

EXHIBIT 86D - SUMMARY OF RESULTS FROM HOLTEC REPORT - "PFSF BEYOND DESIGN BASES SCOPING ANALYSES" SUPPORTING INFORMATION FOR SIMULATIONS LISTED IN ANSWER 118 OF KPS/AIS TESTIMONY

REVISED SUMMARY OF VISUALNASTRAN ANALYSES

Case # - Description	Event	Stiffness	Damping	COF	Remarks
1. - 8 casks	2k	Lower Bound design basis	Lower bound design basis	.8	Confirm Dynamo results. Stiffness values per Appendix D
2. - 8 casks	2k	Resonance @ 5 Hz	1%	.8	Evaluate effect of "tuning" soil springs and low damping
3.-1 cask on pad	10k	Based on mass of 1 cask + entire pad oscillating at 5Hz	1%	.8	Lowest stiffness that gives 5 Hz tuning
4. - 1 cask on pad	10k	Based on mass of 1 cask + entire pad oscillating at 5Hz	5%	.8	Check damping effect
5.-3 casks on pad	10k	Based on mass of 8 casks + pad @ 5 Hz	1%	Random between 0.2 and 1.0	Check real configuration
6.-3 casks on pad	10k	Based on mass of 1 cask + entire pad oscillating at 5Hz	1%	.8	Intermediate loading with lower bound tuned stiffness
7.- 4 casks on pad	10k	Based on mass of 8 casks + entire pad oscillating at 5Hz	1%	.8	Intermediate loading with upper bound tuned stiffness
8.- 8 casks on pad	10k	Based on mass of 8 casks + entire pad oscillating at 5Hz	1%	.8	Fully populated with tuned stiffness and damping per Appendix A.
9.- 8 casks on pad	10k	Based on mass of 8 casks + entire pad oscillating at 5Hz	1%	0.2	Fully populated with upper bound tuned stiffness and damping
10. - 8 casks on pad	10k	Based on mass of 8 casks + entire pad oscillating at 5Hz	1%	Random between 0.2 and 1.0	Fully populated with tuned stiffness and damping - evaluation of the effect of real behavior of friction between casks and pads
11. - 8 casks on pad	10k	Geomatrix Lower Bound Values consistent with 10k	Geomatrix Lower Bound Values consistent with 10k	.8	Design basis equivalent of 2k event. Stiffness values per Appendix C.

In the 11 tables below, the only change from State Exhibit 179 is in the row marked "number of facets"; the value "16" has replaced the value "34".

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EXHIBIT 86D - SUMMARY OF RESULTS FROM HOLTEC REPORT – “PFSF BEYOND DESIGN BASES SCOPING ANALYSES”
SUPPORTING INFORMATION FOR SIMULATIONS LISTED IN ANSWER 118 OF KPS/AIS TESTIMONY

Input Value for Case 1 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	0.8	
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Spring and Damper Data		
Kx(lbf/in)	9,512,000	Appendix D
Cx (lbm/sec)	9.249x10 ⁷	“
Ky(lbf/in)	9,037,000	“
Cy (lbm/sec)	8.789x10 ⁷	“
Kz(lbf/in)	12,040,000	“
Cz (lbm/sec)	1.727x10 ⁸	“
Kxx(lbf-in/deg)	2.423x10 ¹⁰	“
Cxx (lbf in sec/deg)	3.812x10 ⁸	“
Kyy(lbf-in/deg)	8.137x10 ⁹	“
Cyy (lbf in sec/deg)	8.427x10 ⁷	“
Kzz(lbf in/deg)	2.226x10 ¹⁰	“
Czz (lbf in sec/deg)	1.556x10 ⁸	“
Seismic Input (2k)	3 input files	Geomatrix

