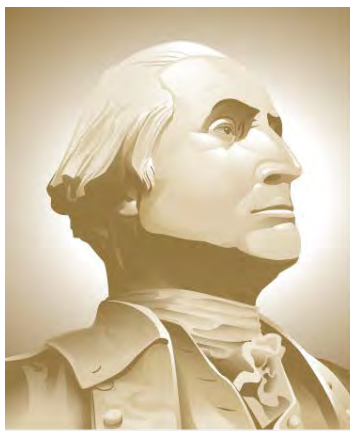


# VTRA 2010 POTENTIAL GROUNDING OIL FUEL AND CARGO LOSSES BY ALL FV, CARGO – FV, TANK- FV and WHAT-IF FV

Presentation by: J. Rene van Dorp



THE GEORGE  
WASHINGTON  
UNIVERSITY

WASHINGTON, DC

VCU

**CASE T: Gateway, Kinder Morgan, Delta Port**

**GWU Personnel:** Dr. J. Rene van Dorp

**VCU Personnel:** Dr. Jason R. W. Merrick

**OCTOBER 9, 2013**

PRELIMINARY

# Table. Focus Vessel (FV) Classification for the 26 VTOSS vessel type classification used in the GW/VCU MTS simulation model.

- NON – FV** : Those vessels that Interacting Vessels (IV) with Focus Vessels (FV)
- BASE CASE CARGO – FV** : Bulk Carriers, Container Vessels, Other Cargo Vessels that travel in VTRA 2010 Base Case
- BASE CASE TANK – FV** : Oil Barge, Oil Tankers, Chemical Carrier, ATB 's that travel in VTRA 2010 Base Case
- WHAT IF – FV** : CARGO AND TANK FV'S added to VTRA 2010 Base Case to model What-If Scenario

**Note:** Focus Vessels (FV's) are also considered as Interacting Vessels (IV's) when interacting with another Focus Vessel.

#	VESSEL TYPE	FOCUS VESSEL?	#	VESSEL TYPE	FOCUS VESSEL?
1	BULKCARRIER	<b>CARGO - FV</b>	14	PASSENGERSHIP	NO
2	CHEMICALCARRIER	<b>TANK - FV</b>	15	REFRIGERATEDCARGO	<b>CARGO-FV</b>
3	CONTAINERSHIP	<b>CARGO - FV</b>	16	RESEARCHSHIP	NO
4	DECKSHIPCARGO	<b>CARGO - FV</b>	17	ROROCARGOSHIP	<b>CARGO-FV</b>
5	FERRY	NO	18	ROROCARGOCONTSHIP	<b>CARGO-FV</b>
6	FERRYNONLOCAL	NO	19	SUPPLYOFFSHORE	NO
7	FISHINGFACTORY	NO	20	TUGTOWBARGE	NO
8	FISHINGVESSEL	NO	21	UNKNOWN	NO
9	LIQGASCARRIER	<b>TANK - FV</b>	22	USCOASTGUARD	NO
10	NAVYVESSEL	NO	23	VEHICLECARRIER	<b>CARGO-FV</b>
11	OILTANKER	<b>TANK - FV</b>	24	YACHT	NO
12	OTHERSPECIALCARGO	<b>CARGO - FV</b>	25	ATB	<b>TANK - FV</b>
13	OTHERSPECIFCSERV	NO	26	OIL BARGE	<b>TANK - FV</b>

# IMPORTANT:

THE OPERATIVE WORD IN PRESENTING THESE ANALYSIS RESULTS IS THE USE OF THE WORD

# POTENTIAL

TO INDICATE THAT THESE ANALYSIS RESULTS DO NOT FOLLOW FROM AN HISTORICAL DATA ANALYSIS, BUT THROUGH THE USE OF AN ANALYSIS TOOL THAT EVALUATES SUCH **POTENTIAL**.

THE 2010 YEAR IS CONSIDERED **THE BASE CASE YEAR** AND A BASE CASE YEAR POTENTIAL IS EVALUATED.

NEXT, **WHAT-IF SCENARIOS** ARE DEVELOPED FROM THE BASE CASE BY ADDING ADDITIONAL HYPOTHETICAL TRAFFIC AND A WHAT-IF POTENTIAL IS EVALUATED AND COMPARED **RELATIVE TO THE BASE CASE** TO INFORM **RISK MANAGEMENT**.



**CASE T: GW 487, KM 348, DP 348 and 67:**

**BASE CASE 2010 TRAFFIC WITH  
FOLLOWING WHAT-IF FOCUS VESSELS**

487 Gateway Bulk Carriers + Bunkering Barges

348 Kinder Morgan Tankers + Bunkering Barges

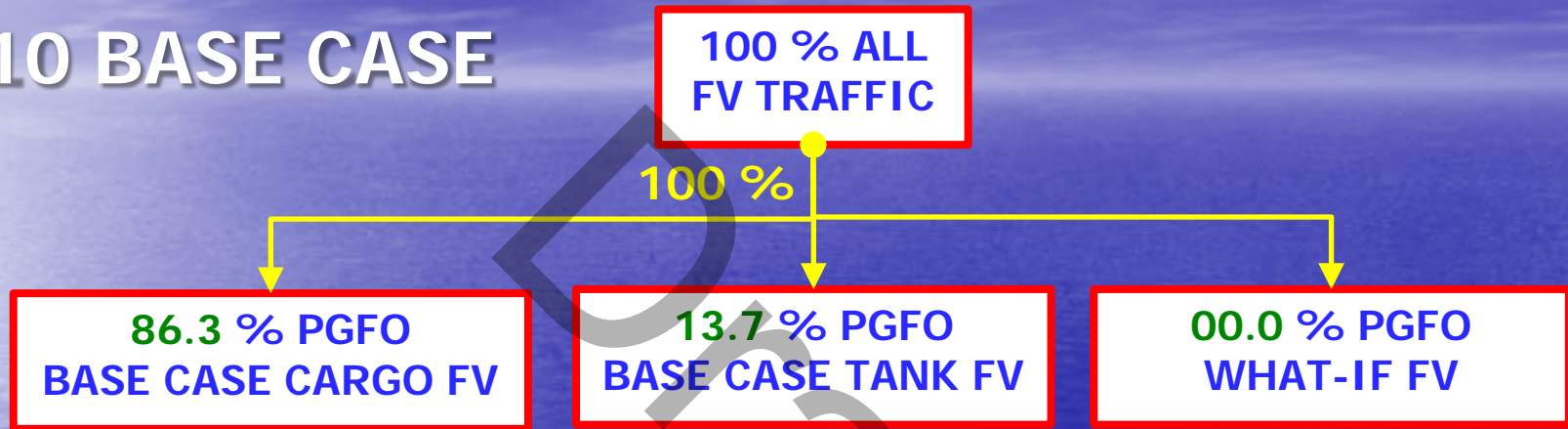
348 Delta Port Bulk Carriers + Bunkering Barges

