



Pompano - Hurricane Ivan



VK989A (Pompano)

4 leg structure
(with 4 intermediate legs to -75' elev.)

12 skirt piles
(3 at each leg)

Water depth: 1284-ft*

Year installed: 1994

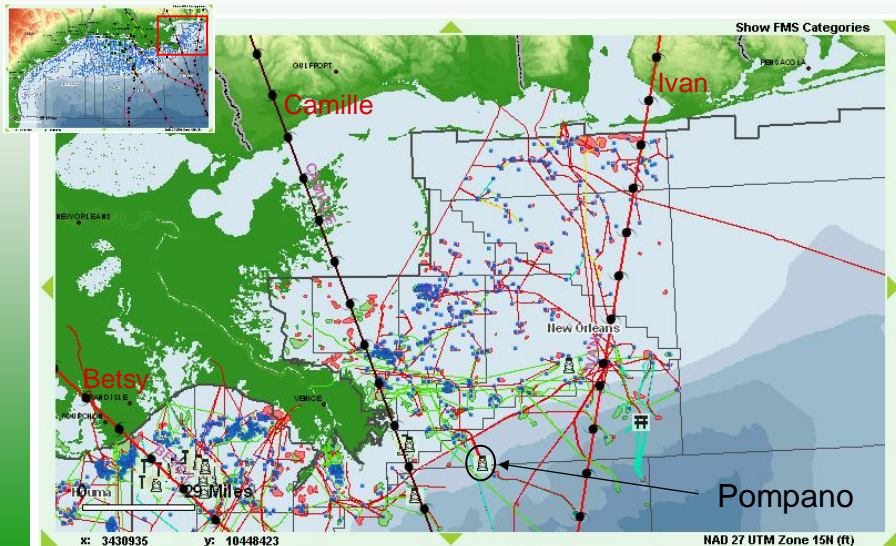
Long. -88°37'13.5"

Lat. 28°59'11"

*The bottom horizontal is at -1284' on the Row 1 side and -1276' on the Row 4 side to compensate for the seabed profile



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Hurricane Damage: -

- **Hurricane Ivan Damage to Pompano: -**
 - Top of jacket handrails majority missing
 - Cable trays & panels damaged on sub-cellar deck
 - Piping and equipment damaged on sub-cellar deck
 - Damaged & missing grating
 - Damage to lights



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Hurricane Ivan Damage (Sept 2004) – Pompano



Top of Jacket
Handrails missing

Damaged Cable
Trays
EL (+) 63 ft





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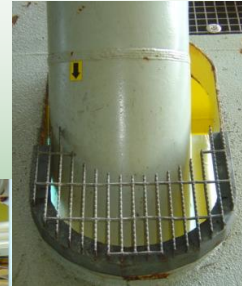


Hurricane Ivan Damage (Sept 2004) – Pompano



Sub-Cellar North Extension

Mica Pig Launcher shifted



Damage



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Hurricane Ivan Damage (Sept 2004) – Pompano



Sub-Cellar handrail damage

Sub-cellar East extension building damage



Sub-cellar deck light damage





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Hurricane Ivan Damage (Sept 2004) – Pompano



Sub-Cellar typical panel and ancillary piping damage

Sub-Cellar deck NW walkway minor lateral displacement



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Jacket Inspection Results

No damage or significant anomalies reported



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Assessment Criteria: -

- API RP2A 19th Edition design criteria
 - Base comparison to original design
- API RP2A 21st Edition Section 2 L-1 design criteria
 - Today's design criteria
- API RP2A 21st Edition Section 17 L-1 design & ultimate criteria
 - Today's assessment criteria
- Hurricane Ivan Criteria
 - Hindcast study upper bound



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Assessment results - base shear comparison (kips)

