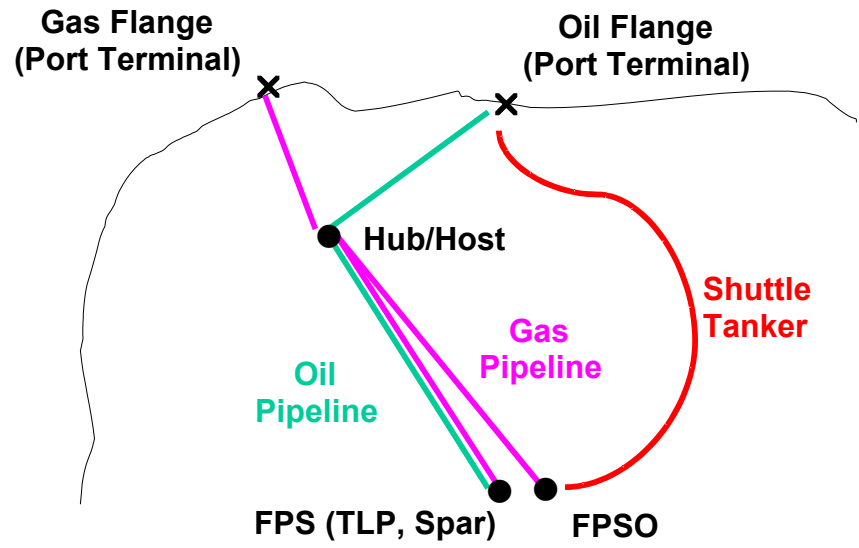


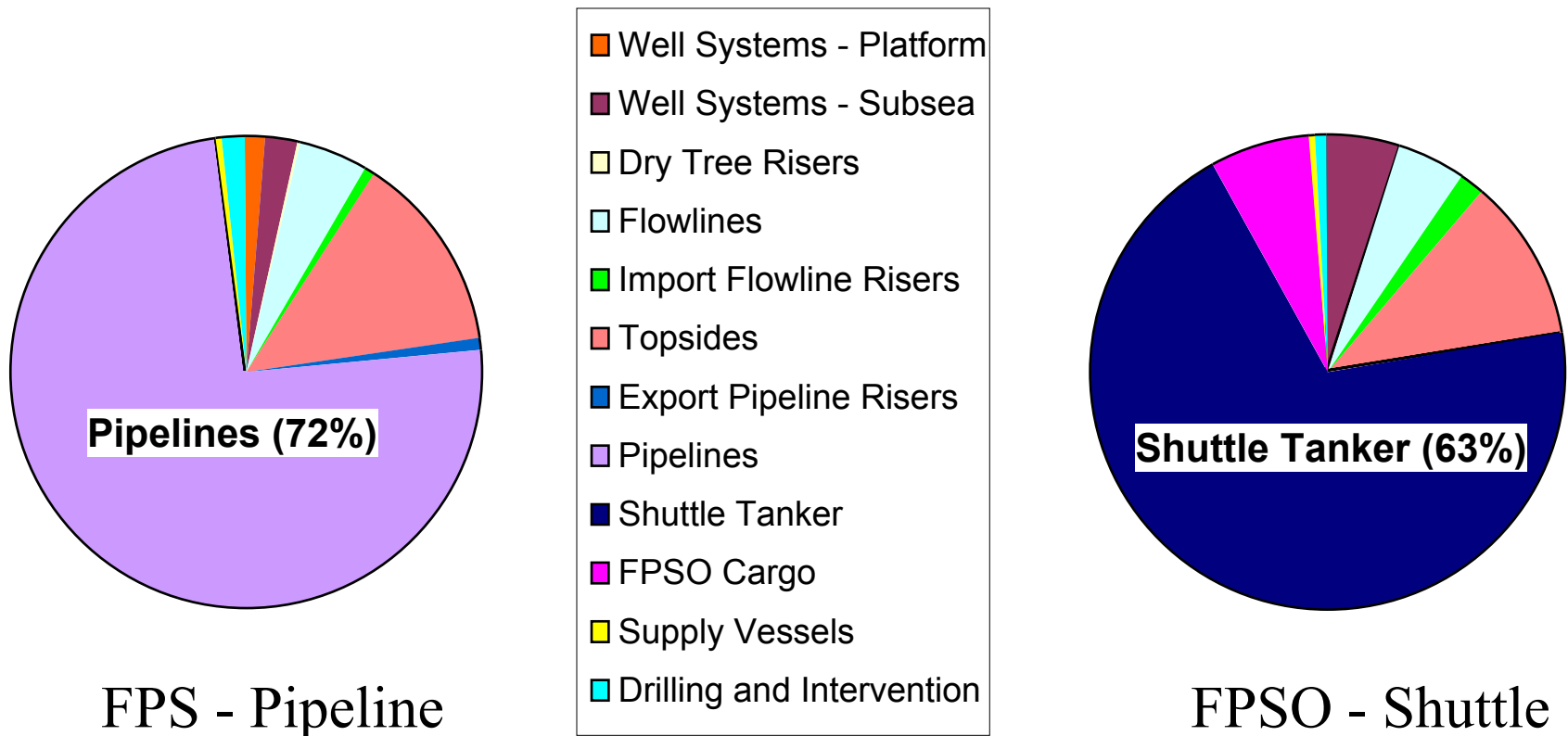
# Comparative Risk Analysis of Deepwater Production Systems