67 Delta Port Container Ships+ Bunkering Barges

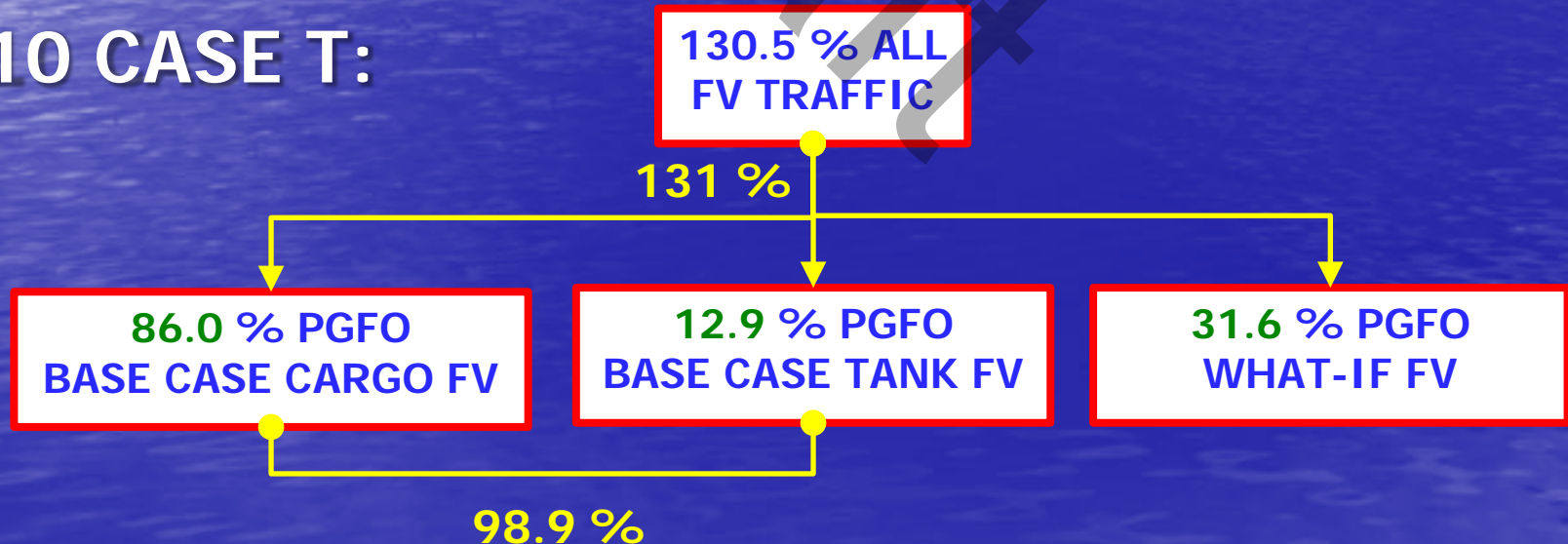
# A TAXONOMY OF 2010 FOCUS VESSEL POTENTIAL ANNUAL GROUNDING FUEL OIL LOSS

PCFO : POTENTIAL GROUNDING FUEL OIL LOSS - PER YEAR

## 2010 BASE CASE

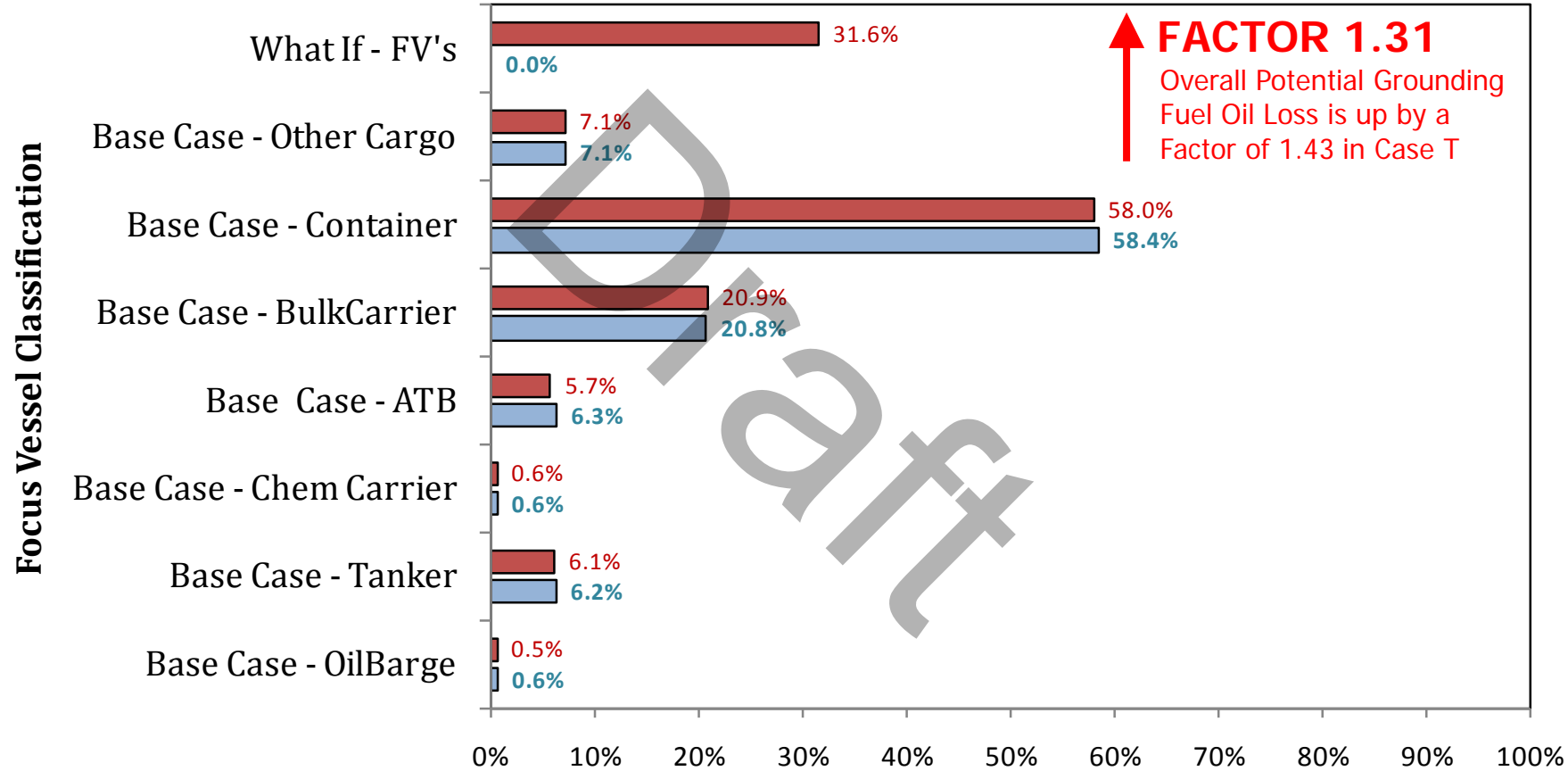


## 2010 CASE T:



# CASE T: GW 487, KM 348, DP 348 and 67:

## VTRA 2010 - GROUNDING FUEL OIL LOSS



**↑ FACTOR 1.31**  
 Overall Potential Grounding Fuel Oil Loss is up by a Factor of 1.43 in Case T

% of 2010 Potential Grounding Fuel Oil Outflow (PGFO)

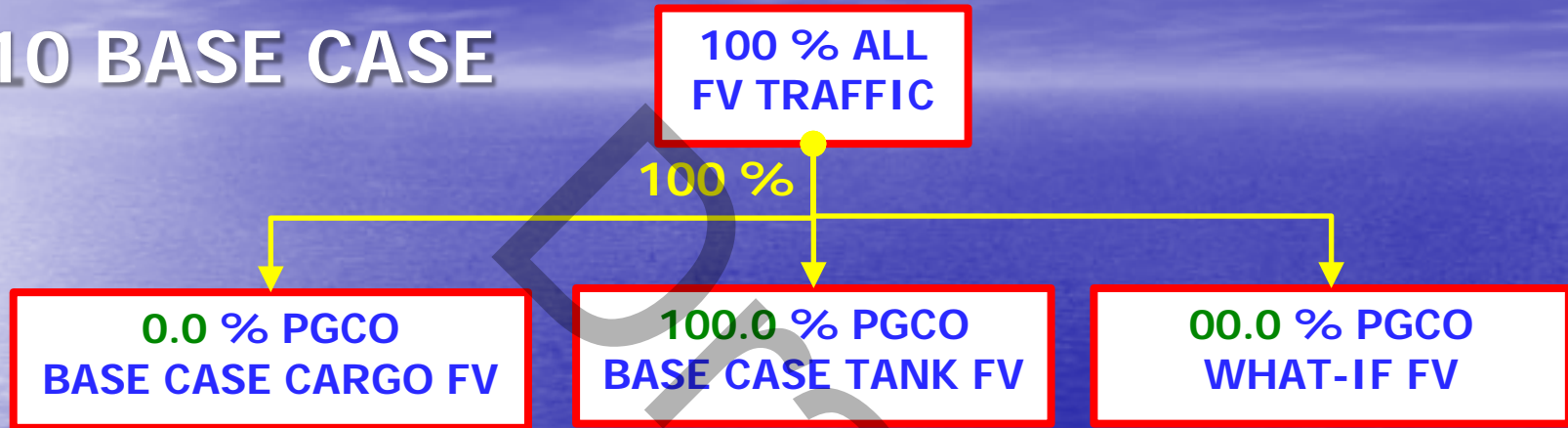
■ T: GW - KM - DP - 130.5%    ■ P: BASE CASE 2010 - 100.0%



