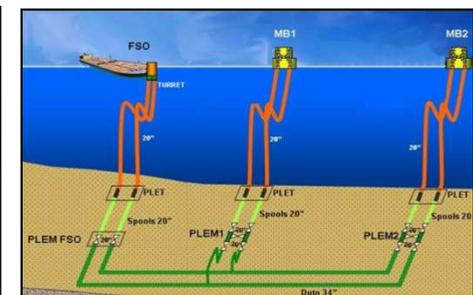
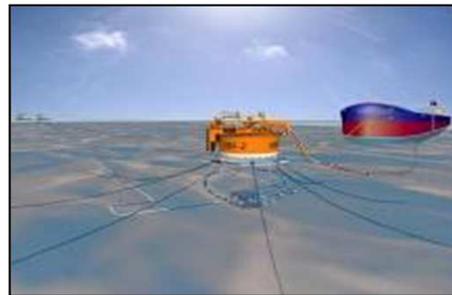


Gerência Geral Offshore

Risk Analysis of oil transfer by Monobuoy with or without Marine Breakaway Coupling -
MBC installed at hoses.



November - 2012

- ▶ Objective;
- ▶ Evaluated Risks;
- ▶ Premises;
- ▶ Risk Qualitative Analysis;
- ▶ Risk Quantitative Analysis:
 - Oil Spill Frequency;
 - Enviromental Polution Risk;
 - Safety Risk;
- ▶ Conclusion

Objective

- ▶ Risk Analysis of oil transfer operation by monobuoy São Francisco do Sul Terminal (TEFRAN) and