



Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

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model1.hsc

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1. Column Internals Summary

Summary

Property	Value	Units
Number of Trayed/Packed stages	30	
Total height	27.29	m
Total head loss (Hot liquid height)	3555	mm
Total pressure drop	195.6	mbar
Number of sections	1	
Number of diameters	1	
Total residence time	64.72	seconds

Sections

Section	Start	End	Diameter (m)	Section Height (m)	Internals Type	Tray or Packing Type	Section Pressure Drop (mbar)	% Approach to Flood	Limiting Stage
CS-1	30_Main Tower	1_Main Tower	5.14	27.29	Trayed	Sieve	195.6	54.6264	1_Main Tower

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2. Feed/Draw Summary

Feed/Draw Summary

Stage Number	Stream	Feed/Draw
30_Main Tower	TopStagePA_Return	Feed
	08	Draw
	TopStagePA_Draw	Draw
28_Main Tower	11	Draw
13_Main Tower	04	Feed
1_Main Tower	Boilup	Feed
	To Reboiler	Draw

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3. CS-1

3.1. Tray Geometry

Section

Property	Value	Units
Tray type	SIEVE	
Diameter	5.14	m
Tray spacing	0.9096	m
Number of passes	4	
Hole diameter	0.0127	m
Hole area / Active area	0.08	
Number of Holes	9989	
Deck gauge thickness	10 GAUGE	
Deck gauge thickness value	3.404	mm
Cross-sectional area	20.75	m2
Active area	15.82	m2
Net area	18.28	m2

Downcomer geometry

Property	Side	Off-center	Center	Units
Downcomer clearance	63.1	63.1	63.1	mm
Downcomer width top	351.4	269.6	240	mm
Downcomer width bottom	351.4	269.6	240	mm
Downcomer area top	0.6166	1.233	1.233	m2
Downcomer area bottom	0.6166	1.233	1.233	m2
Downcomer location (dist. from ctr.)		1169		mm

Weir geometry

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Property	Side	Off-center Outside	Off-center Inside	Center	Units
Weir height	0.0758	0.0758	0.0758	0.0758	m
Weir length	2.594	4.429	4.705	5.134	m

Panels

Property	A	B	C	D	Units
Flow path length	0.9145	0.9145	0.9145	0.9145	m
Bubbling area	3.355	4.553	3.355	4.553	m2

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3.2. Design Parameters

Design Parameters

Property	Value	Units
% Jet flood and downcomer choke flood for design	80	
Minimum downcomer area / Total tray area	0.1	
Downcomer design basis	EQ_FLOW	
Maximum acceptable pressure drop	2.5	kPa
Maximum % jet flood	100	
Maximum % downcomer backup	100	
Maximum % liquid entrainment	10	
Minimum weir loading	4.471	m3/h-m
Maximum weir loading	134.1	m3/h-m
Warning status (% to limit)	10	
System foaming factor	1	
Aeration factor multiplier	1	
Over design factor	1	
Overall section efficiency	1	
Weep method	Hsieh	
Jet flood method	Glitsch6	
Maximum downcomer loading method	Glitsch	
Dry pressure drop multiplier		

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3.3. Results Summary

Summary

Property	Value	Units
Section starting stage	30_Main Tower	
Section ending stage	1_Main Tower	
Calculation Mode	Sizing	
Tray type	SIEVE	
Number of passes	4	
Tray spacing	0.9096	m
Section Diameter	5.14	m
Section height	27.29	m
Section pressure drop	195.6	mbar
Section head loss (Hot liquid height)	3.555	m
Trays with weeping	None	
Section residence time	64.72	seconds

Limiting conditions

Property	Value	Units	Tray	Location
Maximum % jet flood	54.6264		1_Main Tower	
Maximum % downcomer backup (aerated)	30.7406		1_Main Tower	
Maximum downcomer loading	476.1	m3/h-m2	1_Main Tower	OffCenter
Maximum % downcomer choke flood	80		1_Main Tower	OffCenter
Maximum weir loading	113.1	m3/h-m	1_Main Tower	Side
Maximum aerated height over weir	0.1124	m	1_Main Tower	
Maximum % approach to	35.4521		1_Main Tower	