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Input Value for Case 2 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	0.8	
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Data (1% tuned)		Based on mass of 8 casks plus entire pad
Tuning frequency(Hz)	5	Appendix A, p.3
Tuning damping %	0.1(linear);1.0(rotational)	Appendix A, p.3
Kx(lbf/in)	9,796,000	Figure 6
Cx (lbm/sec)	240,800	“
Ky(lbf/in)	9,796,000	Figure 6
Cy (lbm/sec)	240,800	“
Kz(lbf/in)	9,796,000	Figure 6
Cz (lbm/sec)	240,800	“
Kxx(lbf-in/deg)	1.385x10 ⁹	Figure 6
Cxx (lbf in sec/deg)	881,620	“
Kyy(lbf-in/deg)	6.924x10 ⁹	Figure 6
Cyy (lbf in sec/deg)	4,408,000	“
Kzz(lbf-in/deg)	8.309x10 ⁹	Figure 6
Czz (lbf in sec/deg)	5,289,000	“
Seismic Input (2k)	3 input files	Geomatrix

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Input Value for Case 3 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
CaskContact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	0.8	
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Data (Tuned)		Based on Mass of 1 cask plus entire pad
Tuning frequency(Hz)	5	
Tuning damping %	0.1(linear);1.0(rotational)	
Kx(lbf/in)	3,325,000	Use values from case 2 multiplied by ratio = (mass of 1 cask plus entire pad)/(mass of 8 casks plus entire pad)
Cx (lbm/sec)	81,730	
Ky(lbf/in)	3,325,000	
Cy (lbm/sec)	81,730	
Kz(lbf/in)	3,325,000	
Cz (lbm/sec)	81,730	
Kxx(lbf-in/deg)	4.701×10^8	
Cxx (lbf in sec/deg)	299,200	
Kyy(lbf-in/deg)	2.35×10^9	
Cyy (lbf in sec/deg)	1,496,000	
Kzz(lbf-in/deg)	2.82×10^9	
Czz (lbf in sec/deg)	1,795,000	
Seismic Input (10k)	3 input files	Geomatrix

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Input Value for Case 4 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	0.8	
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Data (tuned)		Based on Mass of 1 cask plus entire pad
Tuning frequency(Hz)	5	
Tuning damping %	0.5(linear);5.0(rotational)	
Kx(lbf/in)	3,325,000	
Cx (lbm/sec)	81,730 x 5	All dampers multiplied by 5
Ky(lbf/in)	3,325,000	
Cy (lbm/sec)	81,730 x 5	
Kz(lbf/in)	3,325,000	
Cz (lbm/sec)	81,730 x 5	
Kxx(lbf-in/deg)	4.701×10^8	
Cxx (lbf in sec/deg)	299,200 x 5	
Kyy(lbf-in/deg)	2.35×10^9	
Cyy (lbf in sec/deg)	1,496,000 x 5	
Kzz(lbf-in/deg)	2.82×10^9	
Czz (lbf in sec/deg)	1,795,000 x 5	
Seismic Input (10k)	3 input files	Geomatrix

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Input Value for Case 5 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	Random	See Figure 7 formula
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Data (Tuned)		Based on Mass of 8 casks plus entire pad
Tuning frequency(Hz)	5	
Tuning damping %	0.1(linear);1.0(rotational)	
Kx(lbf/in)	9,796,000	Figure 6
Cx (lbm/sec)	240,800	“
Ky(lbf/in)	9,796,000	Figure 6
Cy (lbm/sec)	240,800	“
Kz(lbf/in)	9,796,000	Figure 6
Cz (lbm/sec)	240,800	“
Kxx(lbf-in/deg)	1.385x10 ⁹	Figure 6
Cxx (lbf in sec/deg)	881,620	“
Kyy(lbf-in/deg)	6.924x10 ⁹	Figure 6
Cyy (lbf in sec/deg)	4,408,000	“
Kzz(lbf-in/deg)	8.309x10 ⁹	Figure 6
Czz (lbf in sec/deg)	5,289,000	“
Seismic Input (10k)	3 input files	Geomatrix

