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Per Well P&A Cost

Apples, Oranges, and Opinions

Per Well P&A Cost – The Basic Questions

- Why Is This Number Important?
- What Is the Real Cost to Plug and Abandon a Well in the Gulf of Mexico?
- What Are the Critical Factors That Make Up That Cost?
- Why Are Some Company's P&A Estimates So Much Higher Than Others?
- What's the Cost if We Don't Get the P&A Right the First Time?

Per Well P&A Cost

- Base Assumptions
  - Gulf of Mexico Shelf Wells Only
  - Performed to BOEMRE Standards as a Minimum
  - Excluding Subsea Wells
  - Excluding Downed Platform Wells

Per Well P&A Cost

- Why Is This Number Important?
  - Used for AFEs
  - Used for Project and Lease Economic Decisions
  - Used in Acquisition and Divestment Decisions
  - Roles Up Into the Decommissioning Liability Estimates on Each Company's Books (provided to Securities and Exchange Commission)
  - Used for Turnkey P&A Quotes
  - Used to Evaluate Performance

Per Well P&A Cost

- What Is the Real Cost to Plug and Abandon a Well in the Gulf of Mexico?
  - $ 130,000 ?
  - $ 250,000 ?
  - $ 750,000 ?
  - $ 1,500,000 ?
  - $ 5,000,000 ?

Per Well P&A Cost

- What Is the Real Cost to Plug and Abandon a Well in the Gulf of Mexico?
  - $ 130,000 ?
  - $ 250,000 ?
  - $ 750,000 ?
  - $ 1,500,000 ?
  - $ 5,000,000 ?
- Our Opinions Are Based in
  - Our Experiences (Apples and Oranges)
  - Our Need to Convince Someone That Our Answer Is Right

Per Well P&A Cost

- What Is the Real Cost to Plug and Abandon a Well in the Gulf of Mexico?
  - $ 130,000 ?
  - $ 250,000 ?
  - $ 750,000 ?
  - $ 1,500,000 ?
  - $ 5,000,000 ?
- The Real Answer Is a Curve for Each Company.
  - The Range of Costs on that Curve Depends on
    - Well Conditions Experienced (Intervention Cases Experienced)
    - Each Company's Execution Standards

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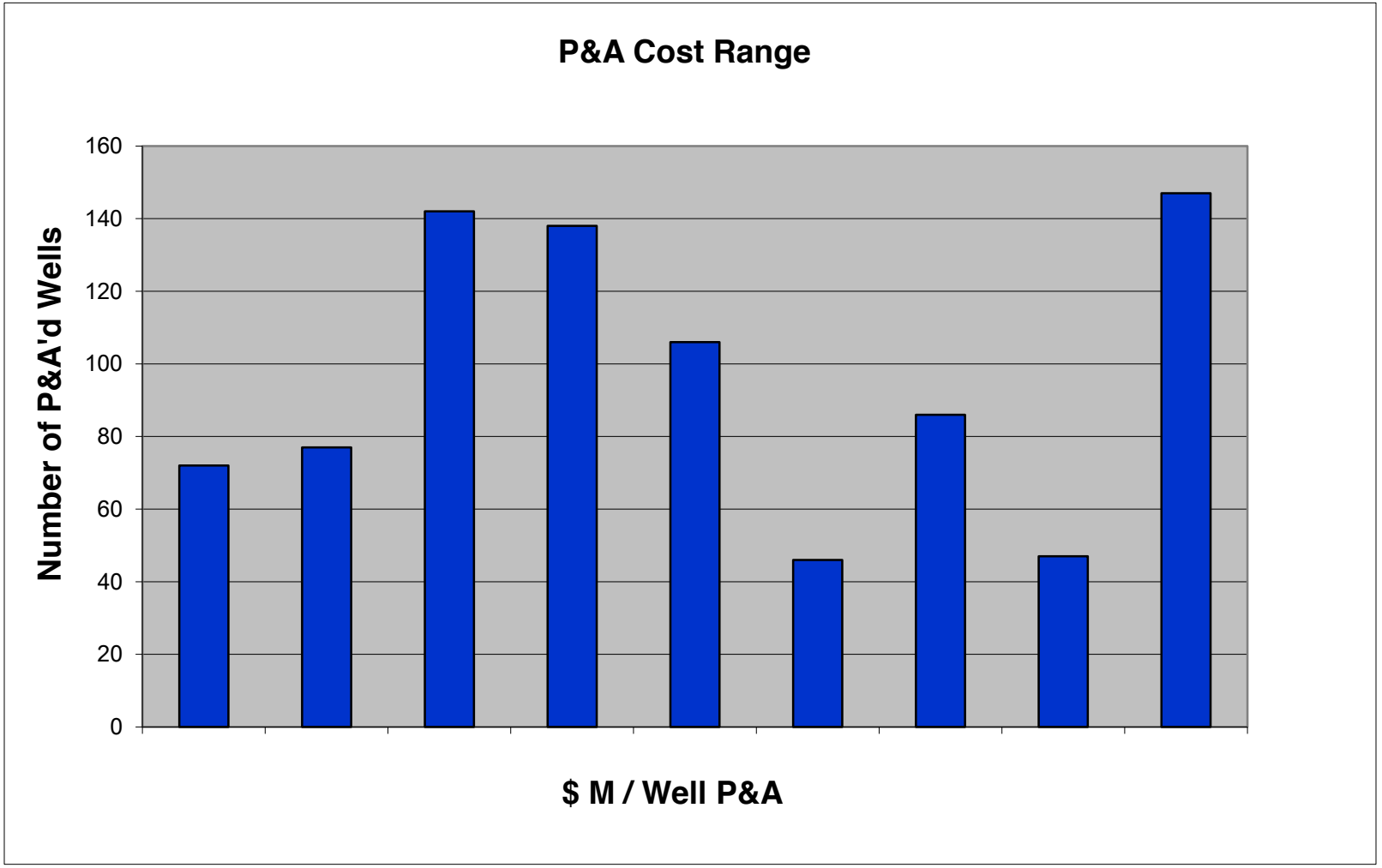
Per Well P&A Cost – Actual Spread