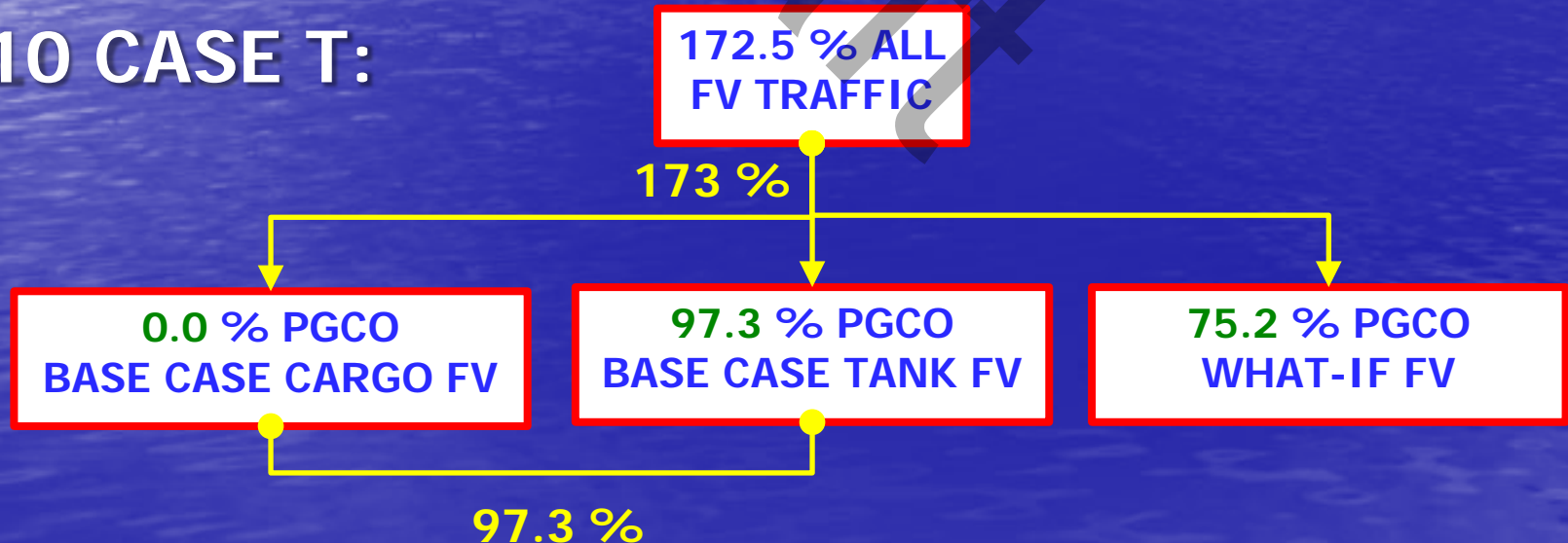
# A TAXONOMY OF 2010 FOCUS VESSEL POTENTIAL ANNUAL GROUNDING CARGO OIL LOSS

PCCO : POTENTIAL GROUNDING CARGO OIL LOSS - PER YEAR

## 2010 BASE CASE



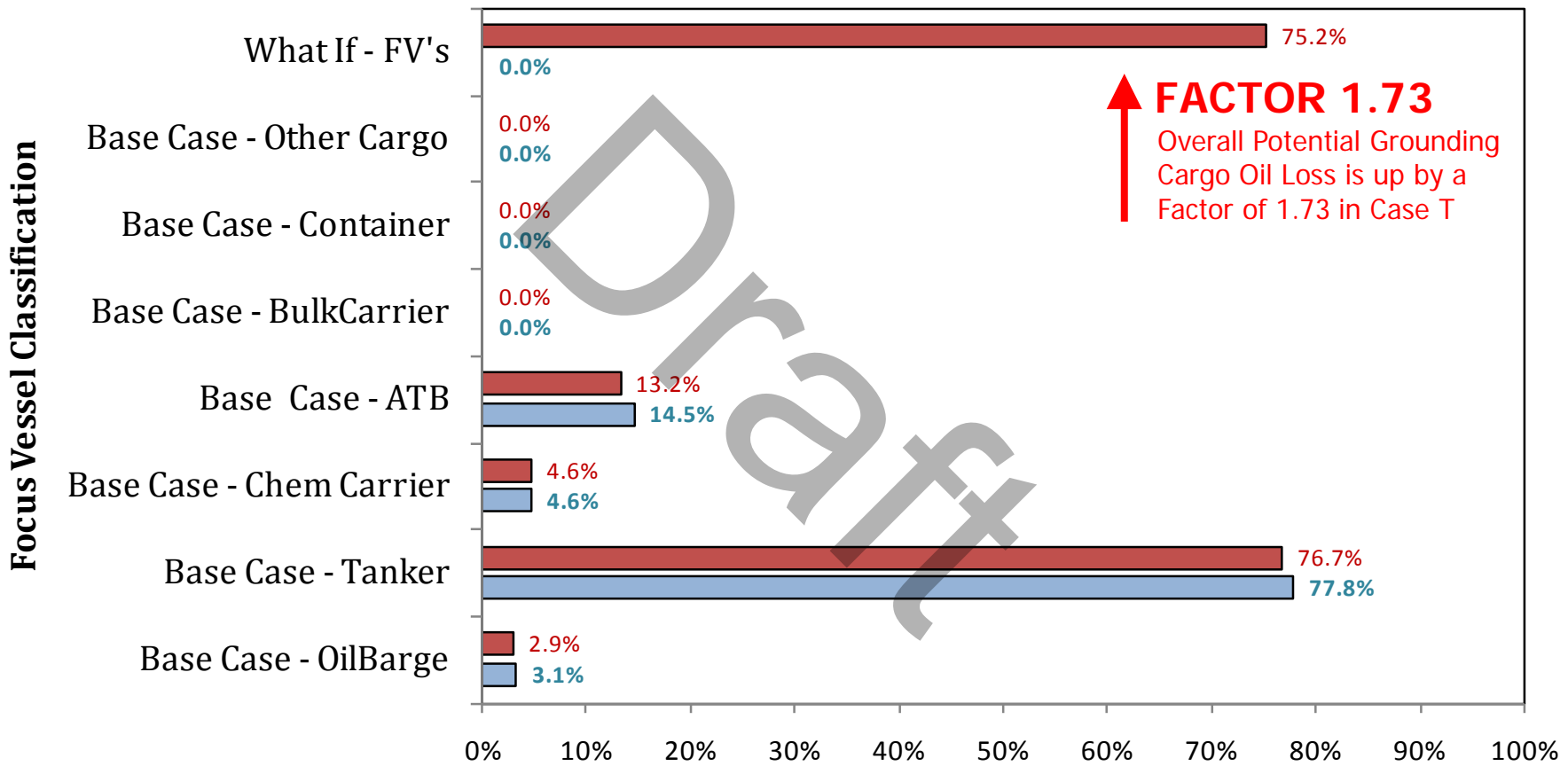
## 2010 CASE T:





# CASE T: GW 487, KM 348, DP 348 and 67:

## VTRA 2010 - GROUNDING CARGO OIL LOSS



% of 2010 Potential Grounding Cargo Oil Outflow (PGCO)