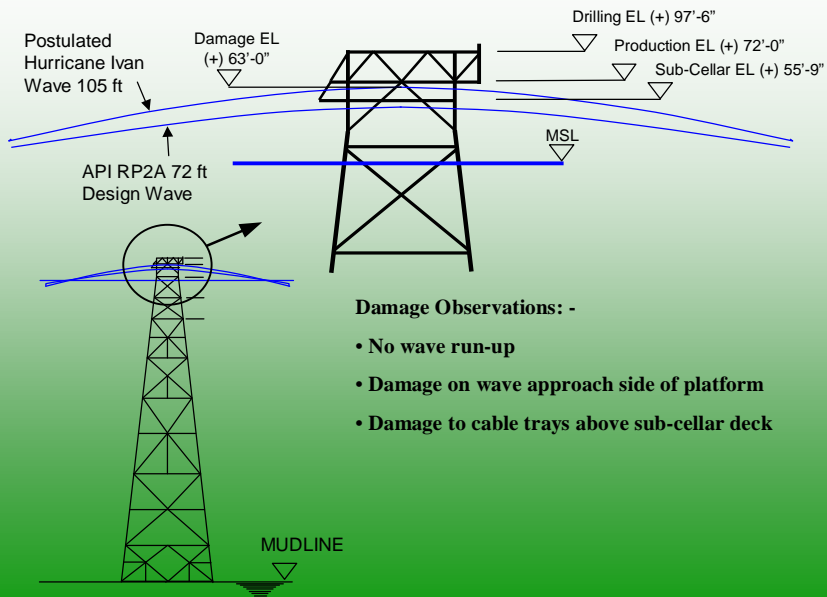
USFOS Analyses	End-on	Broadside	Diagonal
API 21st Section 17 Ultimate Criteria (74 ft Max)	12,713	10,662	13,932
API 21st Section 2 L-1 Design Criteria (71.2 ft Max)	11,401	9,632	12,535
API 19th Section 2 Design Criteria (72 ft Max)	11,931	11,900	11,665
API 21st Section 17 L-1 Design Criteria (57 ft Max) (H _{max} of 105 ft.)	8,273	7,664	8,286
Hurricane Ivan	21,926		



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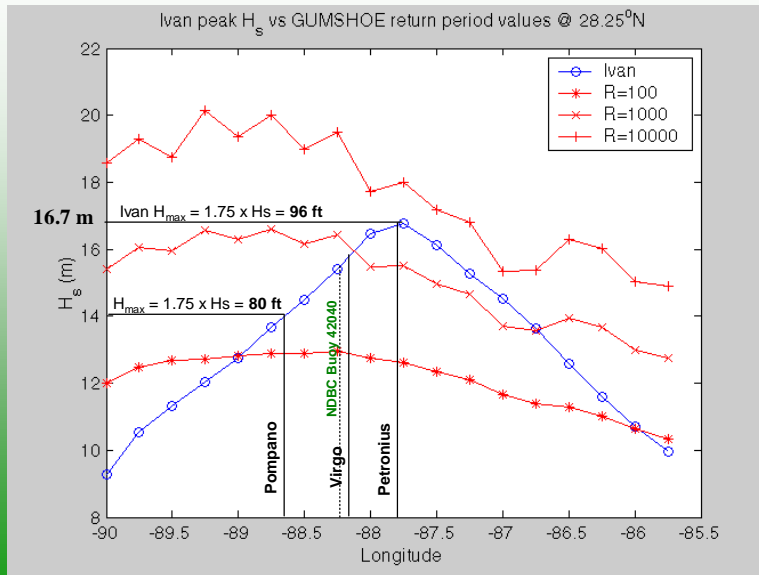




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Ivan Wave Observations: -

Pompano: -

- Observed damage to cable trays at EL (+) 63 ft.
- 3rd order stream function , 55% of wave above MSL
- Estimated wave height = 105 ft assuming 6ft tide & surge.
- Ultimate strength analyses correlate to Pompano surviving event.

Ivan Track at Virgo: -

- Observed damage to cable trays at EL (+) 70 ft.
- 3rd order stream function , 55% of wave above MSL
- Estimated wave height = 116 ft assuming 6ft tide & surge.



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Ivan Return Period: -

- 10,000 year return event considered not possible in GOM due to extremely low central pressure required.
- Return period estimated at 500 to 600 years using 1.8 multiplier. (Rough Engineering Estimate for 100 yr H_{max} = 113 ft)
- Return period estimated at 200 to 300 years using 2.15 multiplier.
- Using H_s multiplier of 2.15 provides good correlation with observed damage on Pompano and on Ivan storm track.