5 Years of Data – 861 Wells Total

Per Well P&A Cost

- What Are the Critical Factors That Make Up That Cost?
  - Single Well vs. Multiple Well Operations
  - Accessibility (Lift Boat Required?)
  - Conductor Recovery with P&A or with Derrick Barge
  - Intervention Requirements
  - Execution Standards

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Critical Factors – Per Well P&A Cost

- Single Well vs. Multiple Well Operations
  - Single Well
    - Waiting on Cement (WOC) Time Is on the Critical Path
    - Problem Time Is on the Critical Path
  - Multiple Well
    - Work on Other Well(s) While WOC
    - Work on Other Well(s) While Resolving Issues on the Problem Well

Critical Factors – Per Well P&A Cost

- Accessibility
  - Platform with Sufficient Quarters and Crane
  - Platform Requiring Rental Quarters and/or Crane
  - Location Requiring Lift Boat Access
  - Location Requiring DP Boat as Tender (too deep for lift boat and too small for rental camp)
  - Location Requiring Jack Up Rig Access (not required by well conditions or company execution standards)

Critical Factors – Per Well P&A Cost

- Conductor Recovery with P&A or with Derrick Barge
  - With P&A at End of Plugging Operation
    - Mechanical Cutting or Abrasive Cutting
  - With Derrick Barge at Time of Platform Removal
    - Explosive Severing or Abrasive Cutting

Critical Factors – Per Well P&A Cost

- Intervention Types
  - Slickline Intervention
  - Braided Wire Intervention
  - Coiled Tubing Intervention
  - Snubbing / HWO Intervention
  - Section Milling (to eliminate bubbles in cemented annuli)
  - Rig Intervention

Critical Factors – Per Well P&A Cost

- Intervention Causes
  - Wellhead Valves Stuck or Leaking
  - Safety Valve Flapper Stuck or Won't Stay Open
  - Stuck Plugs
  - Deep Fish
  - Shallow Fish
  - Lost Wire in Tubing
  - Holes in Tubing
  - Holes in Casing
  - Holes in Conductor and /or Drive Pipe

Critical Factors – Per Well P&A Cost

- Intervention Causes (Continued)
  - Parted or Corkscrewed Tubing
  - Mud Behind Tubing
  - Sand in Tubing
  - Paraffin in Tubing
  - Scale in Tubing
  - Sustained Casing Pressure – Production Casing
  - Sustained Casing Pressure - Intermediate Casing
  - Sustained Casing Pressure (Bubbles) – in Cemented Annuli

Critical Factors – Per Well P&A Cost

- Execution Standards Vary by Company
  - Technical Specifications
  - Operational Standards
  - HSE Standards
  - Accounting Accuracy and Overhead

Critical Factors – Per Well P&A Cost

- Technical Specifications - Examples
  - Number of Cement Plugs (BOEMRE Minimum or More)
  - Use of Mechanical Plugs (CIBPs and Cement Retainers)
  - Length of Cement Plugs
  - Cement Slurry Design and WOC Time
  - Pressure Testing Only or Bubble Testing Too
  - Dual Barrier Policy
  - BOP Use
  - Rig Use

Critical Factors – Per Well P&A Cost

- Operational Standards - Examples
  - Traditional Multi-Tasking 5 Man P&A Team vs. Individual Services
  - Rigorous Application of Batch P&A Process
  - Daylight or 24 Hour Operations
  - Winter Work or Summer Only
  - Number of Personnel on Site / Bed Space Requirements
  - Work Space Requirements
  - Explosive Cutting of Casing Not Allowed

Critical Factors – Per Well P&A Cost

- HSE Standards - Examples
  - Safety Meeting and JSEA Frequency and Duration
  - No Rush Philosophy
  - Torches or No Torches
  - Full Time Safety Consultants on Location
  - Only Twin Engine Helicopters with Two Pilots

Per Well P&A Cost

- Accounting Accuracy and Overhead
  - Total Cost = Days on Location x Cost Per Day + . . .
    - Items Purchased on the Beach That Don't Make It Onto the Field Estimate
    - Dock Charges (Including Fuel and Water)
    - Transportation Charges (Boats, Helicopters Trucking)
    - Office Overhead (Project Management, Engineering, etc.)
  - Accounting Values Typically 15% Higher Than Field Est.