■ T: GW - KM - DP - 172.5%    ■ P: BASE CASE 2010 - 100.0%

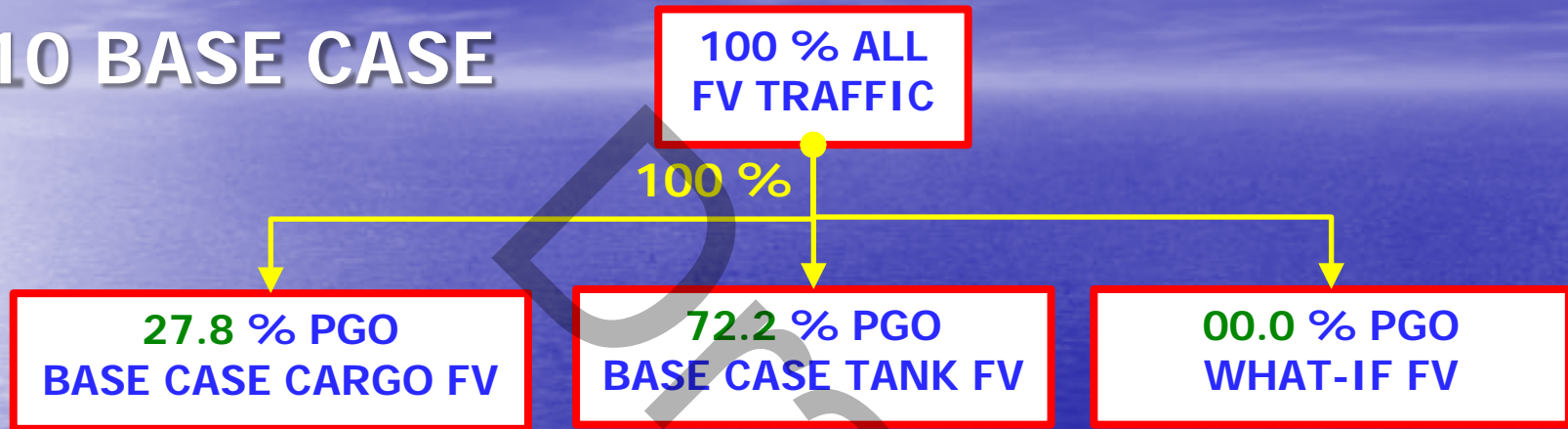




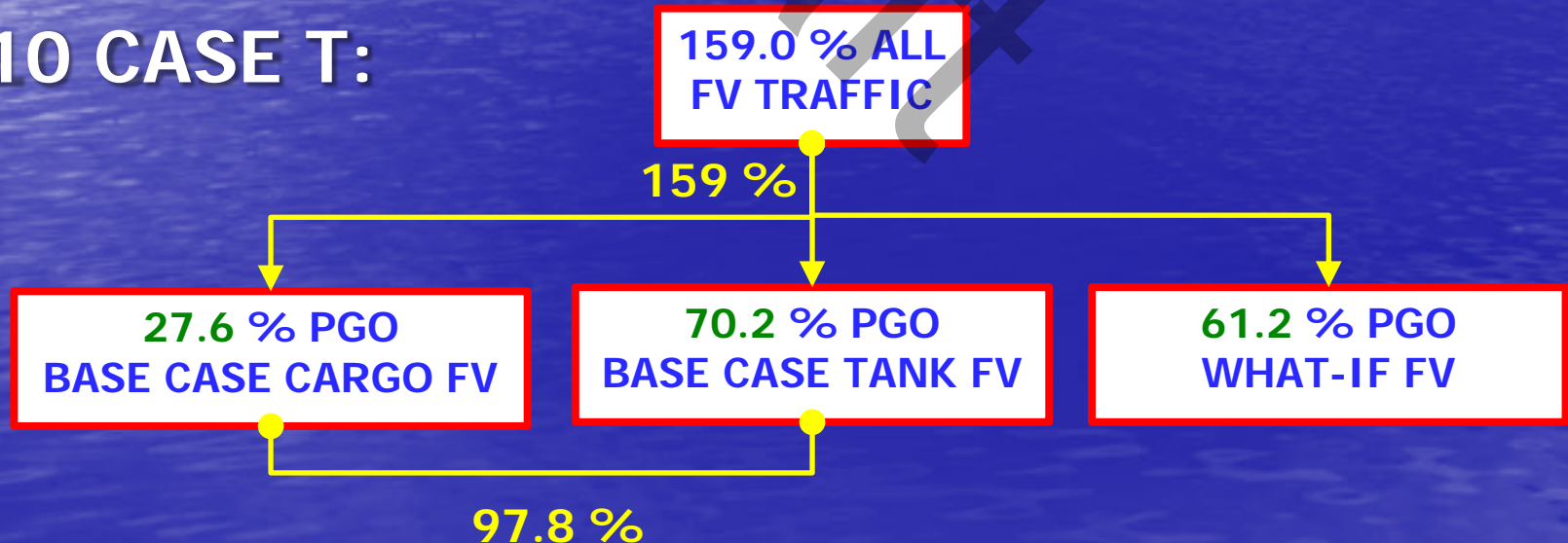
# A TAXONOMY OF 2010 FOCUS VESSEL POTENTIAL ANNUAL GROUNDING OIL LOSS

PGO : POTENTIAL GROUNDING OIL LOSS - PER YEAR

## 2010 BASE CASE

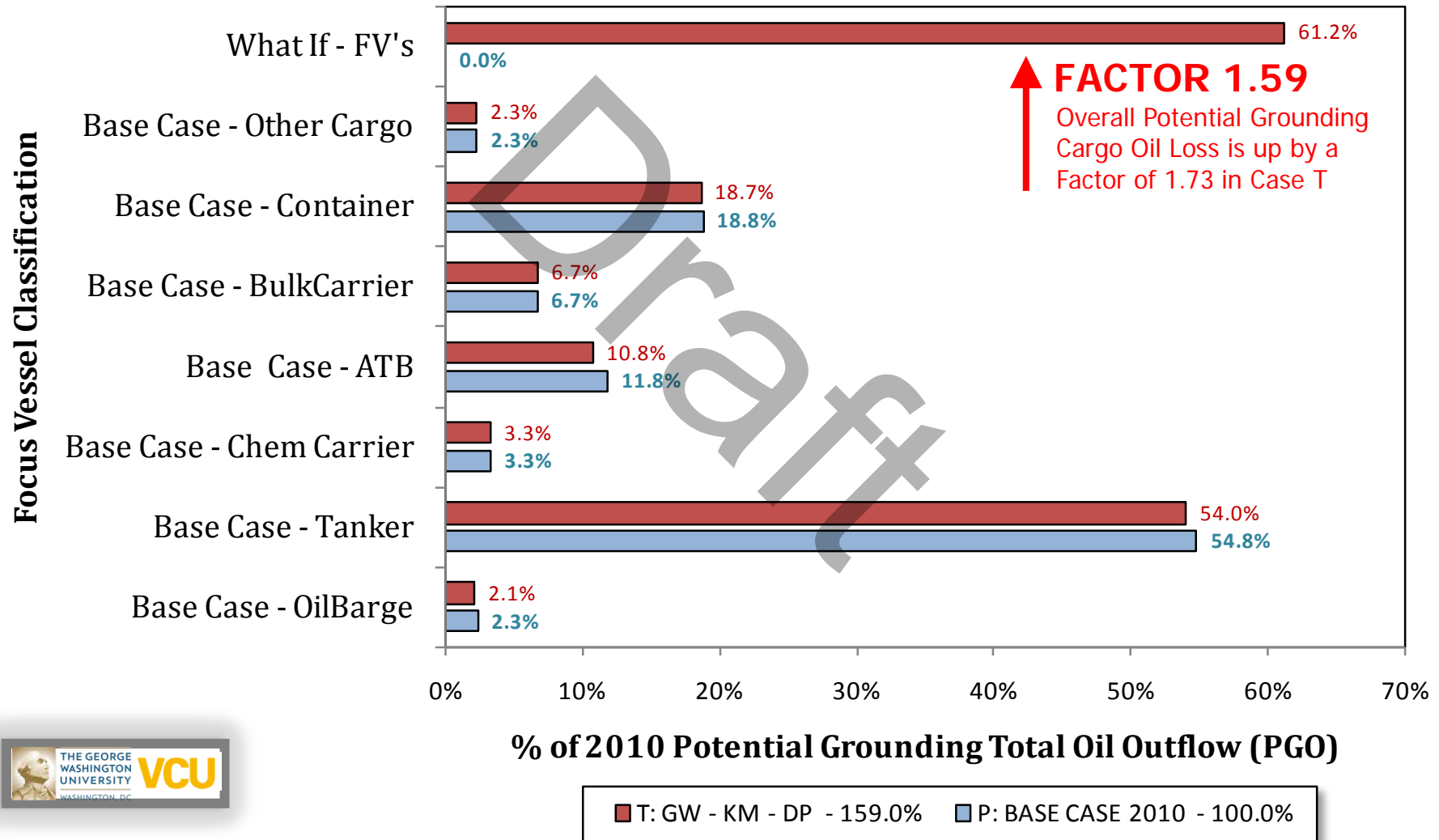


## 2010 CASE T:



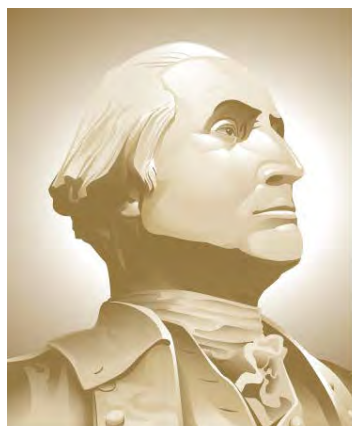
# CASE T: GW 487, KM 348, DP 348 and 67:

## VTRA 2010 - GROUNDING OIL LOSS (CARGO + FUEL)



# VTRA 2010 GROUNDING FREQ. BY CARGO – FV and TANK- FV A WATERWAY BY LOCATION ANALYSIS

Presentation by: J. Rene van Dorp



THE GEORGE  
WASHINGTON  
UNIVERSITY

WASHINGTON, DC

VCU

**CASE T: Gateway, Kinder Morgan, Delta Port**

**GWU Personnel:** Dr. J. Rene van Dorp

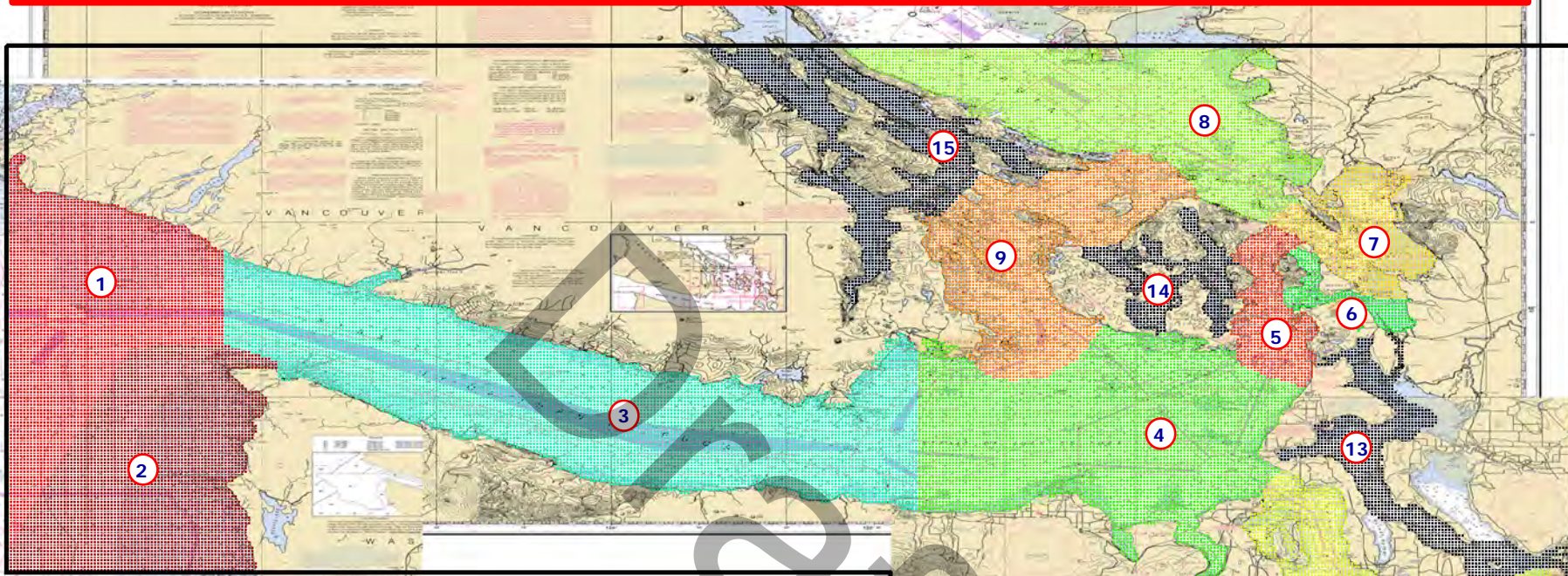
**VCU Personnel:** Dr. Jason R. W. Merrick

**OCTOBER 9, 2013**

PRELIMINARY

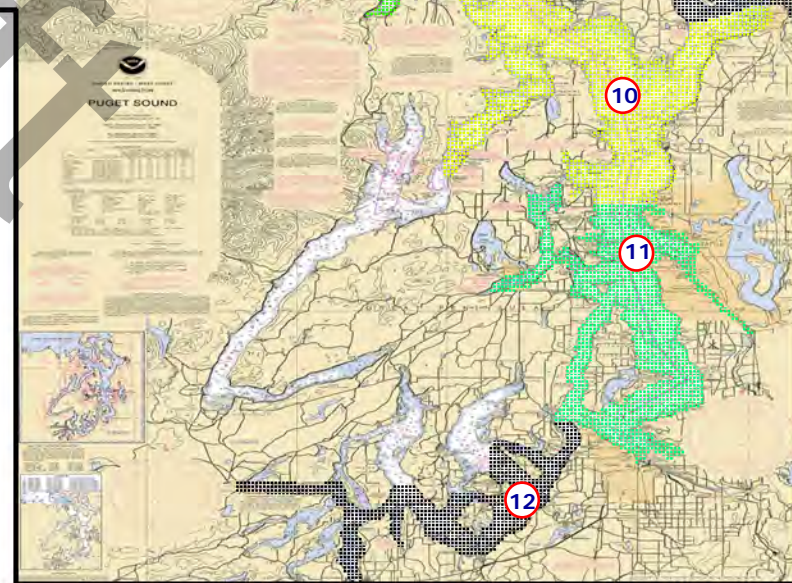


# DEFINITION OF 15 WATERWAY LOCATIONS



## VTRA 2010 Waterway Locations

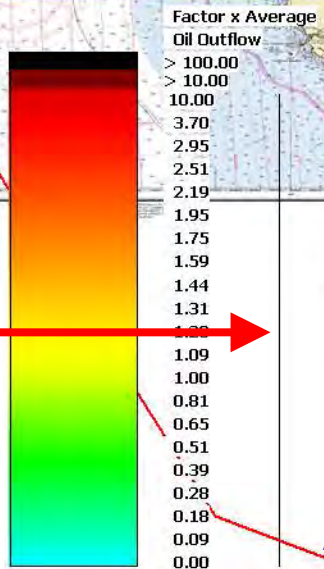
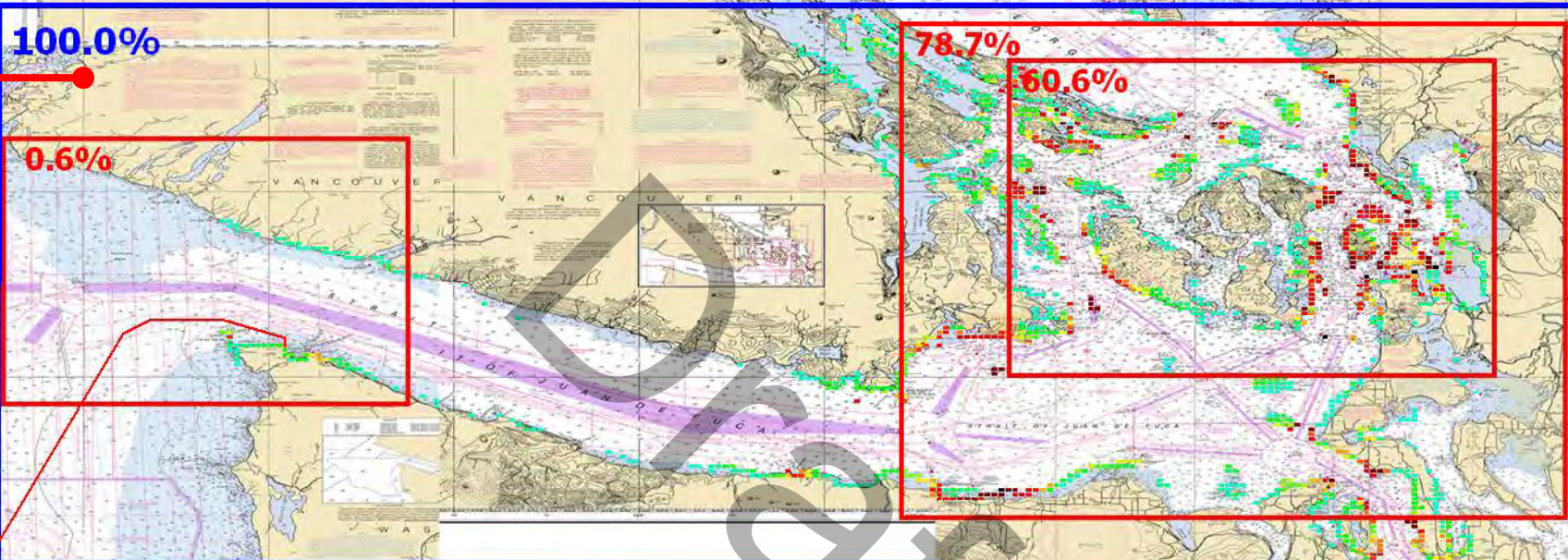
- |                 |                 |
|-----------------|-----------------|
| 1. Buoy J       | 9. Harp/Boun.   |
| 2. ATBA         | 10. PS North    |
| 3. WSJF         | 11. PS South    |
| 4. ESJF         | 12. Tacoma      |
| 5. Rosario      | 13. Sar/Skagit  |
| 6. Guemes       | 14. SJ Islands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