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Input Value for Case 6 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	0.8	
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Data (Tuned)		Based on Mass of 1 casks plus entire pad
Tuning frequency(Hz)	5	
Tuning damping %	0.1(linear);1.0(rotational)	
Kx(lbf/in)	3,325,000	Use values from case 2 multiplied by ratio = (mass of 1 cask plus entire pad)/(mass of 8 casks plus entire pad)
Cx (lbm/sec)	81,730	
Ky(lbf/in)	3,325,000	
Cy (lbm/sec)	81,730	
Kz(lbf/in)	3,325,000	
Cz (lbm/sec)	81,730	
Kxx(lbf-in/deg)	4.701×10^8	
Cxx (lbf in sec/deg)	299,200	
Kyy(lbf-in/deg)	2.35×10^9	
Cyy (lbf in sec/deg)	1,496,000	
Kzz(lbf-in/deg)	2.82×10^9	
Czz (lbf in sec/deg)	1,795,000	
Seismic Input (10k)	3 input files	Geomatrix

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Input Value for Case 7 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	.8	
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Data (Tuned)		Based on Mass of 8 casks plus entire pad
Tuning frequency(Hz)	5	
Tuning damping %	0.1(linear);1.0(rotational)	
Kx(lbf/in)	9,796,000	Figure 6
Cx (lbm/sec)	240,800	“
Ky(lbf/in)	9,796,000	Figure 6
Cy (lbm/sec)	240,800	“
Kz(lbf/in)	9,796,000	Figure 6
Cz (lbm/sec)	240,800	“
Kxx(lbf-in/deg)	1.385x10 ⁹	Figure 6
Cxx (lbf in sec/deg)	881,620	“
Kyy(lbf-in/deg)	6.924x10 ⁹	Figure 6
Cyy (lbf in sec/deg)	4,408,000	“
Kzz(lbf-in/deg)	8.309x10 ⁹	Figure 6
Czz (lbf in sec/deg)	5,289,000	“
Seismic Input (10k)	3 input files	Geomatrix

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Input Value for Case 8 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	.8	
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Data (1% tuned)		
Tuning frequency(Hz)	5	Appendix A, p.3
Tuning damping %	0.1(linear);1.0(rotational)	Appendix A, p.3
Kx(lbf/in)	9,796,000	Figure 6
Cx (lbm/sec)	240,800	“
Ky(lbf/in)	9,796,000	Figure 6
Cy (lbm/sec)	240,800	“
Kz(lbf/in)	9,796,000	Figure 6
Cz (lbm/sec)	240,800	“
Kxx(lbf-in/deg)	1.385x10 ⁹	Figure 6
Cxx (lbf in sec/deg)	881,620	“
Kyy(lbf-in/deg)	6.924x10 ⁹	Figure 6
Cyy (lbf in sec/deg)	4,408,000	“
Kzz(lbf-in/deg)	8.309x10 ⁹	Figure 6
Czz (lbf in sec/deg)	5,289,000	“
Seismic Input (10k)	3 input files	Geomatrix

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Input Value for Case 9 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	0.2	
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Data (1% tuned)		
Tuning frequency(Hz)	5	Appendix A, p.3
Tuning damping %	0.1(linear);1.0(rotational)	Appendix A, p.3
Kx(lbf/in)	9,796,000	Figure 6
Cx (lbm/sec)	240,800	“
Ky(lbf/in)	9,796,000	Figure 6
Cy (lbm/sec)	240,800	“
Kz(lbf/in)	9,796,000	Figure 6
Cz (lbm/sec)	240,800	“
Kxx(lbf-in/deg)	1.385x10 ⁹	Figure 6
Cxx (lbf in sec/deg)	881,620	“
Kyy(lbf-in/deg)	6.924x10 ⁹	Figure 6
Cyy (lbf in sec/deg)	4,408,000	“
Kzz(lbf-in/deg)	8.309x10 ⁹	Figure 6
Czz (lbf in sec/deg)	5,289,000	“
Seismic Input (10k)	3 input files	Geomatrix