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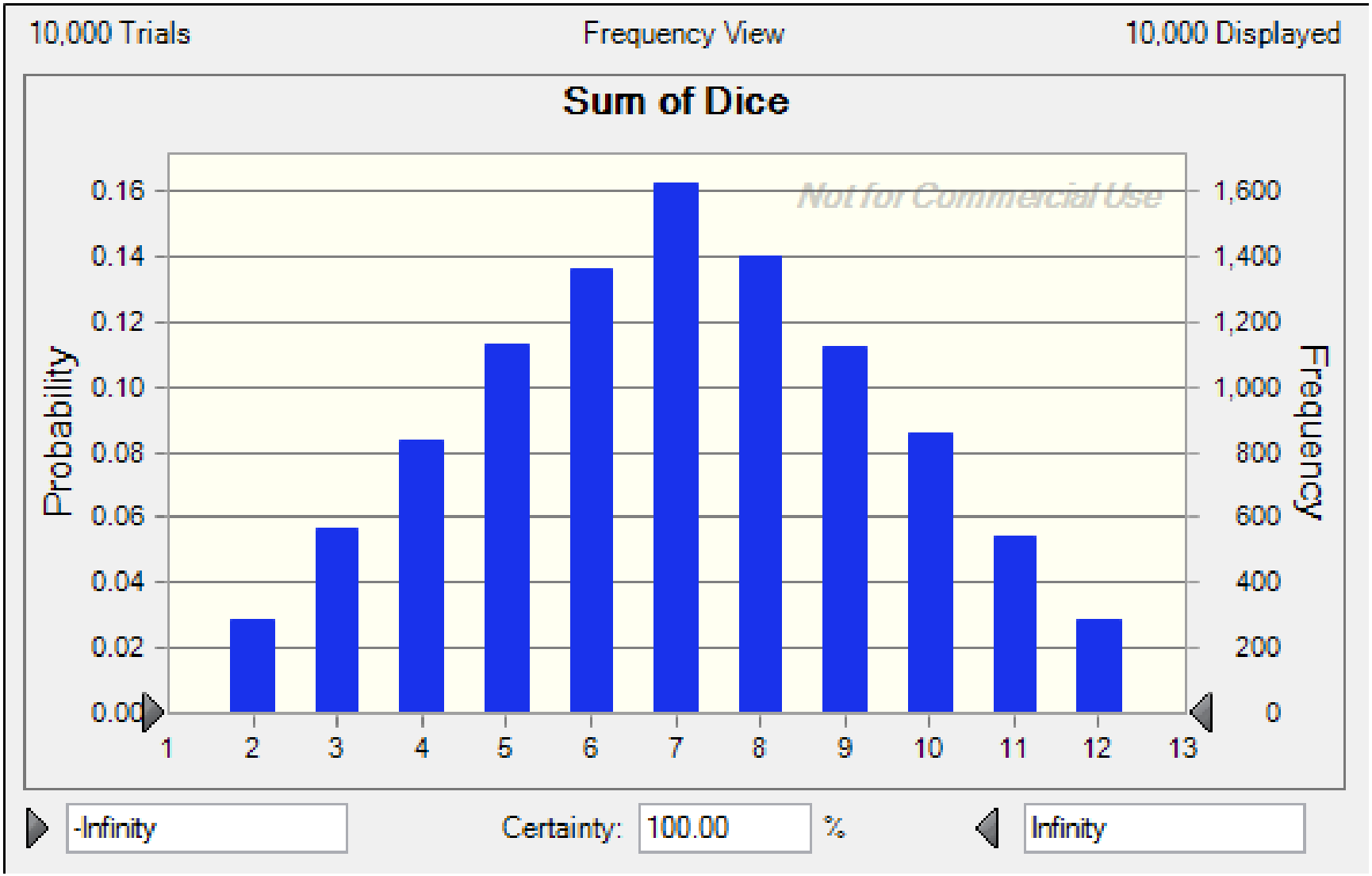
Monte Carlo Simulation



P&A Cost Distribution Input Data

				Days				Day Rate			
	Probability		Min	Most Likely	Max		Min	Most Likely	Max		Subtotal
Base P&A Cost	100%		6	7	10	0	32,500	35,000	37,500	0	0
										Total	0

Range in P&A Days Takes Into Account Variables Such As:

1. **Single Well Location vs. Multiple Well Location**
2. **Singles vs. Dual Completion**
3. **Well Depth**
4. **Weather Impacts**
5. **Time to Prepare a Location for P&A**

Range in Cost Takes Into Account Variables Such As:

1. **Whether or Not Rental Camp and Rental Crane Is Needed**
2. **Differences in Supply Vessel Costs**