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Property	Value	Units	Tray	Location
system limit				
Maximum Cs based on bubbling area	0.05602	m/s	1_Main Tower	

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3.4. By Tray Results

3.4.1. Hydraulic Results

CS-1 Hydraulic results (1)

Tray Number	% Jet flood	Total pressure drop (mbar)	% Downcomer backup (Aerated)	Dry pressure drop (mbar)	Dry pressure drop (Hot liquid height) (m)
30_Main Tower	37.2467	5.787	23.5824	1.754	0.03253
29_Main Tower	38.3914	5.872	23.7793	1.849	0.03445
28_Main Tower	39.4035	5.955	23.9921	1.93	0.03607
27_Main Tower	39.8416	5.987	23.9543	1.993	0.03733
26_Main Tower	40.288	6.019	24.0583	2.029	0.03809
25_Main Tower	40.5044	6.034	24.1119	2.047	0.03845
24_Main Tower	40.5907	6.04	24.1357	2.053	0.03859
23_Main Tower	40.6122	6.041	24.1445	2.053	0.03861
22_Main Tower	40.6032	6.04	24.1465	2.051	0.03859
21_Main Tower	40.5778	6.038	24.1445	2.048	0.03853
20_Main Tower	40.5406	6.036	24.1393	2.043	0.03845
19_Main Tower	40.4893	6.032	24.1309	2.038	0.03835
18_Main Tower	40.4085	6.028	24.1147	2.03	0.03819
17_Main Tower	40.2573	6.021	24.081	2.016	0.03791
16_Main	39.9084	6.005	24.0002	1.986	0.03727

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Tray Number	% Jet flood	Total pressure drop (mbar)	% Downcomer backup (Aerated)	Dry pressure drop (mbar)	Dry pressure drop (Hot liquid height) (m)
Tower					
15_Main Tower	38.8629	5.951	23.764	1.898	0.03542
14_Main Tower	35.5439	5.796	23.1013	1.63	0.02986
13_Main Tower	51.1395	7.128	29.9475	2.313	0.04058
12_Main Tower	51.3311	7.142	29.991	2.331	0.04091
11_Main Tower	51.4641	7.152	30.0222	2.343	0.04114
10_Main Tower	51.5661	7.16	30.0468	2.352	0.04132
9_Main Tower	51.6556	7.167	30.0686	2.36	0.04147
8_Main Tower	51.7466	7.174	30.0908	2.368	0.04162
7_Main Tower	51.8539	7.183	30.1165	2.378	0.0418
6_Main Tower	51.9964	7.195	30.1496	2.391	0.04205
5_Main Tower	52.2051	7.214	30.197	2.411	0.04241
4_Main Tower	52.5252	7.243	30.2685	2.443	0.04298
3_Main Tower	53.0177	7.291	30.3779	2.493	0.04386
2_Main Tower	53.7211	7.365	30.535	2.565	0.04512
1_Main Tower	54.6264	7.483	30.7406	2.655	0.04664

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CS-1 Hydraulic results (2)

Tray Number	Total pressure drop (Hot liquid height) (m)	Downcomer backup (Aerated) (m)	Downcomer backup (Un aerated) (m)	% Downcomer backup (Un aerated)	Liquid mass rate / Column area (kg/s-m2)
30_Main Tower	0.1073	0.2324	0.1356	13.7628	3.114
29_Main Tower	0.1094	0.2343	0.1365	13.8545	3.193
28_Main Tower	0.1113	0.2364	0.1376	13.9649	3.299
27_Main Tower	0.1122	0.236	0.1373	13.9304	3.212
26_Main Tower	0.113	0.2371	0.1378	13.9825	3.254
25_Main Tower	0.1134	0.2376	0.138	14.0085	3.275
24_Main Tower	0.1136	0.2378	0.1381	14.0194	3.283
23_Main Tower	0.1136	0.2379	0.1382	14.0227	3.286
22_Main Tower	0.1136	0.2379	0.1382	14.0224	3.286
21_Main Tower	0.1136	0.2379	0.1382	14.0202	3.284
20_Main Tower	0.1136	0.2379	0.1381	14.0166	3.281
19_Main Tower	0.1135	0.2378	0.1381	14.0115	3.278
18_Main Tower	0.1134	0.2376	0.138	14.003	3.272
17_Main Tower	0.1132	0.2373	0.1378	13.9866	3.262
16_Main Tower	0.1127	0.2365	0.1374	13.948	3.237