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Input Value for Case 10 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	Random	See Figure 7
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Data (1% tuned)		
Tuning frequency(Hz)	5	Appendix A, p.3
Tuning damping %	0.1(linear);1.0(rotational)	Appendix A, p.3
Kx(lbf/in)	9,796,000	Figure 6
Cx (lbm/sec)	240,800	“
Ky(lbf/in)	9,796,000	Figure 6
Cy (lbm/sec)	240,800	“
Kz(lbf/in)	9,796,000	Figure 6
Cz (lbm/sec)	240,800	“
Kxx(lbf-in/deg)	1.385x10 ⁹	Figure 6
Cxx (lbf in sec/deg)	881,620	“
Kyy(lbf-in/deg)	6.924x10 ⁹	Figure 6
Cyy (lbf in sec/deg)	4,408,000	“
Kzz(lbf-in/deg)	8.309x10 ⁹	Figure 6
Czz (lbf in sec/deg)	5,289,000	“
Seismic Input (10k)	3 input files	Geomatrix

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Input Value for Case 11 - Table accompanying Answer 118 of KPS/AIS testimony		
Item	Value	Reference (unless noted reference is to report HI-2022854)
Cask mass (lbm)	360,000	p.12,Figure 8
Cask height (inch)	231.5	HI-STORM FSAR
Cask radius (inch)	66.25	HI-STORM FSAR
Pad length/width/thickness (ft)	67/30/3	Appendix C, p. C-1
Pad mass (lbm)	934700	Figure 8
Cask contact stiffness per facet (lbf/inch)	1179030	Figure 7 and Appendix A, p A-1
Cask Contact damping per facet (lbf *sec/inch)	4549.05	Appendix A, p A-2
Cask-Pad Coefficient of Friction	.8	
Number of facets	16	Appendix A, p.A-1
Cask Locations (confirming runs)	Per array considered	Appendix A, p. A-4
Soil Spring and Damper Data		
Kx(lbf/in)	7,849,520	Appendix C
Cx (lbm/sec)	8.533x10 ⁷	“
Ky(lbf/in)	7,457,040	“
Cy (lbm/sec)	8.106x10 ⁷	“
Kz(lbf/in)	10,280,000	“
Cz (lbm/sec)	1.648x10 ⁸	“
Kxx(lbf-in/deg)	2.069x10 ¹⁰	“
Cxx (lbf in sec/deg)	3.646x10 ⁸	“
Kyy(lbf-in/deg)	6.947x10 ⁹	“
Cyy (lbf in sec/deg)	8.068x10 ⁷	“
Kzz(lbf in/deg)	1.781x10 ¹⁰	“
Czz (lbf in sec/deg)	1.392x10 ⁸	“
Seismic Input (10k)	3 input files	Geomatrix

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Displacement Response for Simulations