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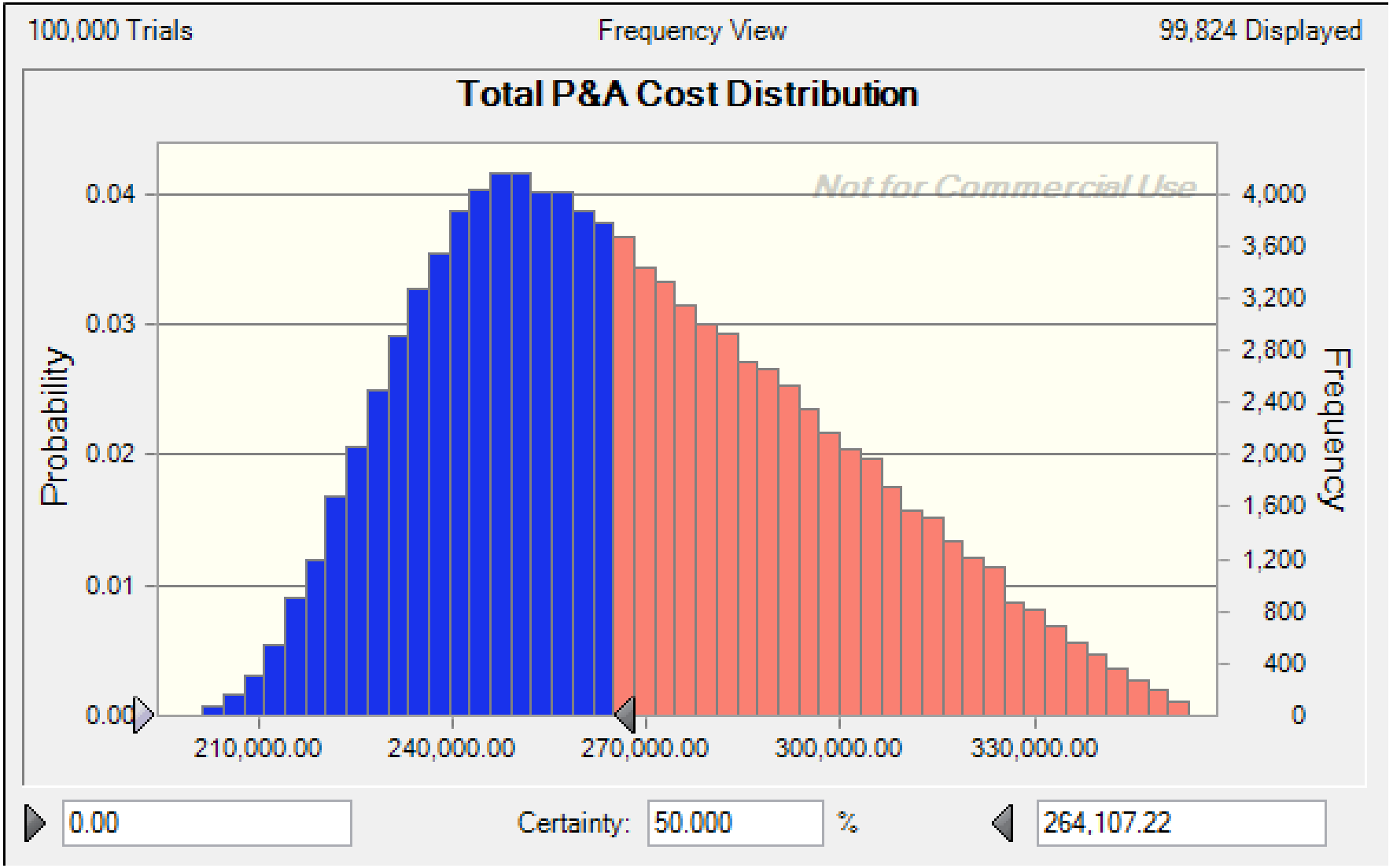
Base P&A Case Cost Distribution



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	Probability		Min	Most Likely	Max		Min	Most Likely	Max		Subtotal
Base P&A Cost	100%		6	7	10	0	32,500	35,000	37,500	0	0
Liftboat Operations	45%	0	6	7	10	0	6,500	14,000	44,000	0	0
										Total	0

Probability – Percentage Representing the Number of Times Per 100 Wells That We Have to Perform That Task