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Tray Number	Total pressure drop (Hot liquid height) (m)	Downcomer backup (Aerated) (m)	Downcomer backup (Un-aerated) (m)	% Downcomer backup (Un-aerated)	Liquid mass rate / Column area (kg/s-m ²)
15_Main Tower	0.111	0.2342	0.1363	13.8348	3.156
14_Main Tower	0.1062	0.2276	0.1332	13.5212	2.894
13_Main Tower	0.125	0.2951	0.1746	17.7137	8.717
12_Main Tower	0.1254	0.2955	0.1748	17.7372	8.735
11_Main Tower	0.1256	0.2958	0.1749	17.754	8.748
10_Main Tower	0.1258	0.2961	0.1751	17.7672	8.758
9_Main Tower	0.1259	0.2963	0.1752	17.7789	8.767
8_Main Tower	0.1261	0.2965	0.1753	17.7909	8.777
7_Main Tower	0.1263	0.2968	0.1754	17.8048	8.788
6_Main Tower	0.1265	0.2971	0.1756	17.8231	8.803
5_Main Tower	0.1269	0.2976	0.1759	17.8497	8.826
4_Main Tower	0.1274	0.2983	0.1763	17.8903	8.86
3_Main Tower	0.1283	0.2993	0.1769	17.9534	8.914
2_Main Tower	0.1296	0.3009	0.1778	18.0456	8.998
1_Main Tower	0.1314	0.3029	0.179	18.1702	9.126

CS-1 Hydraulic results (3)

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Tray Number	Liquid volume rate / Column area (m3/h-m2)	Fs (net area) (sqrt(Pa))	Fs (bubbling area) (sqrt(Pa))	Cs (net area) (m/s)	Cs (bubbling area) (m/s)
30_Main Tower	20.39	0.9359	1.082	0.04042	0.04673
29_Main Tower	21.01	0.9607	1.111	0.04162	0.04811
28_Main Tower	21.77	0.9817	1.135	0.0426	0.04924
27_Main Tower	21.24	0.9975	1.153	0.04335	0.05011
26_Main Tower	21.56	1.007	1.164	0.04379	0.05061
25_Main Tower	21.72	1.011	1.168	0.044	0.05086
24_Main Tower	21.79	1.012	1.17	0.04408	0.05095
23_Main Tower	21.82	1.013	1.17	0.04409	0.05097
22_Main Tower	21.82	1.012	1.17	0.04408	0.05095
21_Main Tower	21.81	1.011	1.169	0.04405	0.05092
20_Main Tower	21.8	1.01	1.168	0.044	0.05087
19_Main Tower	21.78	1.009	1.166	0.04395	0.0508
18_Main Tower	21.74	1.007	1.164	0.04385	0.05069
17_Main Tower	21.65	1.003	1.16	0.04369	0.0505
16_Main Tower	21.44	0.9958	1.151	0.04332	0.05007
15_Main	20.79	0.9735	1.125	0.04223	0.04881

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Tray Number	Liquid volume rate / Column area (m3/h-m2)	Fs (net area) (sqrt(Pa))	Fs (bubbling area) (sqrt(Pa))	Cs (net area) (m/s)	Cs (bubbling area) (m/s)
Tower					
14_Main Tower	18.72	0.9021	1.043	0.03876	0.0448
13_Main Tower	53.98	1.075	1.242	0.04515	0.05219
12_Main Tower	54.12	1.079	1.247	0.04534	0.05241
11_Main Tower	54.22	1.082	1.25	0.04547	0.05256
10_Main Tower	54.3	1.084	1.253	0.04557	0.05267
9_Main Tower	54.38	1.086	1.255	0.04565	0.05277
8_Main Tower	54.45	1.087	1.257	0.04574	0.05287
7_Main Tower	54.54	1.09	1.26	0.04584	0.05298
6_Main Tower	54.64	1.093	1.263	0.04597	0.05314
5_Main Tower	54.8	1.097	1.268	0.04617	0.05337
4_Main Tower	55.03	1.104	1.277	0.04649	0.05373
3_Main Tower	55.38	1.116	1.29	0.04697	0.05429
2_Main Tower	55.88	1.132	1.308	0.04764	0.05507
1_Main Tower	56.59	1.151	1.331	0.04846	0.05602