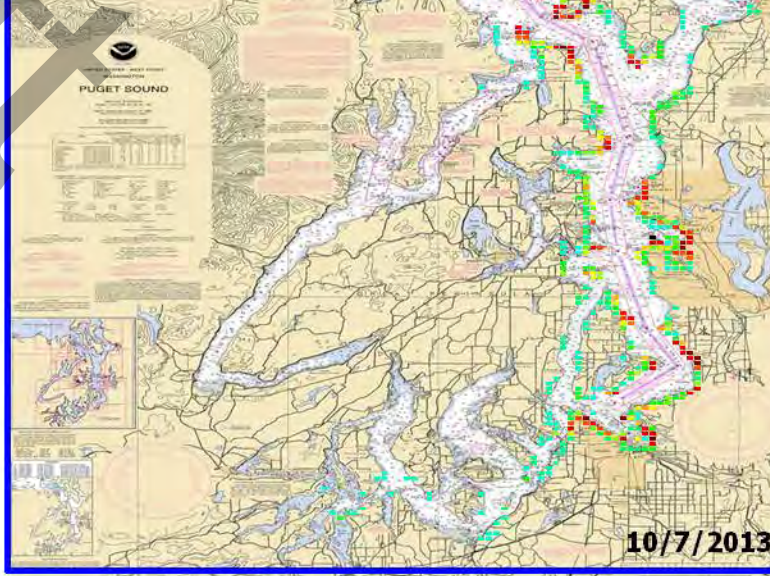
**P: ALL FV POTENTIAL  
GROUNDING OIL (FUEL + CARGO) LOSS (PGO)**

**P: VTRA 2010 - BASE CASE**



- P: POT. GROUND. OIL LOSS (PGO)**
- 06.7% - BULK CARGO
  - 18.8% - CONTAINERSHIP
  - 02.3% - OTHERCARGO
  - 02.3% - OIL BARGE
  - 54.8% - TANKER
  - 03.3% - CHEMICAL CARRIER
  - 11.8% - ATB
  - 00.0% - WHAT-IF FV

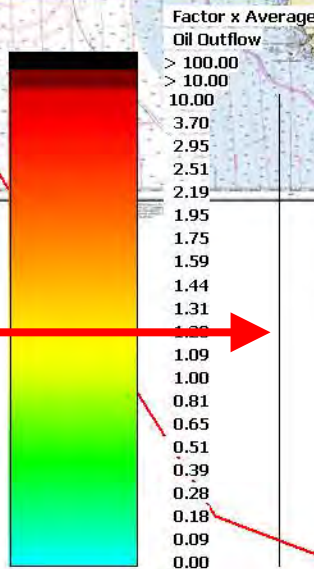
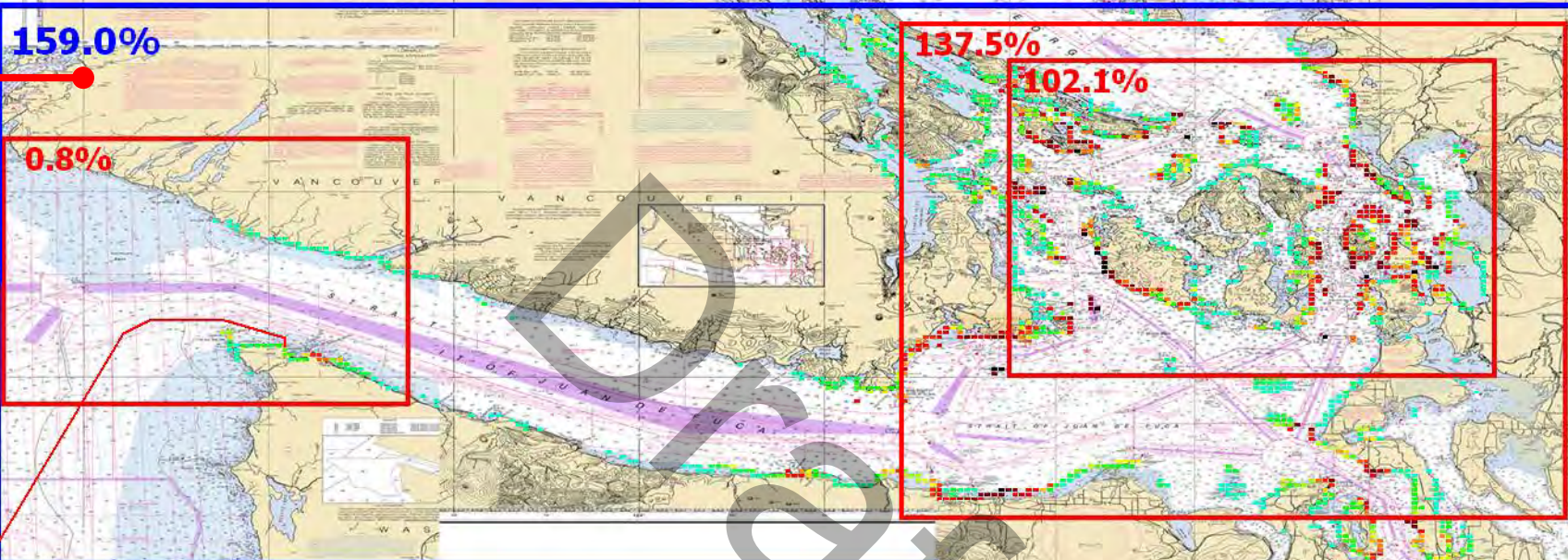
**100.0% of 2010 Base Case  
ALL FV – PGO**





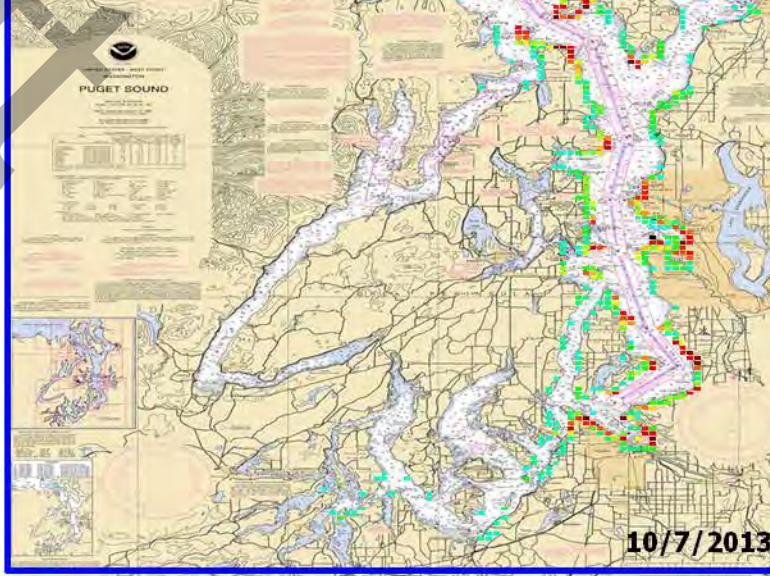
**T: ALL FV POTENTIAL  
GROUNDING OIL (FUEL + CARGO) LOSS (PGO)**

**T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348**



- T: POT. GROUND. OIL LOSS (PGO)**
- 06.7% - BULK CARGO
  - 18.7% - CONTAINERSHIP
  - 02.3% - OTHERCARGO
  - 02.1% - OIL BARGE
  - 54.0% - TANKER
  - 03.3% - CHEMICAL CARRIER
  - 10.8% - ATB
  - 61.2% - WHAT-IF FV

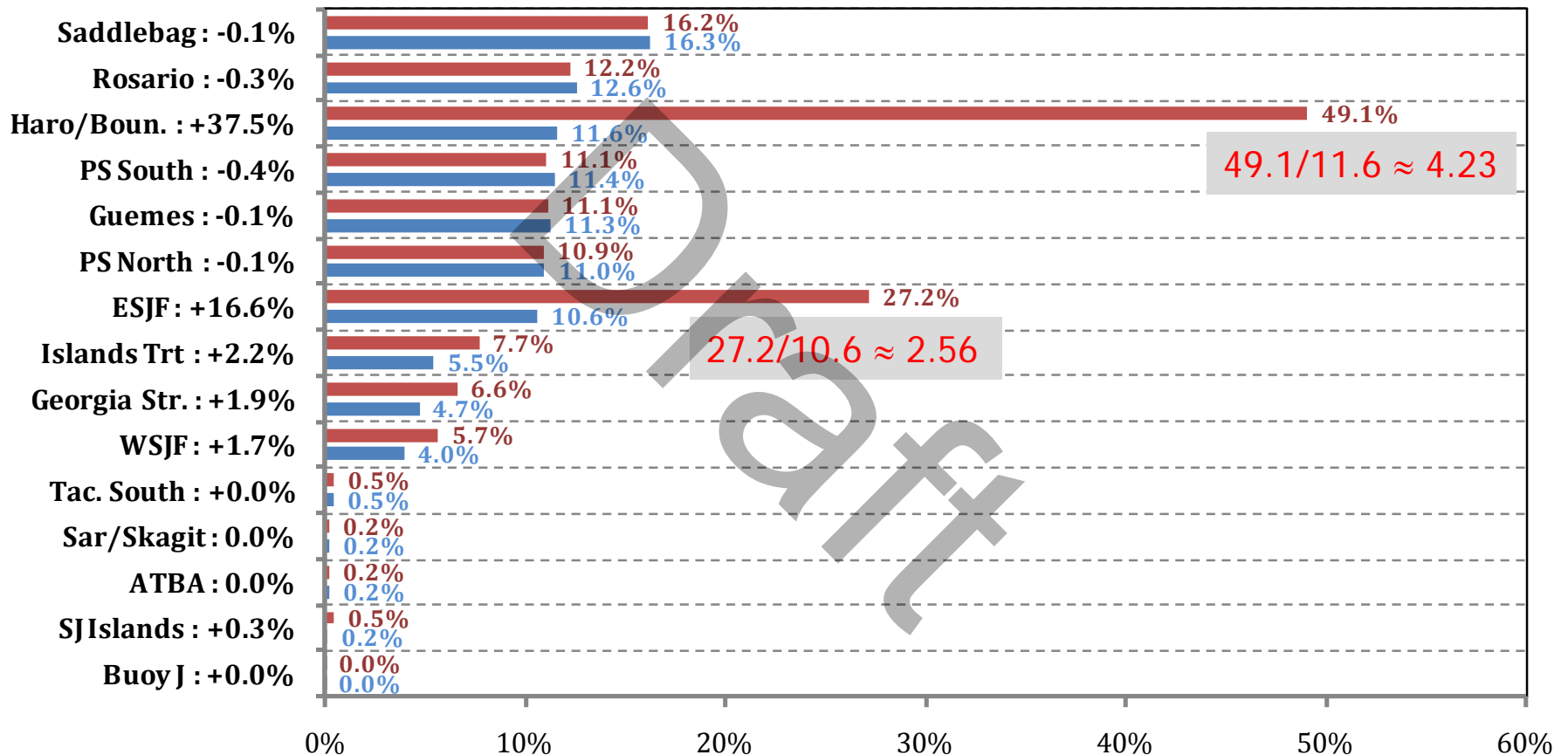
**+  
159.0% of 2010 Base Case  
ALL FV – PGO**