Osório Terminal (TEDUT), with or without Marine Breakaway Coupling - MBC installed at hoses.
- ▶ Use of Det Norske Veritas - DNV;
- ▶ Not technical analysis of breakaway equipment;
- ▶ Statistical Analysis;

Evaluated Risks

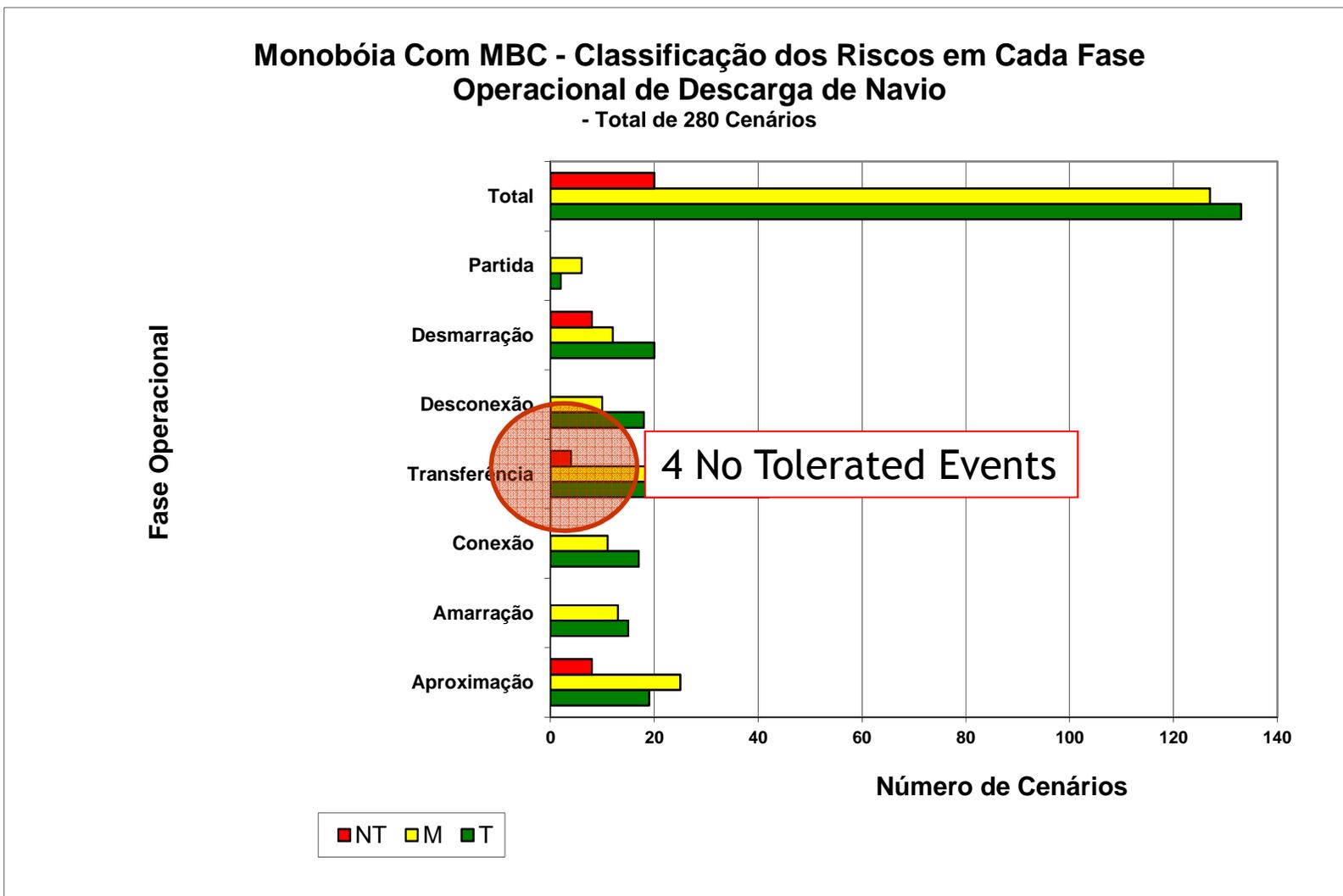
Categorias de Risco	Tipo de Avaliação
Safety	Qualitative (PETROBRAS risk matrix) and Quantitative
Enviroment	Qualitative (PETROBRAS risk matrix) and Quantitative
Damage and Production Stoppage	Qualitative (PETROBRAS risk matrix) and Quantitative
Image	Qualitative (PETROBRAS risk matrix))

