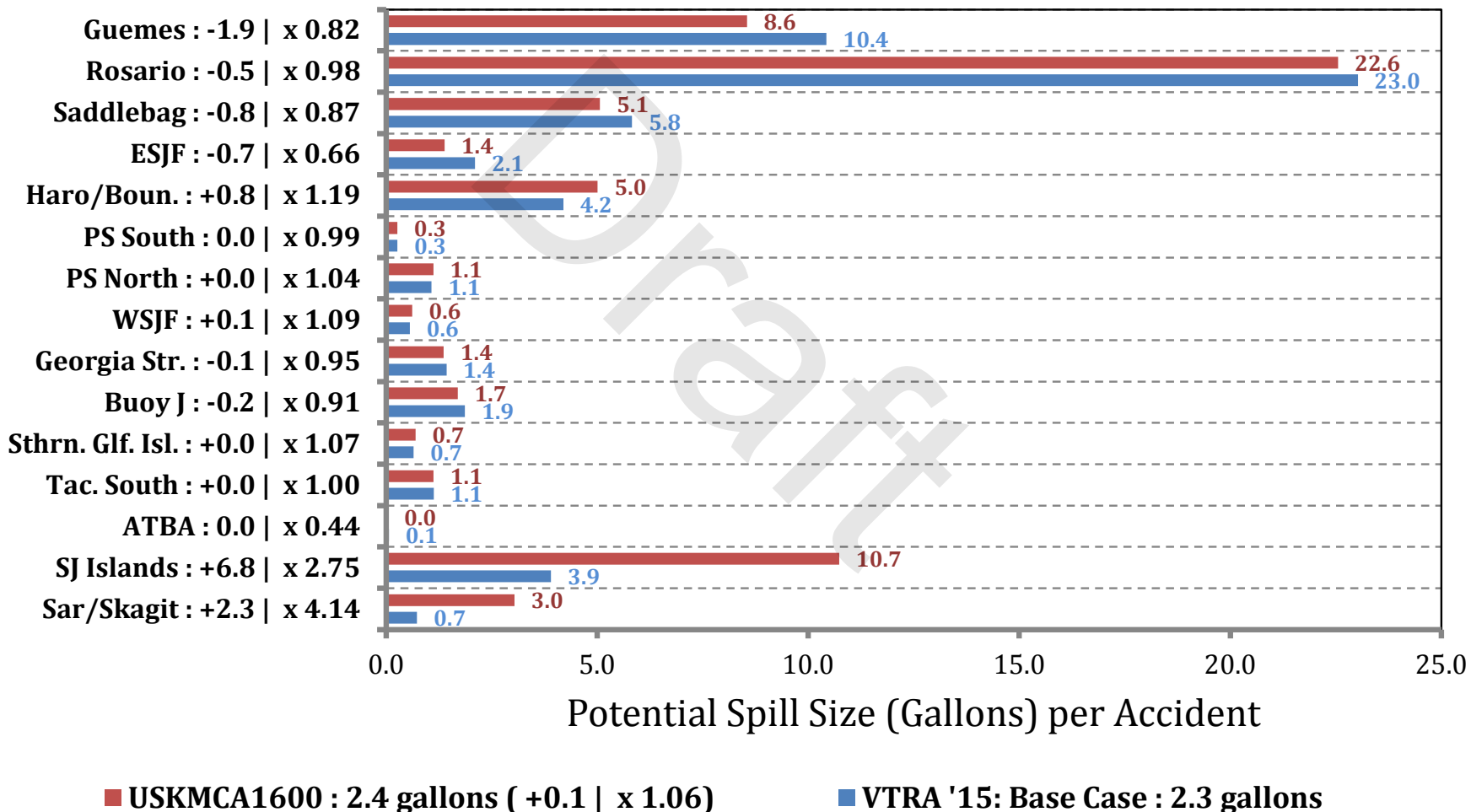


## Prob. Estimate At Least One Accident in 10 Years - ALL\_FV - Oil Spill Size Category: 0 - 264 Gallons



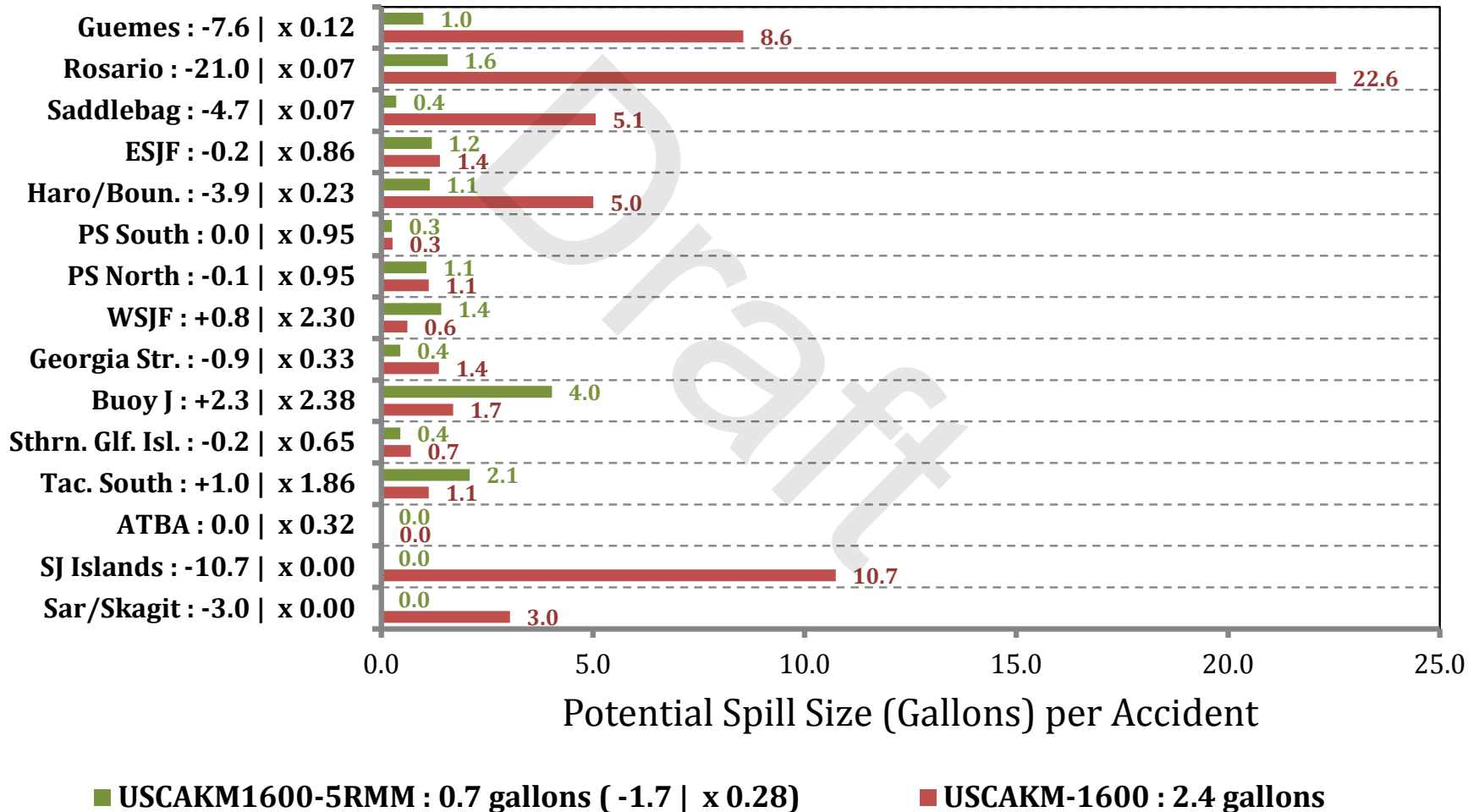
# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## Potential Spill Size (Gallons) per Accident - ALL\_FV - Oil Spill Size Category: 0 - 264 Gallons



# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015

## Potential Spill Size (Gallons) per Accident - ALL\_FV - Oil Spill Size Category: 0 - 264 Gallons



# Summary Risk Comparison

Oil Spill Size Category:  
**All Spill Sizes**

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



## Summary Risk Comparison Base Case to USKMCA1600

		OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
<b>VTRA '15 BASE CASE</b>	Base Case % Potential Annual Oil Loss	42.0%	12.3%	45.3%	0.5%	100.0%
	Base Case % Potential Annual Accident Frequency	0.01%	0.01%	1.8%	98.2%	100.0%
	Average potential spill size per accident (in m <sup>3</sup> )	6,798	1,619	46.9	0.01	1.8
	Probability of at least one accident in 1 year by spill size	0.05%	0.06%	7.5%	98.7%	98.8%
	Probability of at least one accident in 10 year by spill size	0.50%	0.61%	54.2%	100.0%	100.0%
	Probability of at least one accident in 25 years by spill size	1.24%	1.52%	85.8%	100.0%	100.0%
		OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
<b>USKMCA1600</b>	Base Case % Potential Annual Oil Loss	91.1% ( +49.11%   x2.17 )	20.0% ( +7.71%   x1.63 )	72.8% ( +27.54%   x1.61 )	0.5% ( +0.08%   x1.17 )	184.4% ( +84.4%   x1.84 )
	Base Case % Potential Annual Accident Frequency	0.03% ( +0.02%   x2.72 )	0.02% ( +0.01%   x1.56 )	1.9% ( +0.16%   x1.09 )	108.9% ( +10.7%   x1.11 )	110.9% ( +10.9%   x1.11 )
	Average potential spill size per accident (in m <sup>3</sup> )	5413 ( -1385   x0.80 )	1693 ( +75   x1.05 )	69.2 ( +22.3   x1.48 )	0.01 ( +0.00   x1.06 )	3.0 ( +1.2   x1.66 )
	Probability of at least one accident in 1 year by spill size	0.14% ( +0.09%   x2.72 )	0.10% ( +0.03%   x1.56 )	8.2% ( +0.64%   x1.09 )	99.2% ( +0.48%   x1.00 )	99.3% ( +0.45%   x1.00 )
	Probability of at least one accident in 10 year by spill size	1.35% ( +0.85%   x2.71 )	0.95% ( +0.34%   x1.55 )	57.3% ( +3.09%   x1.06 )	100.0% ( 0.00%   x1.00 )	100.0% ( 0.00%   x1.00 )
	Probability of at least one accident in 25 years by spill size	3.35% ( +2.10%   x2.70 )	2.36% ( +0.84%   x1.55 )	88.1% ( +2.27%   x1.03 )	100.0% ( 0.00%   x1.00 )	100.0% ( 0.00%   x1.00 )

# VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2015



## Summary Risk Comparison USKMCA1600 to USKMCA1600-5RMM

		OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
<b>USACAKM1600</b>	Base Case % Potential Annual Oil Loss	91.0%	19.9%	72.7%	0.5%	184.1%
	Base Case % Potential Annual Accident Frequency	0.03%	0.02%	1.9%	108.9%	110.9%
	Average potential spill size per accident (in m <sup>3</sup> )	5,413	1,693	69.2	0.01	3.0
	Probability of at least one accident in 1 year by spill size	0.14%	0.10%	8.2%	99.2%	99.3%
	Probability of at least one accident in 10 year by spill size	1.35%	0.95%	57.3%	100.0%	100.0%
	Probability of at least one accident in 25 years by spill size	3.35%	2.36%	88.1%	100.0%	100.0%
		OIL_2500_MORE	OIL_1000_2500	OIL_1_1000	OIL_0_1	TOTAL_OIL
<b>USACAKM1600 - 5RMM</b>	Base Case % Potential Annual Oil Loss	83.1% ( -7.8%   x0.91 )	12.9% ( -7.05%   x0.65 )	35.1% ( -37.60%   x0.48 )	0.1% ( -0.42%   x0.22 )	131.2% ( -52.9%   x0.71 )
	Base Case % Potential Annual Accident Frequency	0.03% ( 0.00%   x0.84 )	0.01% ( -0.01%   x0.67 )	1.4% ( -0.50%   x0.74 )	82.9% ( -26.0%   x0.76 )	84.3% ( -26.5%   x0.76 )
	Average potential spill size per accident (in m <sup>3</sup> )	5901 ( +488   x1.09 )	1646 ( -48   x0.97 )	45.3 ( -23.9   x0.65 )	0.00 ( -0.01   x0.29 )	2.8 ( -0.2   x0.94 )
	Probability of at least one accident in 1 year by spill size	0.11% ( -0.02%   x0.84 )	0.06% ( -0.03%   x0.67 )	6.1% ( -2.08%   x0.75 )	97.5% ( -1.74%   x0.98 )	97.6% ( -1.64%   x0.98 )
	Probability of at least one accident in 10 year by spill size	1.13% ( -0.22%   x0.84 )	0.63% ( -0.32%   x0.67 )	46.6% ( -10.69%   x0.81 )	100.0% ( 0.00%   x1.00 )	100.0% ( 0.00%   x1.00 )
	Probability of at least one accident in 25 years by spill size	2.81% ( -0.53%   x0.84 )	1.57% ( -0.78%   x0.67 )	79.2% ( -8.92%   x0.90 )	100.0% ( 0.00%   x1.00 )	100.0% ( 0.00%   x1.00 )