# WATERWAY LOCATION

## Potential Grounding Oil Loss Comparison – ALL FV

### % Base Case Grounding Oil Loss - ALL\_FV



49.1/11.6 ≈ 4.23

27.2/10.6 ≈ 2.56

59.2%  
of 2010 Base Case  
ALL FV – PGO

### % Base Case Grounding Oil Loss (GOL) - ALL\_FV

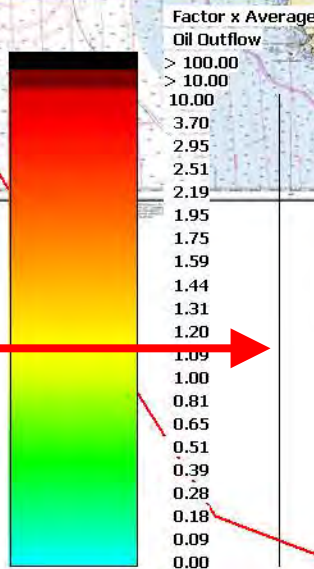
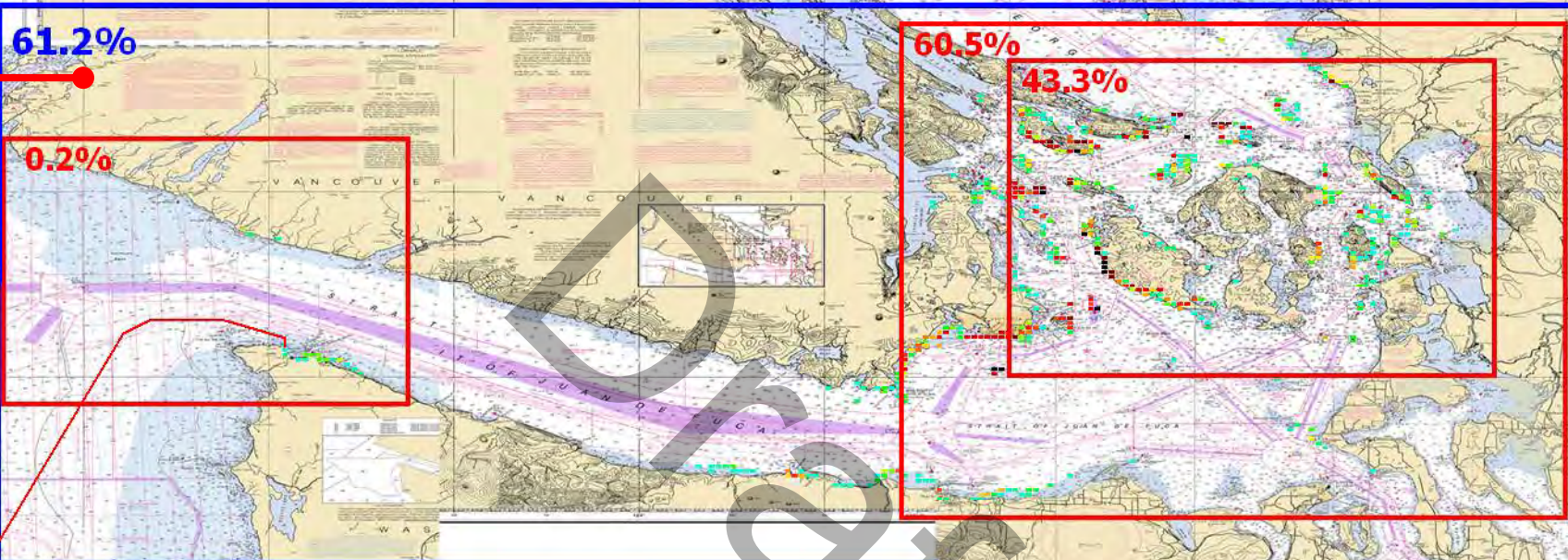
T: GW - KM - DP : 159.2%

P: BASE CASE : 159.2%



# T: WHAT-IF FV POTENTIAL GROUNDING OIL (FUEL + CARGO) LOSS (PGO)

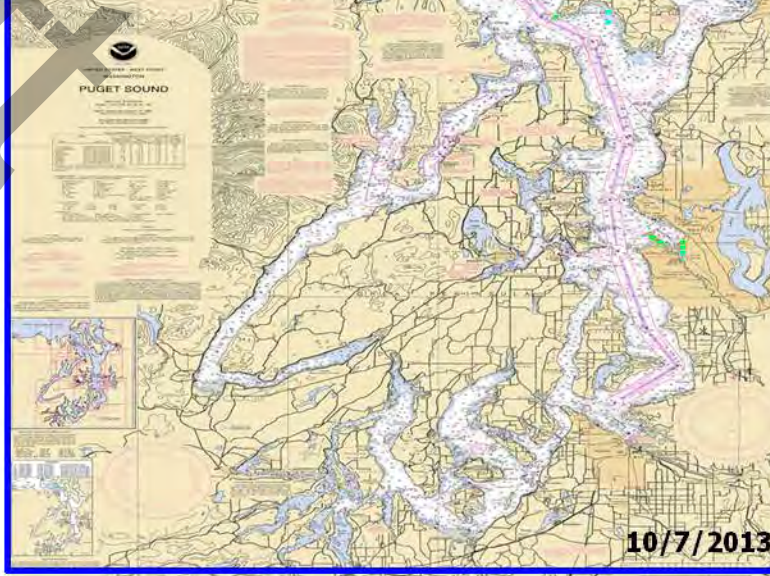
T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348