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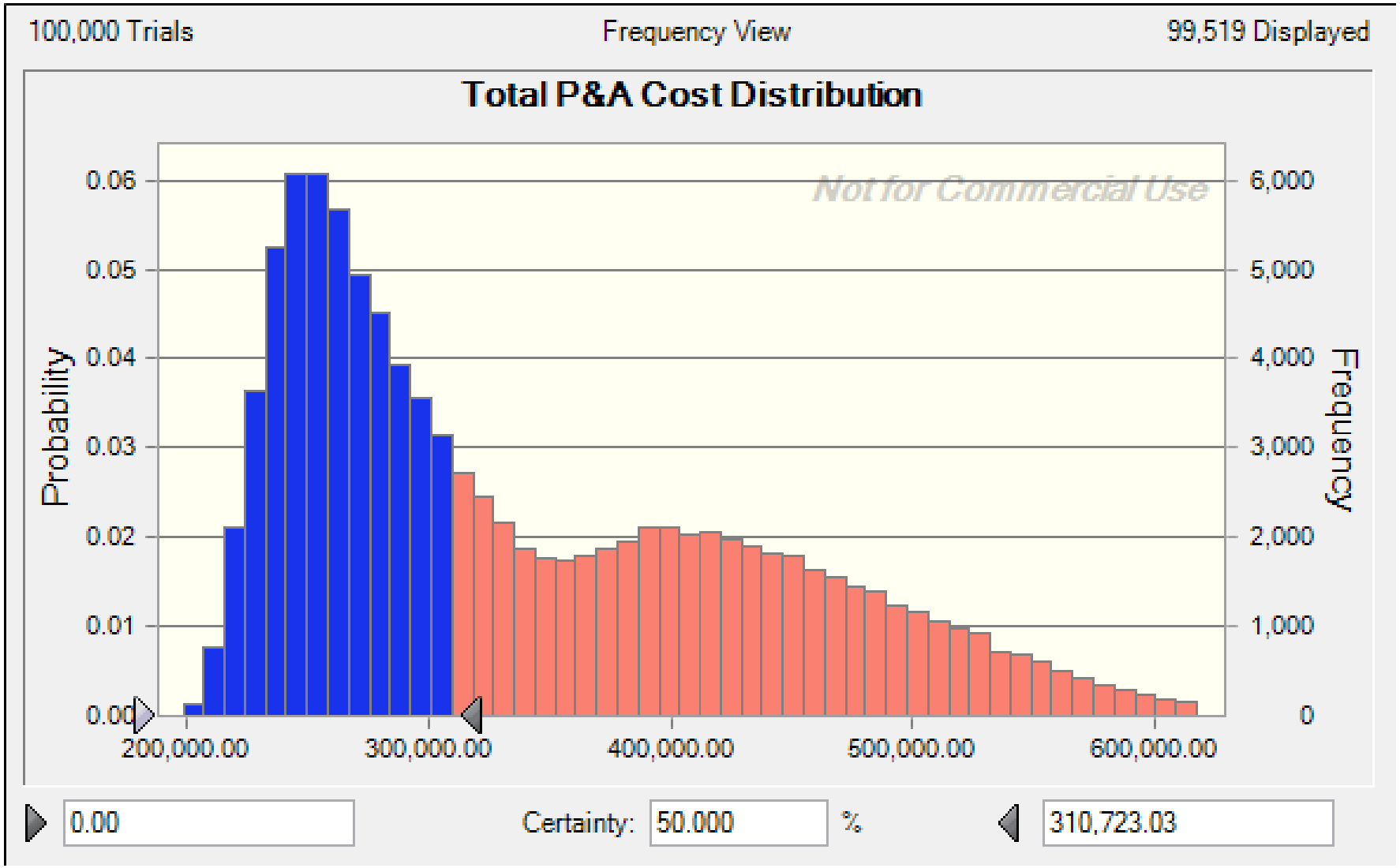
Cost Distribution with Liftboats



P&A Cost Distribution Input Data

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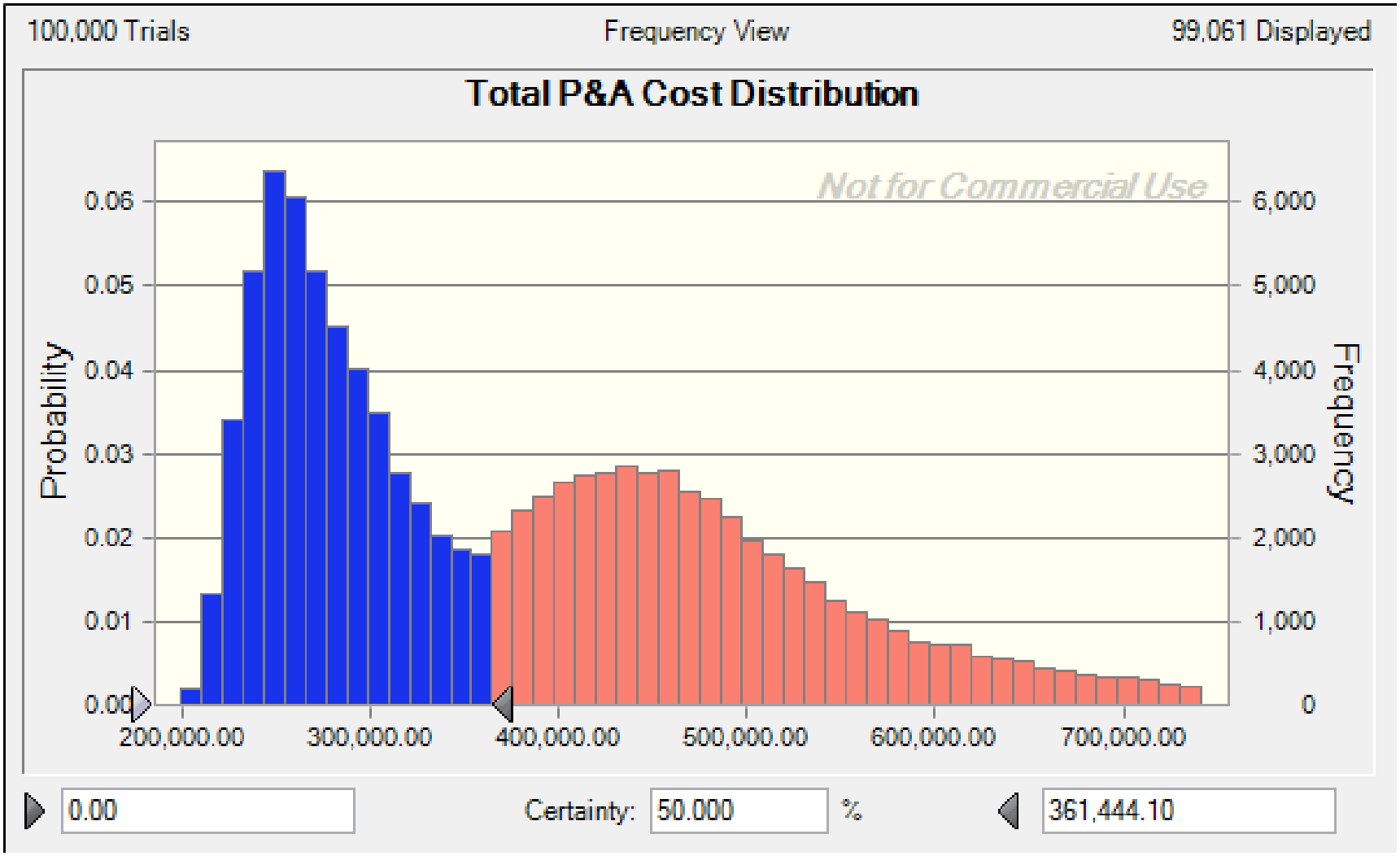
Base P&A Cost	100%		6	7	10	0	32,500	35,000	37,500	0	0
Liftboat Operations	45%	0	6	7	10	0	6,500	14,000	44,000	0	0
Conductor Removal Ops	20%	0	2	3.5	5	0	50,000		64,000	0	0
										Total	0

