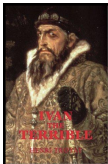


## 2005 Offshore Hurricane Readiness and Recovery Conference

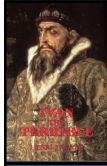
### Pipeline Failures Data Gathering

Tom Wicklund  
BP Pipelines NA  
July 27, 2005



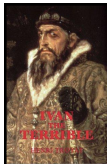
### Pipeline Team Focus

- How did pipelines on the OCS perform during Hurricane Ivan?
- Does pipeline performance data raise concern for the adequacy of current design standards?
- Did Ivan uncover pipeline installation or operational concerns that warrant further consideration?
- Was pipeline damage that resulted from Ivan different from historical experience in GoM?



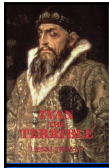
## Pipeline Data

- MMS pipeline damage data based on post Ivan NTL
- Detailed company data primarily provided by API team members (Shell, BP & Chevron)
  - Initial focus was on hurricane impacted lines;
  - Data collection effort expanded to include pipelines that performed well and were located within the swath



## Data Analysis

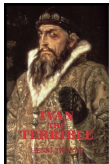
- MMS post Ivan data obtained by API team
- Pipeline operators modified data and reevaluated
- Performed comparison of pipeline operators data to MMS data
- Not prudent to draw firm conclusions regarding cause of failures (based on MMS data)



# Pipeline Failure Data Sheet

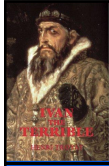
- Segment ID: \_\_\_\_\_
- Company: \_\_\_\_\_
- P/L Name \_\_\_\_\_
- Export or E&P \_\_\_\_\_
- GoM Block Location:\* \_\_\_\_\_
- Water Depth:\* \_\_\_\_\_
- Pipeline Diameter: \_\_\_\_\_
- Wall Thickness: \_\_\_\_\_
- Pipe Grade: \_\_\_\_\_
- Year Installed: \_\_\_\_\_
- Design Basis:(psig) \_\_\_\_\_
- Pipeline Orientation: (relative to shore)\* \_\_\_\_\_
- Pipeline Contents: \_\_\_\_\_
- Failure Mode: \_\_\_\_\_
- S.G. w/contents: \_\_\_\_\_
- Burial Depth: \_\_\_\_\_
- Horizontal Displacement Distance: \_\_\_\_\_
- Horizontal Displacement Length: \_\_\_\_\_
- Notes: \_\_\_\_\_
- Weight Coat \_\_\_\_\_ Type \_\_\_\_\_ Amount \_\_\_\_\_
- Mud Flow Area? \_\_\_\_\_ Yes \_\_\_\_\_ No \_\_\_\_\_
- Third Party Impact? \_\_\_\_\_ Yes \_\_\_\_\_ No \_\_\_\_\_
- Pipeline Crossing? \_\_\_\_\_ Yes \_\_\_\_\_ No \_\_\_\_\_

\* Specific location of failure or damage



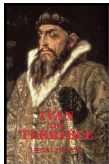
# Observations Regarding Failure Modes

- General observations
  - No predominant failure mode, pipelines experienced various types;
  - BP, CVX and Shell experienced similar types of failures;
  - Performance in traditional mud slide areas consistent with historical performance;
  - Many failures in the delta area, west of the swath of the storm;
- Failure modes
  - Large lateral displacement (several thousand feet);
  - Anchor line/chain drag damage;
  - Reefed or sunken vessels being moved onto pipelines;
  - Req'd separation lost at crossings;
  - Pipeline failed due to tension;
  - Only 1 riser was lost in shallow water



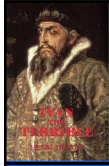
## Findings

- More data analysis is req'd to draw conclusions;
  - failures from Ivan does not seem to be atypical to historical
  - possible exception of the near-shore Mississippi River delta area
- Opportunities to explore:
  - Implications of disturbance and uplifting of sedimentation at the mouth of the river
  - New mudflow areas possibly identified as a result of Ivan
    - » May need to reconsider how we define mudflow areas
    - » Potential for better mapping of unstable areas
  - Implications of storm surge; ebb or run-off; and turbid flows on design criteria or pipeline configuration/orientation



## Path Forward

- Industry/government effort to identify/collect data critical to assessing pipeline performance
  - Understand possible factors which contributed to storm impact
  - Collect additional data required to perform analysis
    - » Damage/failures
    - » Mapping (pipe movement, mudslides, etc...)
- Expand make-up of API team to include representatives of oil and gas transmission companies and/or pipeline design consultants
- Pursue value added study or research opportunities
  - Geotechnical (mudslides, silting, seafloor mapping, etc..)
  - Storm trajectory impact on infrastructure configuration/orientation
- Outcome of pipeline performance assessment should determine need to revise pipeline standards



## Immediate Needs

- Additional participants on API team\*
- Industry data
  - Sonar/mapping data
  - Failure data

\*contact any current team member