**T: POT. GROUND. OIL LOSS (PGO)**

- 06.1% - BULKCARRIER
- 03.3% - CONTAINERSHIP
- 51.6% - OIL TANKER
- 00.3% - OIL BARGE

**61.3% of 2010 Base Case  
ALL FV – PGO**

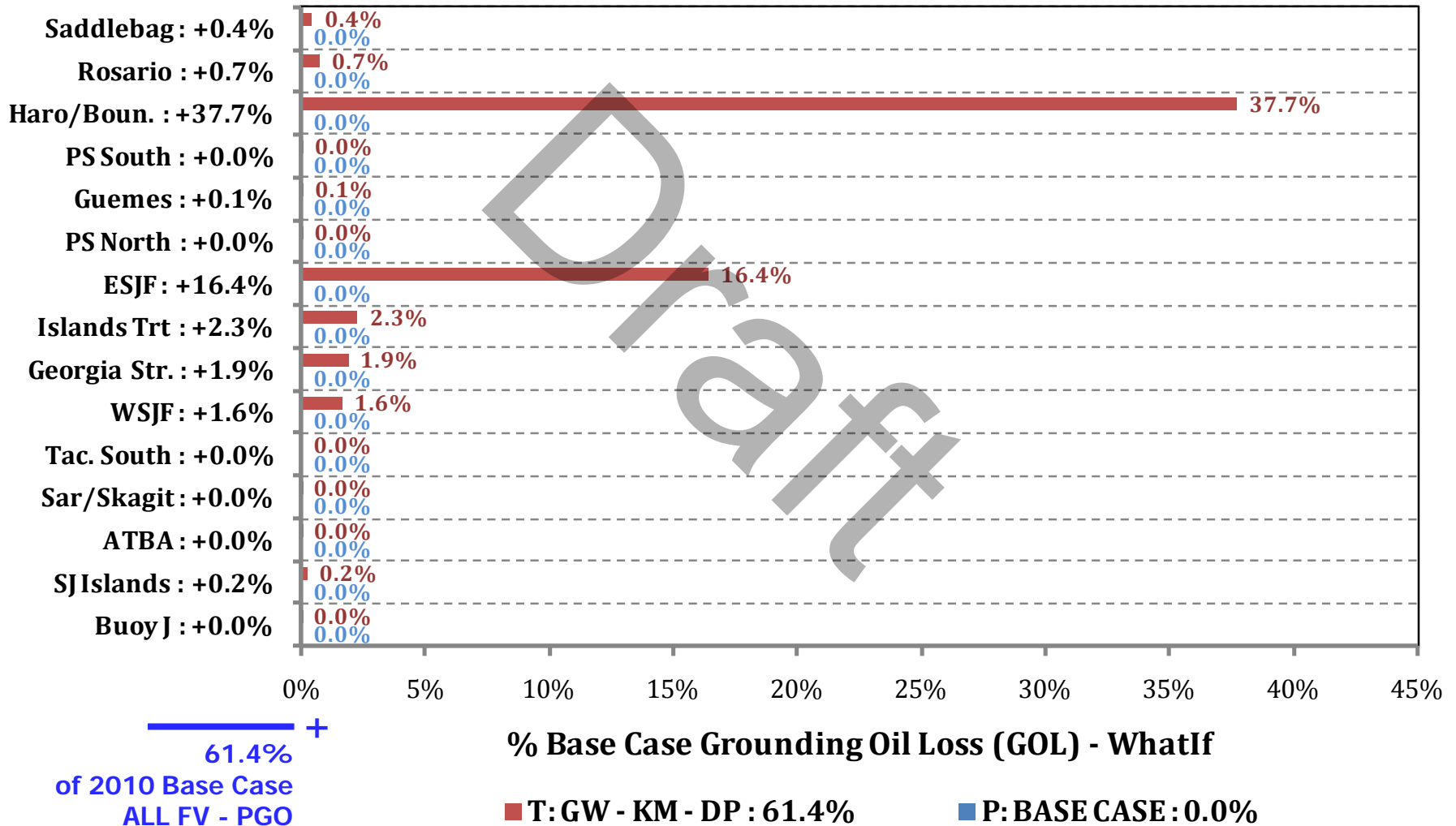




# WATERWAY LOCATION

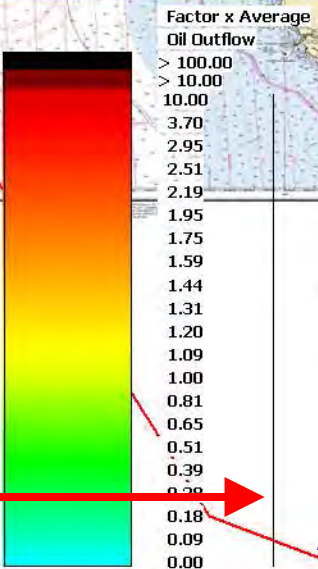
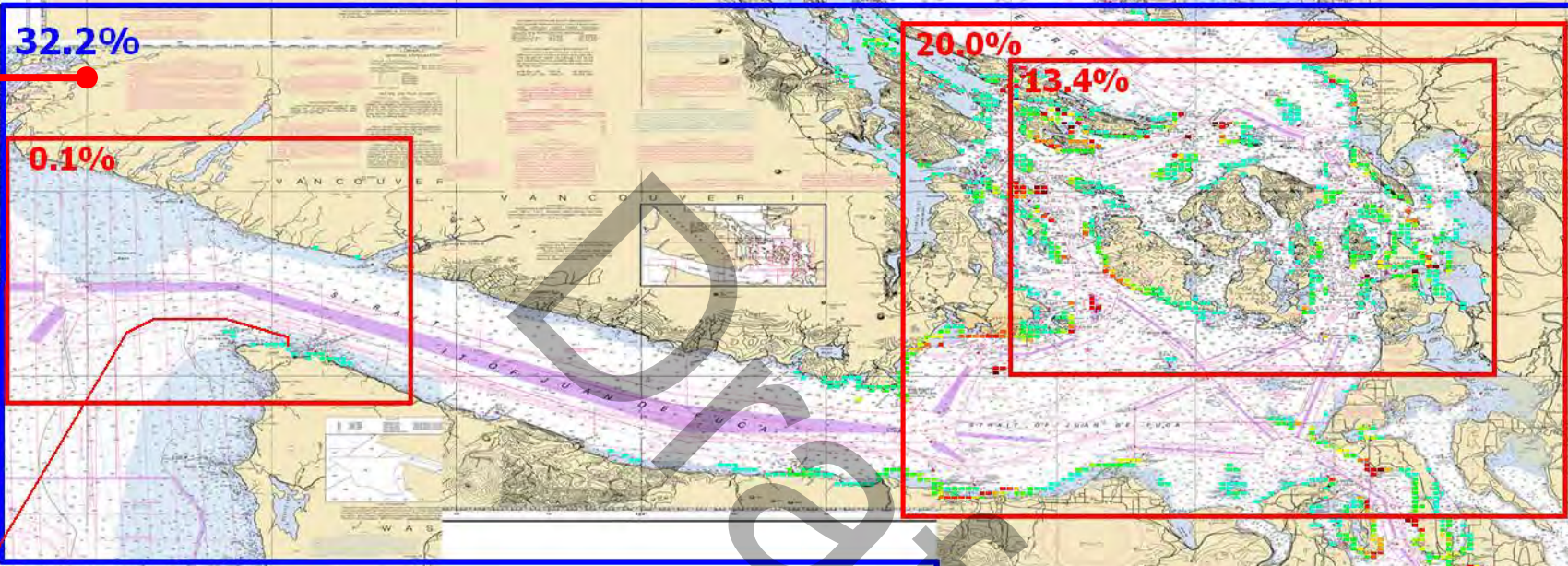
## Potential Grounding Oil Loss Comparison – ALL FV

### % Base Case Grounding Oil Loss - WhatIf



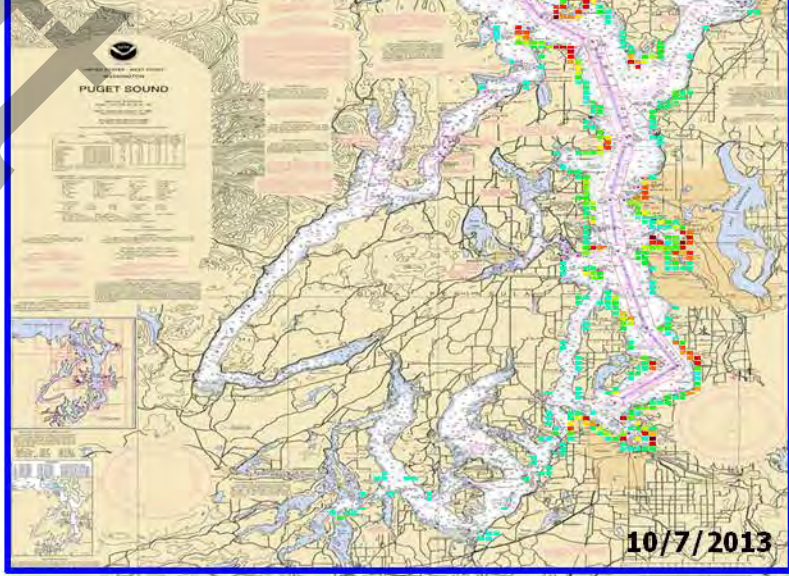
**P: ALL FV POTENTIAL  
GROUNDING FUEL OIL LOSS (PGFO)**

**P: VTRA 2010 - BASE CASE**



- P: POT. GROUND. FUEL OIL (PGFO)**
- 06.7% - BULK CARGO
  - 18.8% - CONTAINERSHIP
  - 02.3% - OTHERCARGO
  - 00.2% - OIL BARGE
  - 02.0% - TANKER
  - 00.2% - CHEMICAL CARRIER
  - 02.0% - ATB
  - 00.0% - WHAT-IF FV

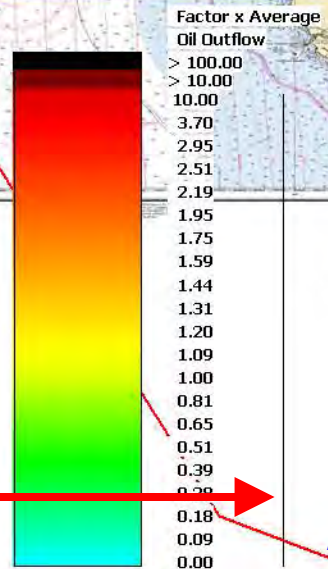
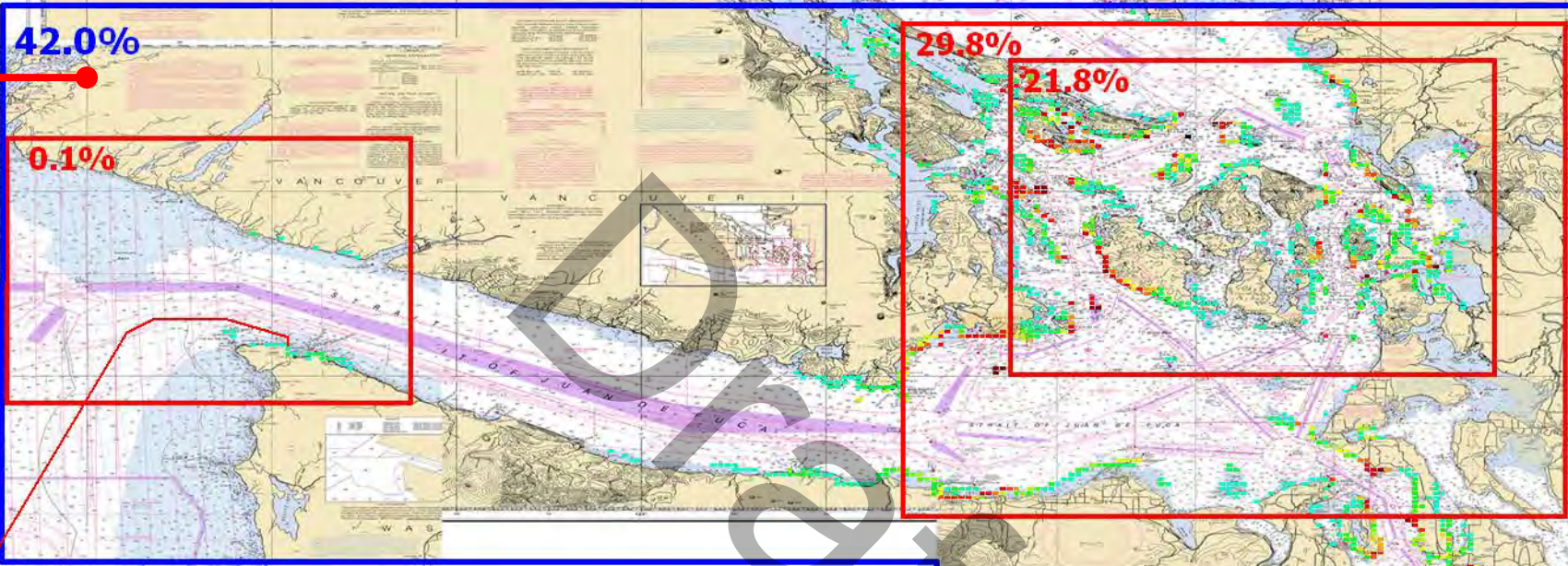
**+  
32.2% of 2010 Base Case  
ALL FV - PGO**





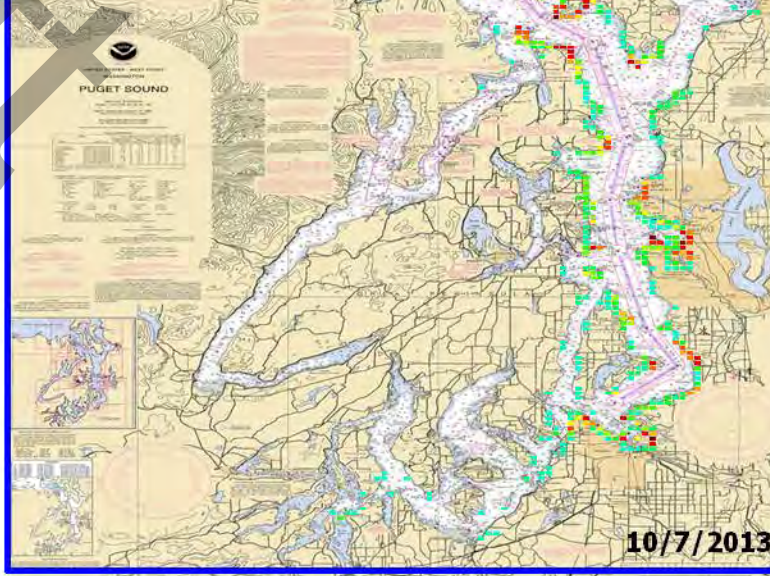
**T: ALL FV POTENTIAL  
GROUNDING FUEL OIL LOSS (PGFO)**