CS-1 Hydraulic results (4)

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Description:

Tray Number	Side downcomer exit velocity (m/s)	Center downcomer exit velocity (m/s)	Off-center downcomer exit velocity (m/s)	Approach to system limit (%)	% Side downcomer choke flood
30_Main Tower	0.1795	0.09068	0.1019	28.4202	29.5792
29_Main Tower	0.1849	0.09345	0.1051	29.6269	30.5737
28_Main Tower	0.1916	0.09681	0.1088	30.5705	31.7252
27_Main Tower	0.187	0.09447	0.1062	31.2659	31.0063
26_Main Tower	0.1898	0.0959	0.1078	31.6749	31.5067
25_Main Tower	0.1912	0.09661	0.1086	31.8701	31.7599
24_Main Tower	0.1918	0.09692	0.109	31.9455	31.8728
23_Main Tower	0.192	0.09703	0.1091	31.9614	31.9161
22_Main Tower	0.1921	0.09705	0.1091	31.9493	31.9276
21_Main Tower	0.192	0.09702	0.1091	31.9229	31.9213
20_Main Tower	0.1919	0.09696	0.109	31.887	31.9023
19_Main Tower	0.1917	0.09686	0.1089	31.8397	31.8699
18_Main Tower	0.1913	0.09668	0.1087	31.7693	31.807
17_Main Tower	0.1906	0.0963	0.1083	31.6431	31.6722
16_Main Tower	0.1887	0.09537	0.1072	31.3589	31.3359
15_Main	0.183	0.09246	0.1039	30.5221	30.2894

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Description:

Tray Number	Side downcomer exit velocity (m/s)	Center downcomer exit velocity (m/s)	Off-center downcomer exit velocity (m/s)	Approach to system limit (%)	% Side downcomer choke flood
Tower					
14_Main Tower	0.1648	0.08325	0.09359	27.8744	27.0129
13_Main Tower	0.4752	0.2401	0.2699	32.5869	76.1904
12_Main Tower	0.4764	0.2407	0.2706	32.7425	76.4109
11_Main Tower	0.4773	0.2412	0.2711	32.8502	76.5708
10_Main Tower	0.478	0.2415	0.2715	32.9325	76.6987
9_Main Tower	0.4786	0.2419	0.2719	33.0044	76.8132
8_Main Tower	0.4793	0.2422	0.2723	33.0776	76.9291
7_Main Tower	0.48	0.2426	0.2727	33.1638	77.061
6_Main Tower	0.481	0.243	0.2732	33.2787	77.2274
5_Main Tower	0.4823	0.2437	0.274	33.447	77.4599
4_Main Tower	0.4844	0.2447	0.2751	33.7064	77.8016
3_Main Tower	0.4874	0.2463	0.2769	34.108	78.3108
2_Main Tower	0.4919	0.2485	0.2794	34.6887	79.0298
1_Main Tower	0.4981	0.2517	0.2829	35.4521	80

CS-1 Hydraulic results (5)

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Description:

Tray Number	% Center downcomer choke flood	% Offcenter downcomer choke flood	Side weir loading (m3/h-m)	Center weir loading (m3/h-m)	Offcenter inside weir loading (m3/h-m)
30_Main Tower	29.5792	29.5792	40.76	20.6	22.48
29_Main Tower	30.5737	30.5737	42.01	21.23	23.16
28_Main Tower	31.7252	31.7252	43.52	21.99	24
27_Main Tower	31.0063	31.0063	42.47	21.46	23.42
26_Main Tower	31.5067	31.5067	43.11	21.78	23.77
25_Main Tower	31.7599	31.7599	43.43	21.95	23.95
24_Main Tower	31.8728	31.8728	43.57	22.02	24.03
23_Main Tower	31.9161	31.9161	43.62	22.04	24.05
22_Main Tower	31.9276	31.9276	43.63	22.05	24.06
21_Main Tower	31.9213	31.9213	43.62	22.04	24.05
20_Main Tower	31.9023	31.9023	43.59	22.03	24.03
19_Main Tower	31.8699	31.8699	43.54	22	24.01
18_Main Tower	31.807	31.807	43.46	21.96	23.96
17_Main Tower	31.6722	31.6722	43.29	21.88	23.87
16_Main Tower	31.3359	31.3359	42.88	21.67	23.64
15_Main	30.2894	30.2894	41.57	21	22.92