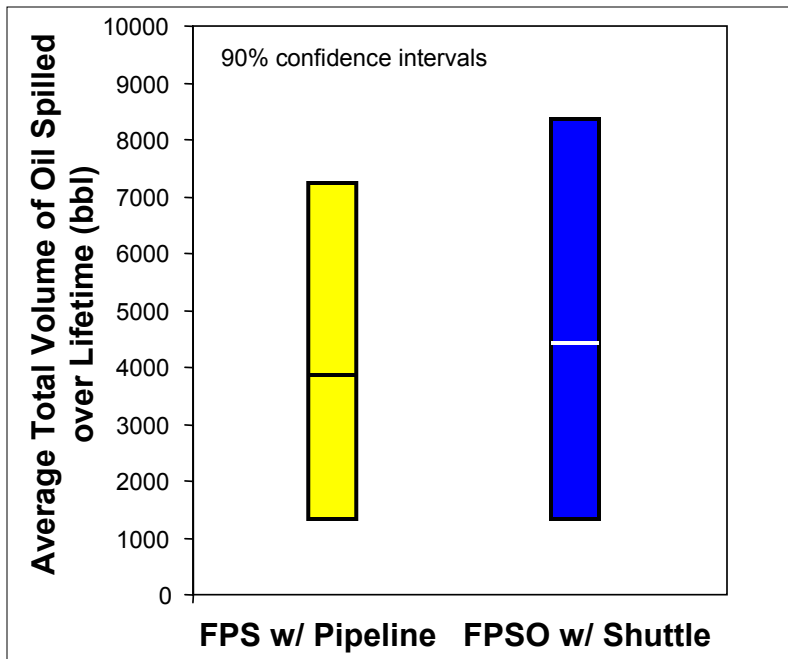
- Study for MMS by OTRC
- FPSO vs. existing FPS's
- 150,000 BOPD
- Complete assessment of systems & operations throughout 20-year production life
- Risks – fatalities & oil spills
- Regulators
  - MMS
  - USCG
- DeepStar
  - Operators
  - Contractors
  - Class Societies



# Contribution to Average Total Oil Spill Volume Versus Spill Source



# Oil Spill Risks in Gulf of Mexico



- Comparable for FPSO's & FPS's
- Dominated by rare, large spills.
- Dominated by transportation systems (pipelines and shuttle tankers).
- Large uncertainties
  - ~ order of magnitude
  - limited historical data

# Transportation Oil Spill Risks



## Shuttle Tankers

- Risk  $\propto$  number of docking calls at port and in field
- Maximum credible spill size  $\sim$  150,000 bbl
  - tank compartmentalization
- Large spills due to collisions and explosions