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Images from GIS Application for Hurricane Emergency Response Planning – 2004 Prototype

1. Hurricane Ivan Cat. 3 just North of Tobago
2. Ivan proceeding into GOM increasing to Cat. 4
3. Ivan making landfall as Cat. 3 hurricane



bp Integrated Planning Environment 2004 Demo
GIS Application for Integrated Planning, Integrity Management and Hurricane Emergency Response



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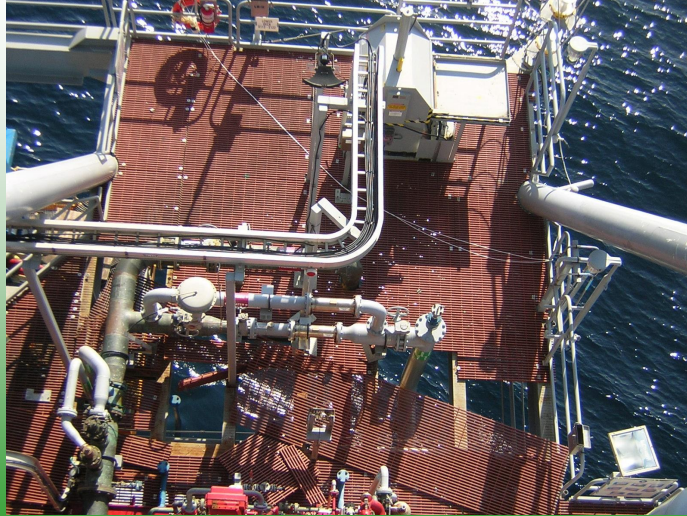


Nakika - Hurricane Ivan





Nakika - Hurricane Ivan



Grating Damage – SE Cellar Deck NE Mooring h Porch – H.R. & Grtg.



Nakika - Hurricane Ivan



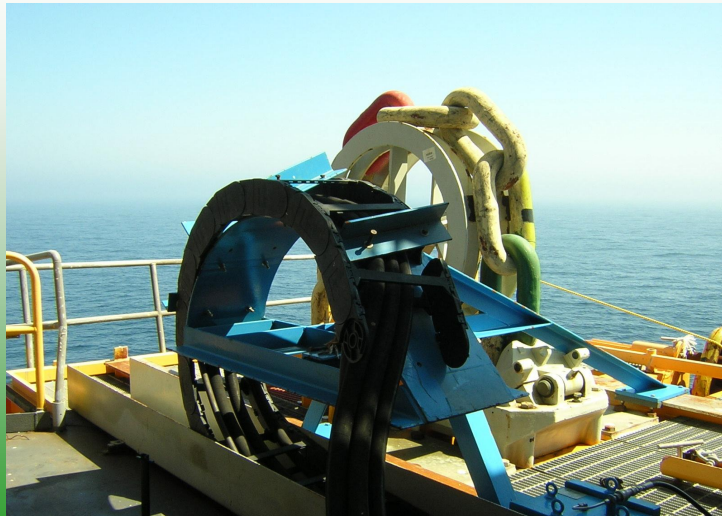
Damage NE Mooring Porch – Debris



Nakika - Hurricane Ivan



Nakika - Hurricane Ivan



NE Mooring Porch – Damage to Drag Chain Storm Brace SE Mooring Porch



Nakika - Hurricane Ivan



Hurricane Ivan



Points for discussion/consideration going forward: -

- API earthquake design practice considers both a design (strength) event and extreme survival (ductility) event, also draft API RP 2FB and ISO 19902
- Modern GOM fixed platforms considered likely to survive 1,000-yr event, 10,000-yr survival less likely or unknown?
- GOM fixed platforms have wave-in-deck for extreme storm waves between 100 & 1,000 year return period?
- What would be a suitable GOM survival event? 1,000-yr? What is that wave height? What are the associated wind and current?
- Should deck heights for fixed platforms be set to a survival criteria or alternatively platforms designed for wave inundation to this criteria? or are we ok with current practice ?.