Premises

Risk Qualitative Analysis

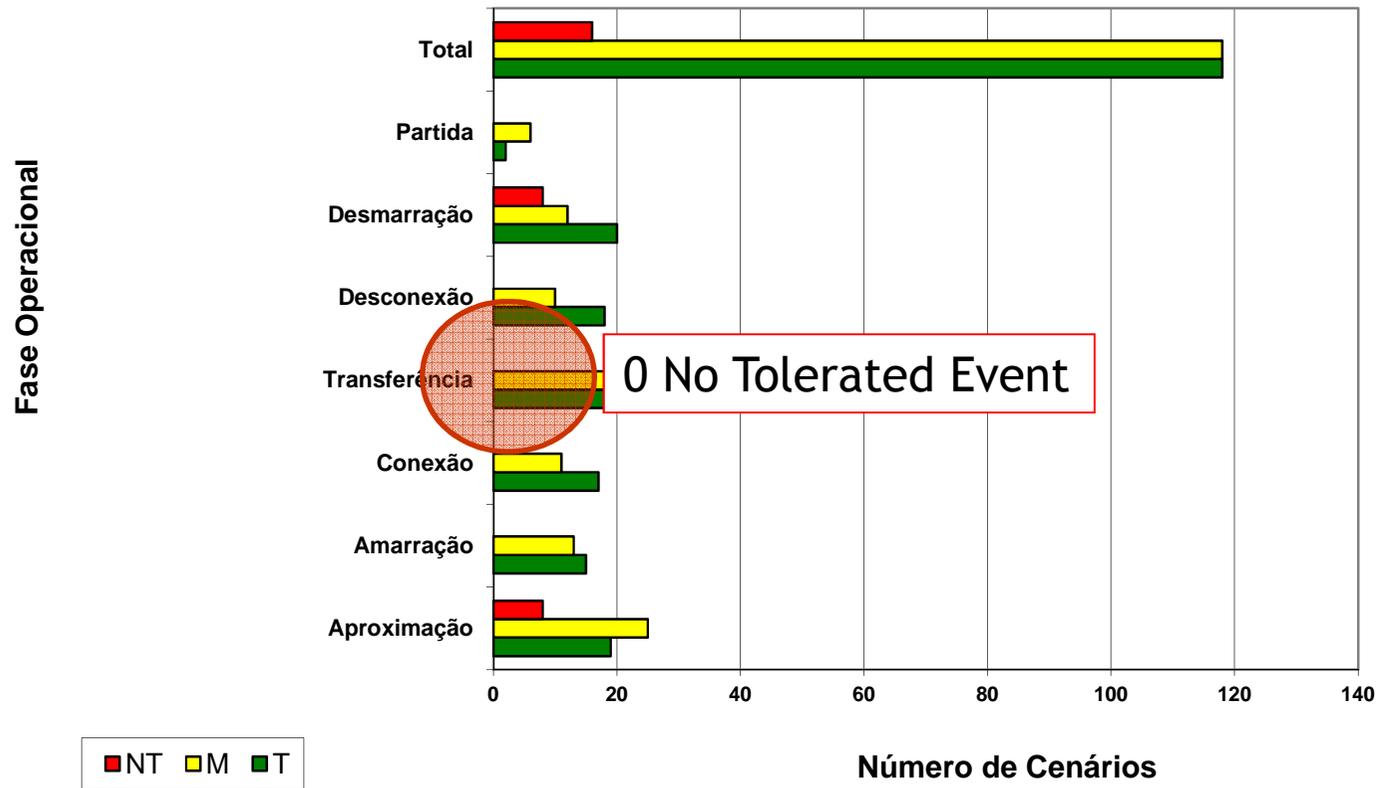
Risk Preliminary Analysis (APR) of Oil Transfer Operation
with or without MBC