Cost Distribution with Conductor Removal



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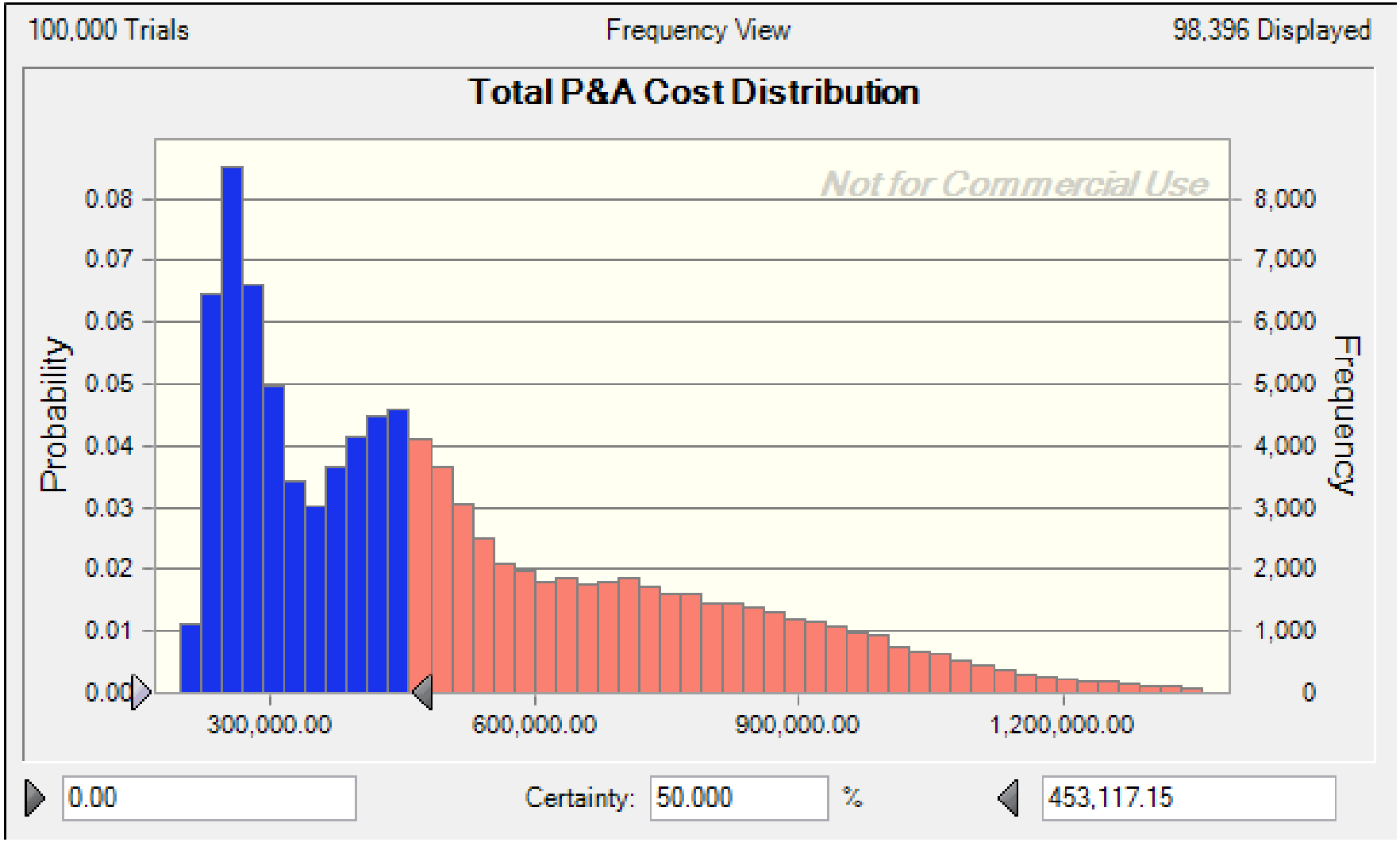
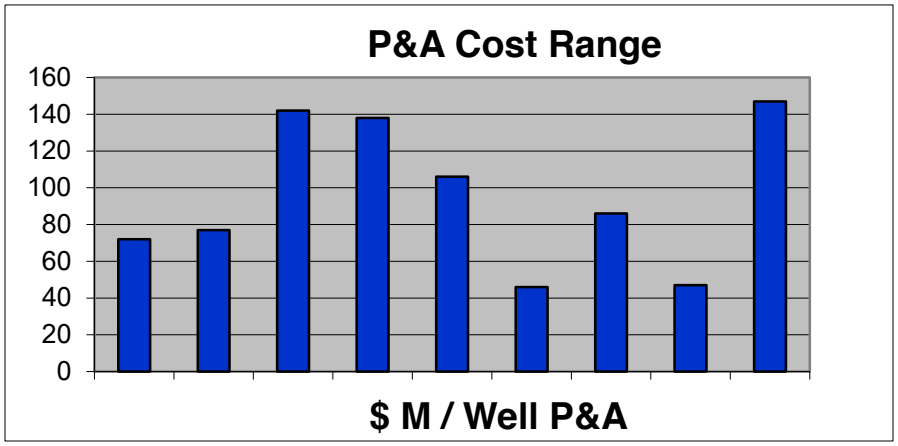
Conductor Removal Ops	20%	0	2	3.5	5	0	50,000		64,000	0	0
Slickline Fishing	10%	0	1	3	7	0	35,000		49,000	0	0
Braided Line Fishing	2%	0	1	3	7	0	40,000		54,000	0	0
Coiled Tubing Operations	20%	0	5	7	10	0	55,000		69,000	0	0
Snubbing Operations	0.50%	0	8	10	12	0	60,000		74,000	0	0
Section Milling Operations	5%	0	5	7	14	0	50,000		64,000	0	0
Rig Operations	1%	0	7	9	16	0	100,000	125,000	150,000	0	0
										Total	0