## Pipelines

- Risk  $\propto$  length & time of exposure
- Maximum credible spill size  $\sim$  30,000 bbl
  - operational constraints
  - large hydrostatic pressures
  - undulating seafloor
- Large spills due to impact and snagging

# Transportation Oil Spill Data



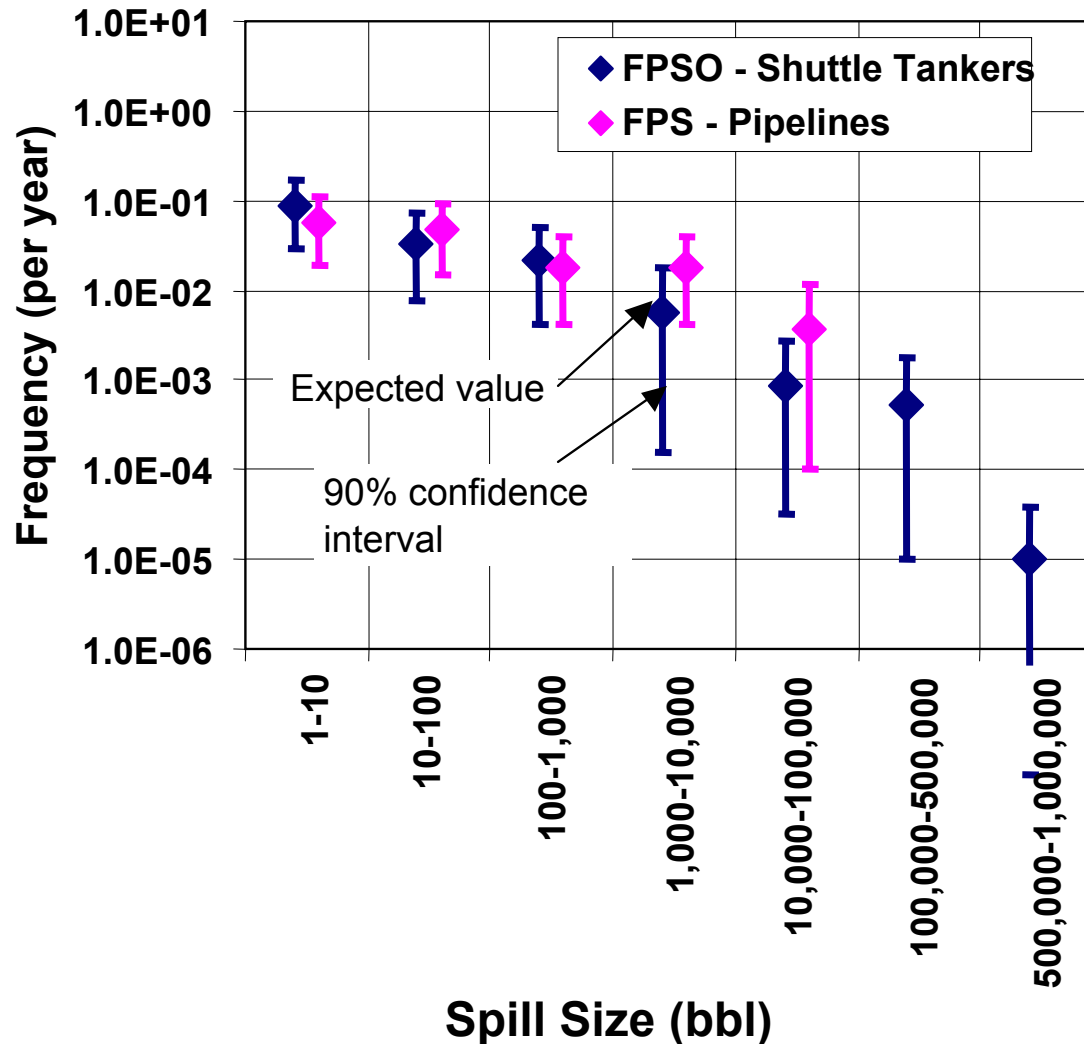
## Shuttle Tankers

- GOM Data
  - Used >1992 data
  - OPA 90 significant change
  - <1992 not representative of current operations
- World Data
  - Spill frequency ~ 40 x GOM
  - Reasons
    - Stricter regulatory environment
    - Milder environment
    - Less grounding risk
    - Less congested waterway
    - Newer vessels
    - Smaller shuttle tankers