With Breakaway



Without Breakaway

Monobóia Sem MBC - Classificação dos Riscos em Cada Fase Operacional da Descarga de Navio
 - Total de 252 Cenários

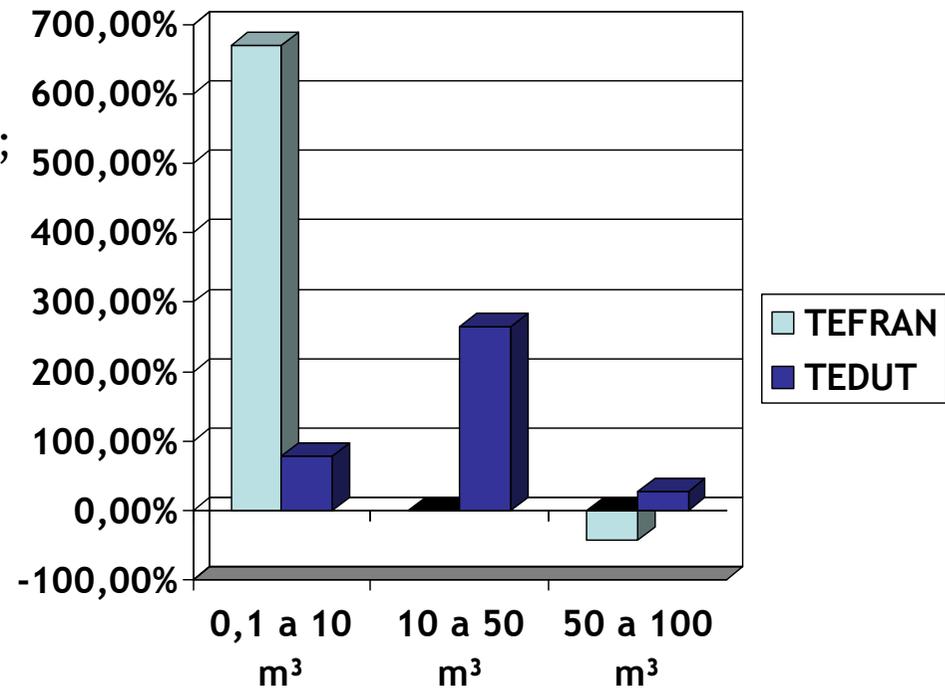


Risk Quantitative Analysis

Oil Spill Frequency

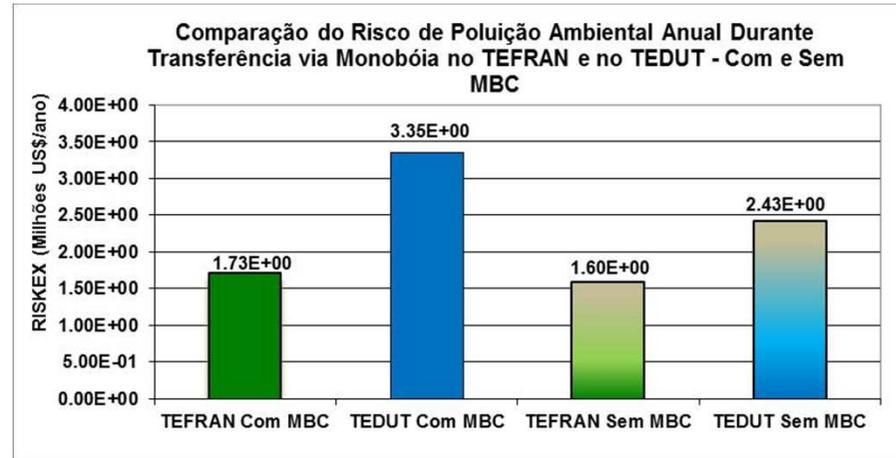
- ▶ TEFRAN:
 - Increase 672,2% between 0,1 e 10 m³;
 - Decrease 42,5% between 50 e 100 m³;

- ▶ TEDUT:
 - Increase 78,3% between 0,1 e 10 m³;
 - Increase 264,9% between 10 e 50 m³;
 - Increase 27,4% between 50 e 100 m³.



Environmental Pollution Risk

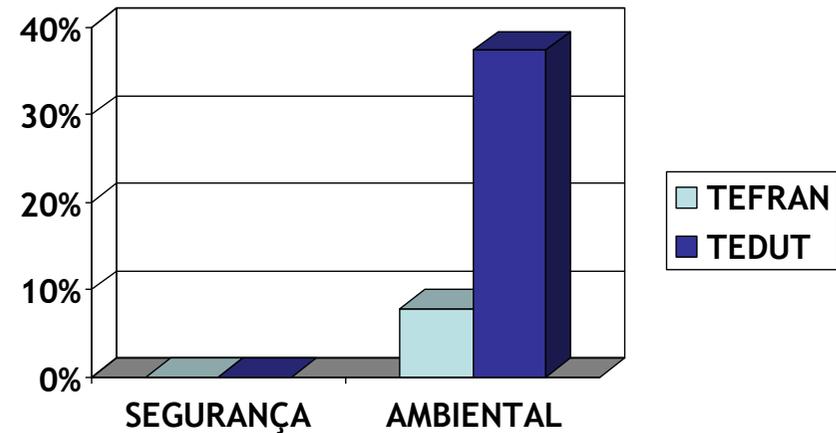
- ▶ TEFRAN:
 - Increase 7,8%;
- ▶ TEDUT:
 - Increase 37,4%;



Safety Risk

- ▶ TEFRAN:
 - No contribution;
- ▶ TEDUT:
 - No contribution;