Cost Distribution with Intervention Costs

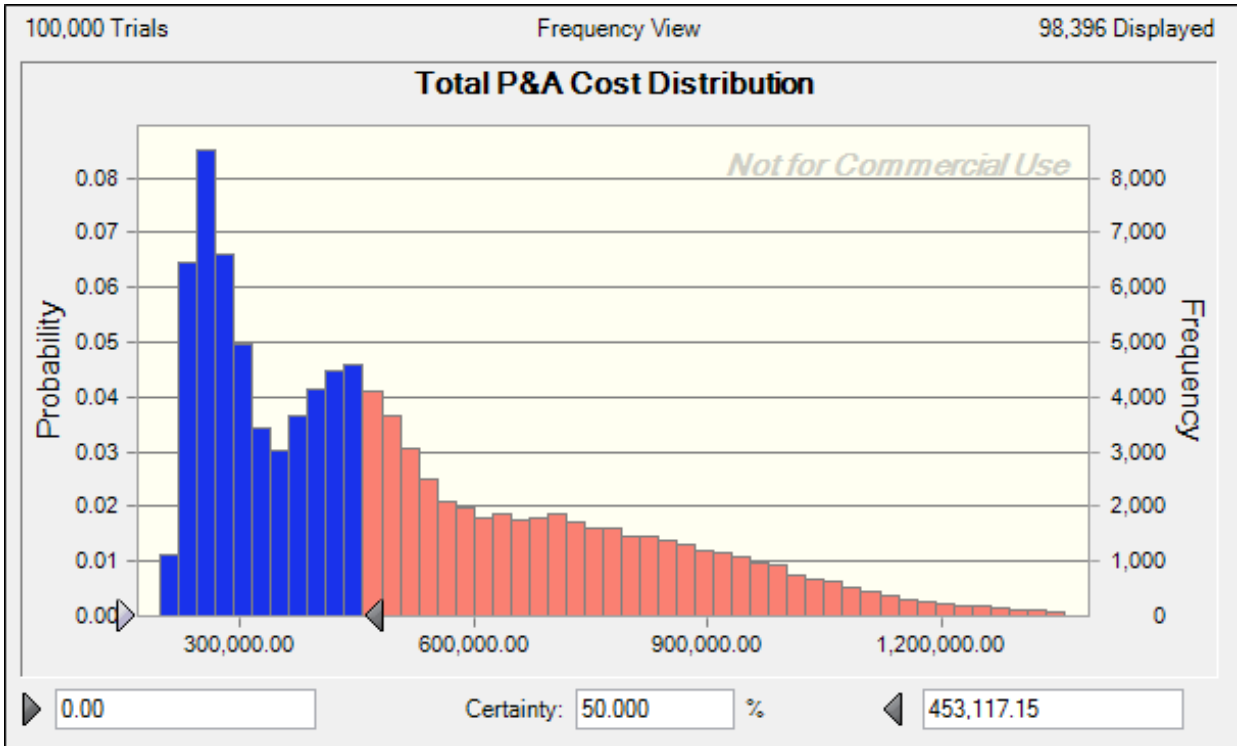


Actual Vs. Monte Carlo Distribution



Definite Similarities

Liftboat Requirement and Coiled Tubing Operations Are Biggest Cost Driving Factors