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Tray Number	% Center downcomer choke flood	% Offcenter downcomer choke flood	Side weir loading (m3/h-m)	Center weir loading (m3/h-m)	Offcenter inside weir loading (m3/h-m)
Tower					
14_Main Tower	27.0129	27.0129	37.43	18.91	20.64
13_Main Tower	76.1904	76.1904	107.9	54.54	59.52
12_Main Tower	76.4109	76.4109	108.2	54.68	59.67
11_Main Tower	76.5708	76.5708	108.4	54.78	59.78
10_Main Tower	76.6987	76.6987	108.6	54.87	59.87
9_Main Tower	76.8132	76.8132	108.7	54.94	59.95
8_Main Tower	76.9291	76.9291	108.9	55.01	60.03
7_Main Tower	77.061	77.061	109	55.1	60.12
6_Main Tower	77.2274	77.2274	109.3	55.21	60.24
5_Main Tower	77.4599	77.4599	109.6	55.36	60.41
4_Main Tower	77.8016	77.8016	110	55.6	60.67
3_Main Tower	78.3108	78.3108	110.7	55.95	61.05
2_Main Tower	79.0298	79.0298	111.7	56.46	61.61
1_Main Tower	80	80	113.1	57.17	62.39

CS-1 Hydraulic results (6)

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Tray Number	Offcenter outside weir loading (m3/h-m)	Height over weir (Aerated) (m)	Height over weir (Unaerated) (m)	Side downcomer volume (m3)	Side downcomer residence time (seconds)
30_Main Tower	23.88	0.05133	0.01675	0.08362	2.847
29_Main Tower	24.61	0.05303	0.01698	0.08418	2.78
28_Main Tower	25.49	0.05485	0.0173	0.08485	2.705
27_Main Tower	24.88	0.05437	0.01696	0.08464	2.765
26_Main Tower	25.25	0.05516	0.01709	0.08496	2.734
25_Main Tower	25.44	0.05554	0.01716	0.08512	2.719
24_Main Tower	25.52	0.0557	0.01719	0.08518	2.713
23_Main Tower	25.55	0.05575	0.0172	0.0852	2.71
22_Main Tower	25.56	0.05574	0.01721	0.0852	2.71
21_Main Tower	25.55	0.05571	0.01721	0.08519	2.71
20_Main Tower	25.53	0.05565	0.0172	0.08517	2.711
19_Main Tower	25.51	0.05558	0.0172	0.08513	2.713
18_Main Tower	25.46	0.05546	0.01718	0.08508	2.716
17_Main Tower	25.36	0.05523	0.01715	0.08498	2.724
16_Main Tower	25.12	0.05467	0.01707	0.08475	2.743
15_Main	24.35	0.05298	0.01681	0.08406	2.806

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Tray Number	Offcenter outside weir loading (m3/h-m)	Height over weir (Aerated) (m)	Height over weir (Unaerated) (m)	Side downcomer volume (m3)	Side downcomer residence time (seconds)
Tower					
14_Main Tower	21.92	0.04766	0.01595	0.08216	3.046
13_Main Tower	63.23	0.1053	0.03112	0.1076	1.384
12_Main Tower	63.39	0.1056	0.03114	0.1078	1.382
11_Main Tower	63.51	0.1059	0.03116	0.1079	1.381
10_Main Tower	63.6	0.1061	0.03118	0.108	1.38
9_Main Tower	63.69	0.1063	0.03119	0.108	1.379
8_Main Tower	63.77	0.1065	0.03121	0.1081	1.378
7_Main Tower	63.87	0.1067	0.03123	0.1082	1.377
6_Main Tower	64	0.107	0.03125	0.1083	1.375
5_Main Tower	64.18	0.1074	0.03127	0.1085	1.374
4_Main Tower	64.45	0.108	0.03131	0.1087	1.371
3_Main Tower	64.86	0.109	0.03137	0.1091	1.367
2_Main Tower	65.45	0.1105	0.03145	0.1096	1.362
1_Main Tower	66.28	0.1124	0.03159	0.1104	1.354