AUMENTO DE RISCOS

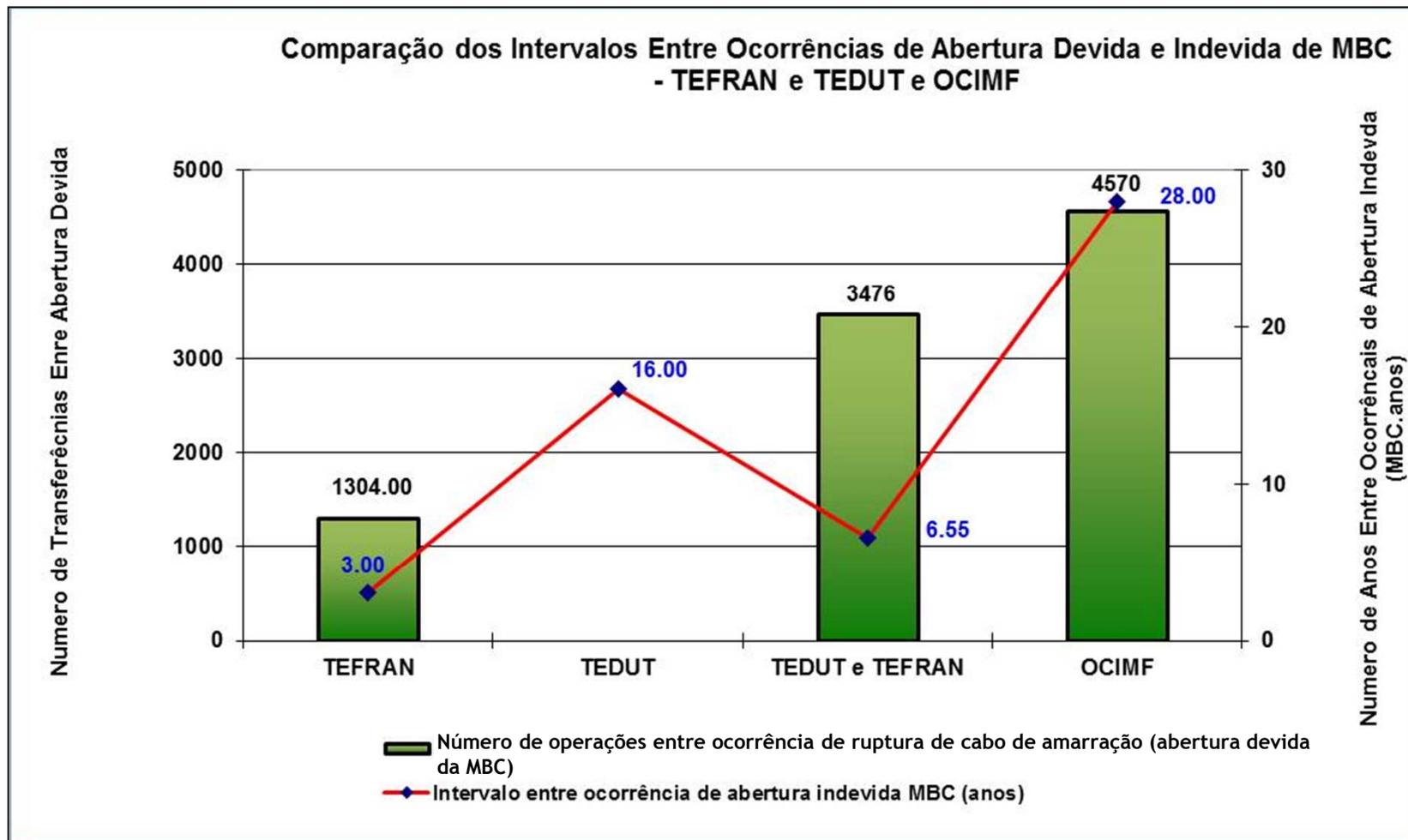


- ▶ Contribution to increase the **frequency with** MBC:
 - Oil Spill Hoses- MBC;
 - Small oil spill at monobuoy;
 - Ship's oil spill;
 - Ship's colision with monoboy and hoses;

- ▶ Contribution to increase the **frequency without** MBC:
 - Small oil spill at monobuoy;
 - Ship's oil spill;
 - Oil Spill Hoses- Mooring Line Rupture;
 - Ship's colision with monoboy and hoses;

- ▶ Contribution to increase the **risk (riskex) with** MBC:
 - Oil Spill Hoses- MBC;
 - Ship's colision with monoboy and hoses;
 - Oil Spill at PLEM;

- ▶ Contribution to increase the **risk (riskex) without** MBC:
 - Ship's colision with monoboy and hoses;
 - Oil Spill Hoses- Mooring Line Rupture;
 - Oil Spill at PLEM;



Conclusion

- ▶ The current project of *Marine Breakaway Coupling* is not efficient to reduce oil pollution risk at Transpetro Terminals;
- ▶ To avoid new oil spills caused by unexpected opening, it was suggested the removal of Marine Breakaway Coupling, with mitigation procedures:
 - Mooring Line and chain stopper specified by OCIMF; ✓
 - Stand by Ship with Mooring Master all time onboard; ✓
 - Mooring Line replacement considering cycles of operation; ✓
 - Enviromental Monitoring; ✓
 - Stand by Tugboat; **TEFRAN** ✓ **TEDUT - Hiring**
 - Active Monitoring Tension at Mooring Line **In aquisition**