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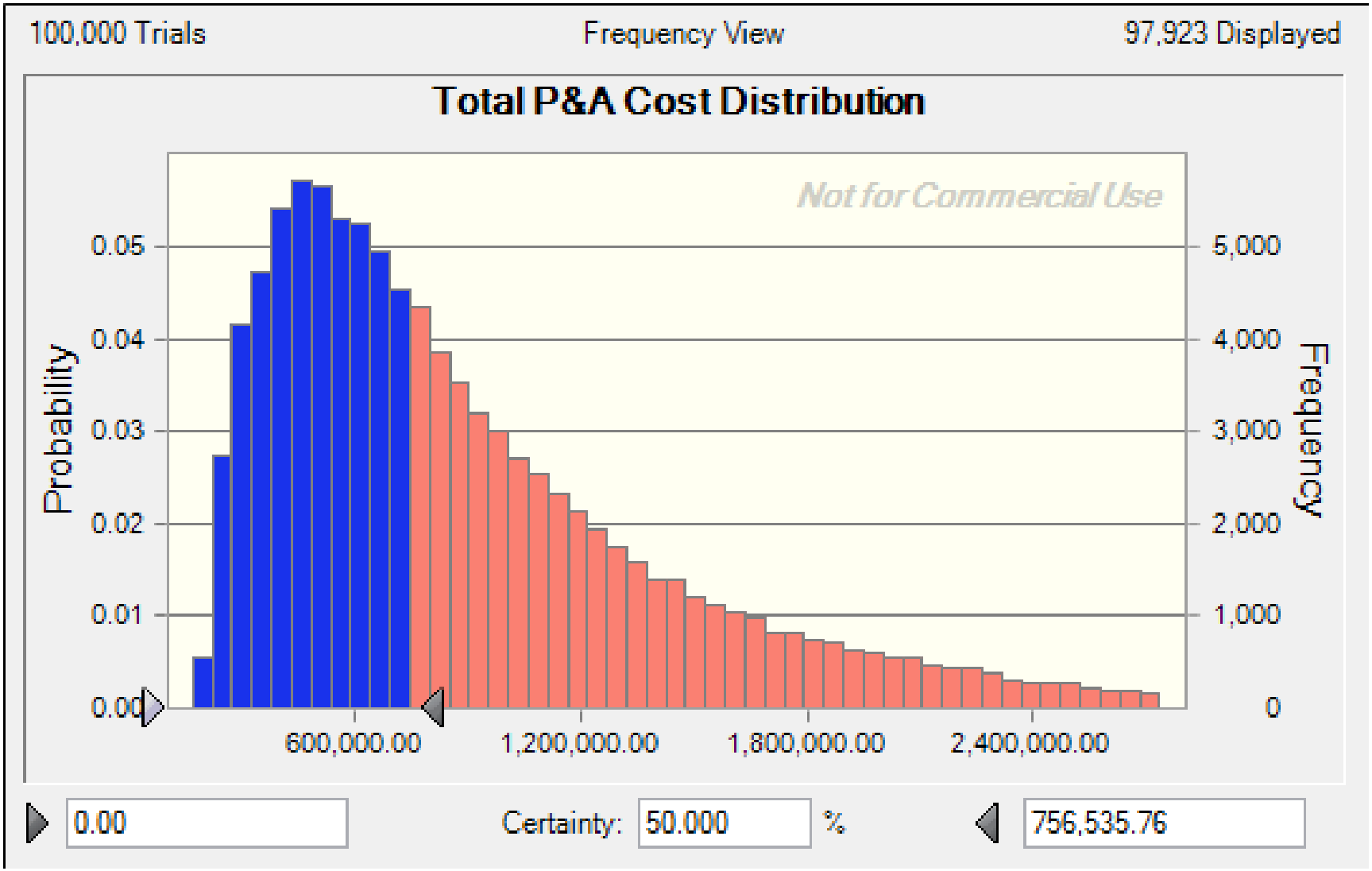
Braided Line Fishing	2%	0	1	3	7	0	40,000		54,000	0	0
Coiled Tubing Operations	20%	0	5	7	10	0	55,000		69,000	0	0
Snubbing Operations	0.50%	0	8	10	12	0	60,000		74,000	0	0
Section Milling Operations	5%	0	5	7	14	0	50,000		64,000	0	0
Rig Operations	1%	0	7	9	16	0	100,000	125,000	150,000	0	0
Execution Standards							0.75	1.00	3.50		0
										Total	0

Cost Distribution with Execution Standards



Ultimate Cost

- What's the Cost if We Don't Get the P&A Right the First Time?
  - $ Cost
  - Increased Regulation
  - Company Reputation
  - Public Perception of Industry
- Wells Must Be Plugged Effectively for Geologic Time.

Quotations with a Message About Decom.

- "The Scope of Work Determines the Cost." (Jim Fitzhugh)
  - Not the Value on the AFE or on the Turnkey Bid
- "You Don't Know What You Don't Know." (Tom Straub)
  - Decommissioning Is All About Resolving All of the Problems That People Before You Left for You But Didn't Put in the Files.
- "If It Ain't Broke It Ain't Ours." (Terry Costlow)
  - We Don't Get to Work with New Equipment
- "It's Easier to Explain Why It Took So Long Than Why It Went So Wrong." (Jerry Foster)
  - Plan Your Work and Work Your Plan

Summary

- There Is No Single Number That Represents the Average P&A Cost in the Gulf of Mexico.
- Intervention Costs and Access Costs Are Two of the Biggest Drivers of True Per Well P&A Costs.
- Execution Standards Vary by Company and Have a Significant Impact on P&A Costs.
- We Cannot Lose Sight of the Ultimate Cost of Not Getting Wells P&A'd Right the First Time

Conclusion

- The Real Cost to P&A a Well in the Gulf of Mexico Is a Range of Costs Based on the Scope of Work on Each Well and the Execution Standards of the Operating Company