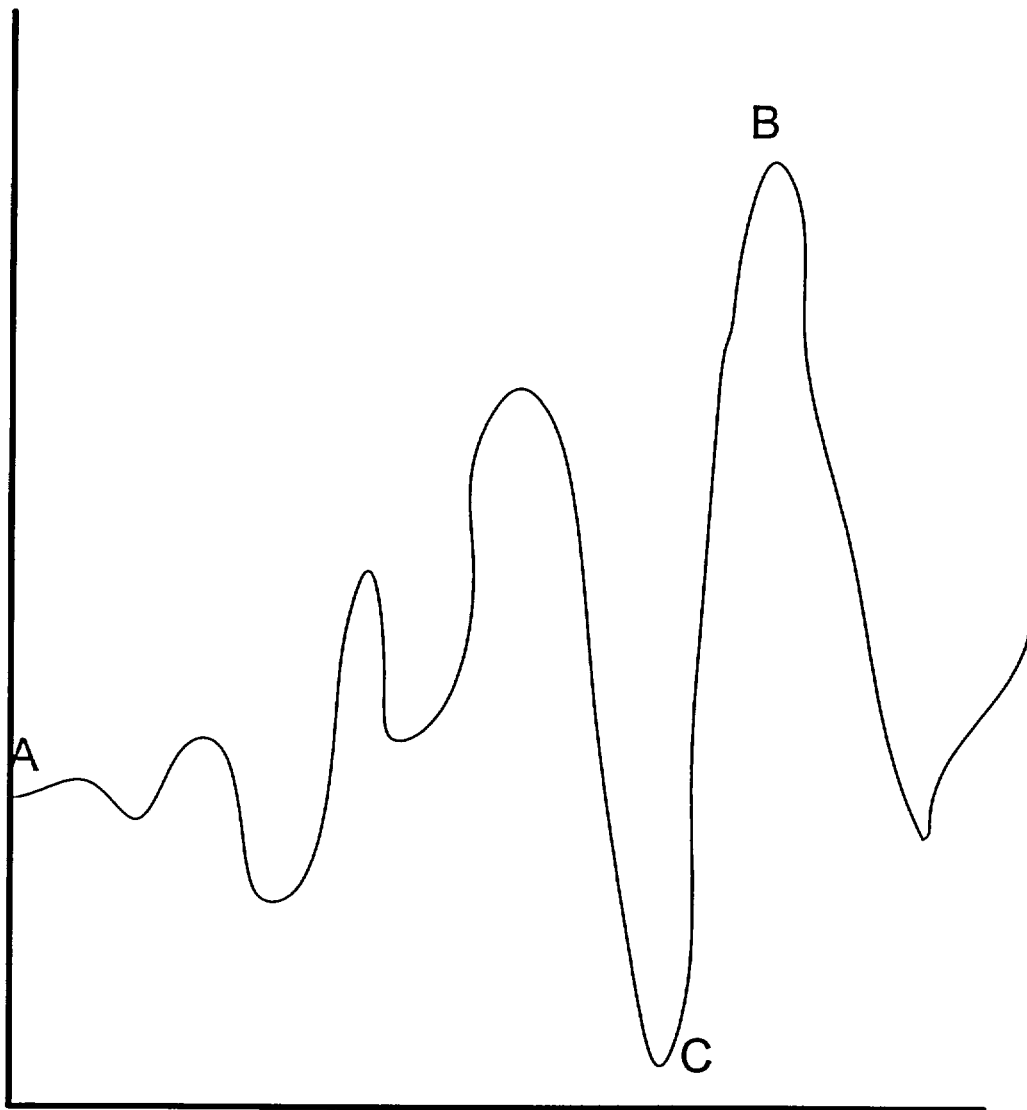
(All results are for cask #1)

Displacement/Rotation Results From 11 Simulations			
Case Number	Max. Excursion of Top of Cask From Location at Start of Run (inch)	Max. Peak-to-Peak Excursion in a Single Cycle (inch)	Rotation Angle From Vertical (degrees) (Based on 50% of Peak-to-Peak Excursion)
1	3.7	6.1	0.75
2	4.65	5.75	0.71
3	60.0	26.0	3.21
4	56.0	43.5	5.37
5	17.5	22.2	2.74
6	18.6	36.2	4.47
7	52.5	82.8	10.13
8	39.0	71.0	8.72
9	14.8	18.0	**
10	12.5	13.7	1.70
11	22.7	36.5	4.51

** Essentially Pure Sliding – Base of cask mirrors motion of top of cask – maximum difference in lateral position bounded by 1”

See illustration below that describes how each column computed

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Max. Excursion = greater of absolute value of (value at B-value at A) or (value at A-value at C)

Peak-to-Peak Swing = absolute value of (value at B-value at C) (for largest amplitude cycle)

Rotation angle is $\arctan(0.5 \times (\text{value at B-value at C})/\text{cask height})$

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In the matter of PS

Staff _____	IDENTIFIED <u>-</u>
Applicant <u>✓</u>	RECEIVED <u>-</u>
Intervenor _____	REJECTED _____
Other _____	WITHDRAWN _____
DATE <u>6/8/82</u>	Witness _____
Clerk _____	