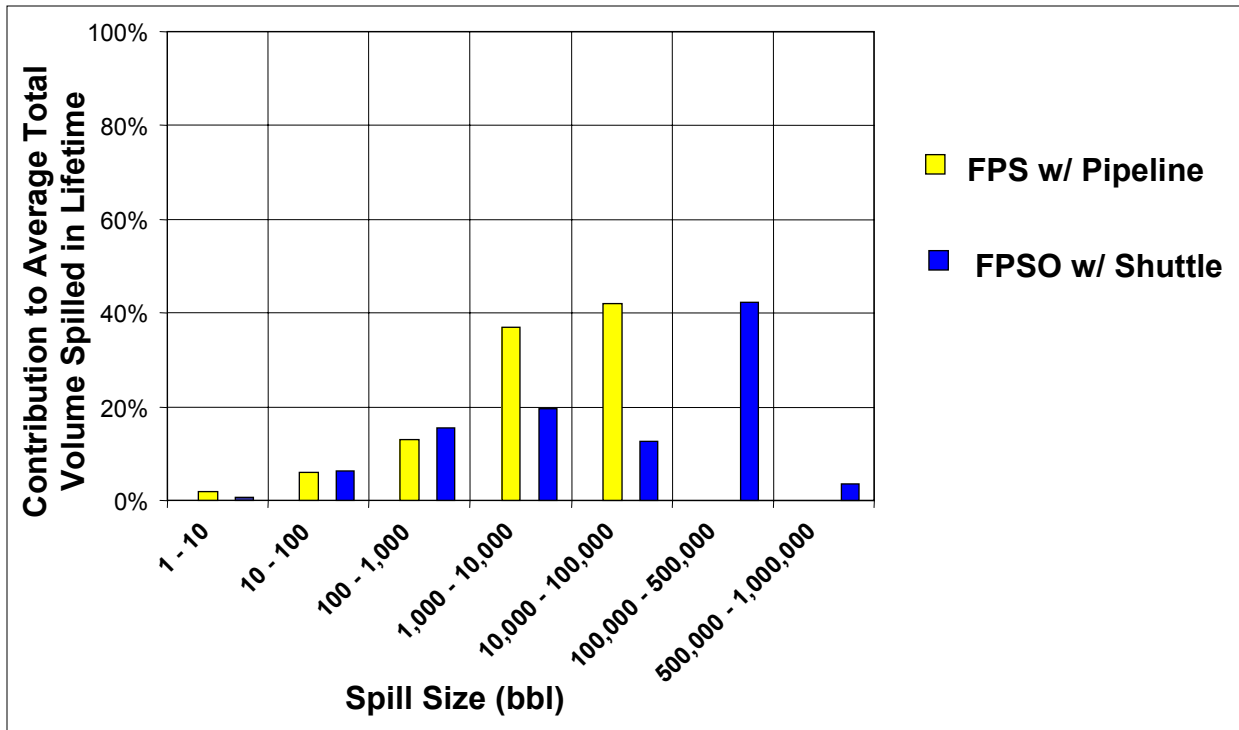
## Pipelines

- GOM Data only
  - Used > 1990 data
  - API RP14C significant change
  - < 1990 not representative of current operation

# Comparison of Transportation Systems



# Lifetime Oil Spill Statistics



Expected Return Period (years) vs. Spill Size							
System	1 - 10 bbl	10 - 100 bbl	100 - 1,000 bbl	1,000 - 10,000 bbl	10,000 - 100,000 bbl	100,000 - 500,000 bbl	500,000 - 1,000,000 bbl
FPS	0.8	3	15	60	580	Not Credible	Not Credible
FPSO	3	3	12	110	2,500	4,700	300,000