**T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348**



- T: POT. GROUND. FUEL OIL (PGFO)**
- 06.7% - BULK CARGO
  - 18.7% - CONTAINERSHIP
  - 02.3% - OTHERCARGO
  - 00.2% - OIL BARGE
  - 02.0% - TANKER
  - 00.2% - CHEMICAL CARRIER
  - 01.8% - ATB
  - 10.2% - WHAT-IF FV

**+  
42.0% of 2010 Base Case  
ALL FV – PGO**





# T: WHAT-IF FV POTENTIAL GROUNDING FUEL OIL LOSS (PGFO)



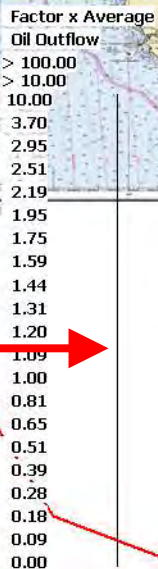
## T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348

10.2%

0.0%

10.0%

8.6%



### T: POT. GROUND. FUEL OIL (PGFO)

- 06.0% - BULKCARRIER
- 03.2% - CONTAINERSHIP
- 01.0% - OIL TANKER
- 00.0% - OIL BARGE

— +  
**10.2% of 2010 Base Case**  
**ALL FV – PGO**



# P: ALL FV POTENTIAL GROUNDING CARGO OIL LOSS (PGCO)

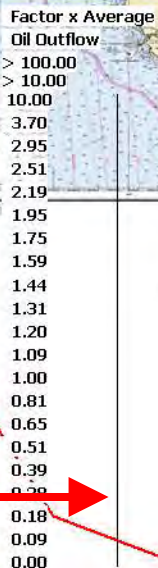
P: VTRA 2010 - BASE CASE

67.8%

0.5%

58.7%

47.2%



## P: POT. GROUND CARGO OIL (PGCO)

- 00.0% - BULK CARGO
- 00.0% - CONTAINERSHIP
- 00.0% - OTHERCARGO
- 02.1% - OIL BARGE
- 52.8% - TANKER
- 03.1% - CHEMICAL CARRIER
- 09.8% - ATB
- 00.0% - WHAT-IF FV

+  
67.8% of 2010 Base Case  
ALL FV - PGO



# T: ALL FV POVTENTIAL GROUNDING CARGO OIL LOSS (PGCO)

T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348

117.0%

0.7%

107.7%

80.3%

Factor x Average  
Oil Outflow

- > 100.00
- > 10.00
- 10.00
- 3.70
- 2.95
- 2.51
- 2.19
- 1.95
- 1.75
- 1.59
- 1.44
- 1.31
- 1.20
- 1.09
- 1.00
- 0.81
- 0.65
- 0.51
- 0.39
- 0.29
- 0.18
- 0.09
- 0.00

## T: POT. GROUND CARGO OIL (PGCO)

- 00.0% - BULK CARGO
- 00.0% - CONTAINERSHIP
- 00.0% - OTHERCARGO
- 01.9% - OIL BARGE
- 52.1% - TANKER
- 03.1% - CHEMICAL CARRIER
- 08.9% - ATB
- 51.0% - WHAT-IF FV

+  
117.0% of 2010 Base Case  
ALL FV - PGO



# T: WHAT-IF FV POTENTIAL GROUNDING CARGO OIL LOSS (PGCO)



T: VTRA 2010 - GW 487- KM 348 - DP Cont. 67 and Bulk 348

51.0%

0.1%

50.5%

34.7%

Factor x Average  
Oil Outflow

- > 100.00
- > 10.00
- 10.00
- 3.70
- 2.95
- 2.51
- 2.19
- 1.95
- 1.75
- 1.59
- 1.44
- 1.31
- 1.20
- 1.09
- 1.00
- 0.81
- 0.65
- 0.51
- 0.39
- 0.28
- 0.18
- 0.09
- 0.00

T: POT. GROUND. CARGO OIL (PGCO)

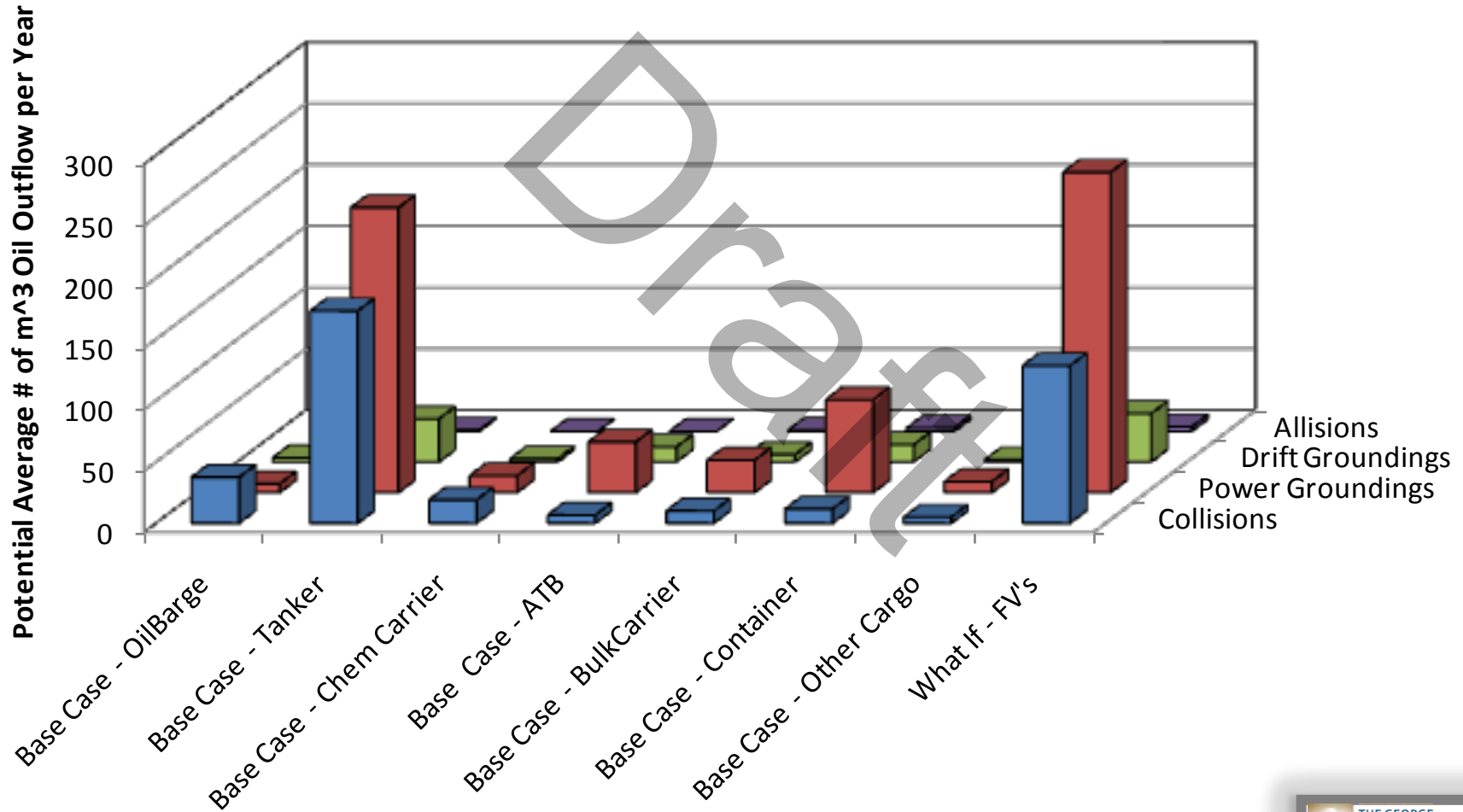
- 00.0% - BULKCARRIER
- 00.0% - CONTAINERSHIP
- 50.8% - OIL TANKER
- 00.3% - OIL BARGE

+  
51.0% of 2010 Base Case  
ALL FV – PGO

# A TAXONOMY OF 2010 FOCUS VESSEL POTENTIAL ACCIDENT FREQUENCY AND ACCIDENT TYPE

## CASE T: GW 487, KM 348, DP 348 and 67:

**T - VTRA 2010 : Potential Average # of m<sup>3</sup> Oil Outflow per Year**





**T - VTRA 2010 : Potential Average # of m<sup>3</sup> Oil Outflow per Year**

Focus Vessel	Collisions	Power Groundings	Drift Groundings	Allisions	Total
Base Case - OilBarge	18.1%	1.7%	4.4%	0.0%	6.8%
Base Case - Tanker	83.6%	55.9%	46.0%	21.1%	62.7%
Base Case - Chem Carrier	9.2%	3.3%	3.4%	0.0%	5.0%
Base Case - ATB	3.2%	10.0%	16.0%	0.0%	8.6%
Base Case - All Tank FV's	114.1%	70.9%	69.9%	21.1%	83.1%
Base Case - BulkCarrier	4.9%	6.4%	7.9%	16.1%	6.2%
Base Case - Container	5.6%	18.2%	18.5%	50.8%	14.8%
Base Case - Other Cargo	2.4%	2.1%	2.4%	10.9%	2.3%
Base Case - All Cargo FV's	12.9%	26.7%	28.8%	77.9%	23.3%
Base Case - All FV's	127.0%	97.7%	98.6%	99.0%	106.4%
What If - FV's	62.0%	62.9%	51.6%	64.7%	61.4%
<b>Total - Base Case + What- IF</b>	<b>189.0%</b>	<b>160.6%</b>	<b>150.2%</b>	<b>163.7%</b>	<b>167.8%</b>

**T - VTRA 2010 : Potential Average # of m<sup>3</sup> Oil Outflow per Year**

Focus Vessel	Collisions	Power Groundings	Drift Groundings	Allisions	Total
Base Case - OilBarge	37.5	7.1	3.4	0.0	48.0
Base Case - Tanker	173.1	232.3	35.1	1.2	441.8
Base Case - Chem Carrier	19.0	13.7	2.6	0.0	35.3
Base Case - ATB	6.7	41.3	12.2	0.0	60.3
Base Case - All Tank FV's	236.3	294.5	53.4	1.2	585.3
Base Case - BulkCarrier	10.1	26.4	6.0	0.9	43.5
Base Case - Container	11.7	75.8	14.1	2.9	104.4
Base Case - Other Cargo	5.0	8.9	1.8	0.6	16.3
Base Case - All Cargo FV's	26.7	111.1	22.0	4.4	164.2
Base Case - All FV's	263.0	405.6	75.3	5.6	749.6
What If - FV's	128.4	261.2	39.4	3.7	432.7
<b>Total - Base Case + What- IF</b>	<b>391.4</b>	<b>666.7</b>	<b>114.7</b>	<b>9.3</b>	<b>1182.2</b>