CS-1 Hydraulic results (7)

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

Tray Number	Side downcomer apparent residence time (seconds)	Side downcomer velocity from top (m/s)	Side downcomer velocity from bottom (m/s)	Center downcomer volume (m3)	Center downcomer residence time (seconds)
30_Main Tower	19.09	0.04764	0.04764	0.1672	2.847
29_Main Tower	18.53	0.0491	0.0491	0.1684	2.78
28_Main Tower	17.88	0.05087	0.05087	0.1697	2.705
27_Main Tower	18.32	0.04964	0.04964	0.1693	2.765
26_Main Tower	18.05	0.05039	0.05039	0.1699	2.734
25_Main Tower	17.92	0.05076	0.05076	0.1702	2.719
24_Main Tower	17.86	0.05093	0.05093	0.1704	2.713
23_Main Tower	17.84	0.05098	0.05098	0.1704	2.71
22_Main Tower	17.84	0.05099	0.05099	0.1704	2.71
21_Main Tower	17.84	0.05098	0.05098	0.1704	2.71
20_Main Tower	17.85	0.05094	0.05094	0.1703	2.711
19_Main Tower	17.87	0.05089	0.05089	0.1703	2.713
18_Main Tower	17.91	0.0508	0.0508	0.1702	2.716
17_Main Tower	17.98	0.0506	0.0506	0.17	2.724
16_Main Tower	18.15	0.05011	0.05011	0.1695	2.743
15_Main	18.72	0.04858	0.04858	0.1681	2.806

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

Tray Number	Side downcomer apparent residence time (seconds)	Side downcomer velocity from top (m/s)	Side downcomer velocity from bottom (m/s)	Center downcomer volume (m3)	Center downcomer residence time (seconds)
Tower					
14_Main Tower	20.8	0.04374	0.04374	0.1643	3.046
13_Main Tower	7.21	0.1262	0.1262	0.2153	1.384
12_Main Tower	7.192	0.1265	0.1265	0.2155	1.382
11_Main Tower	7.178	0.1267	0.1267	0.2157	1.381
10_Main Tower	7.168	0.1269	0.1269	0.2159	1.38
9_Main Tower	7.158	0.1271	0.1271	0.2161	1.379
8_Main Tower	7.148	0.1272	0.1272	0.2162	1.378
7_Main Tower	7.137	0.1274	0.1274	0.2164	1.377
6_Main Tower	7.123	0.1277	0.1277	0.2166	1.375
5_Main Tower	7.103	0.1281	0.1281	0.2169	1.374
4_Main Tower	7.073	0.1286	0.1286	0.2174	1.371
3_Main Tower	7.029	0.1294	0.1294	0.2182	1.367
2_Main Tower	6.965	0.1306	0.1306	0.2193	1.362
1_Main Tower	6.878	0.1322	0.1322	0.2208	1.354

CS-1 Hydraulic results (8)

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

Tray Number	Center downcomer apparent residence time (seconds)	Center downcomer velocity from top (m/s)	Center downcomer velocity from bottom (m/s)	Off-center downcomer volume (m3)	Off-center downcomer residence time (seconds)
30_Main Tower	19.09	0.04764	0.04764	0.1672	2.847
29_Main Tower	18.53	0.0491	0.0491	0.1684	2.78
28_Main Tower	17.88	0.05087	0.05087	0.1697	2.705
27_Main Tower	18.32	0.04964	0.04964	0.1693	2.765
26_Main Tower	18.05	0.05039	0.05039	0.1699	2.734
25_Main Tower	17.92	0.05076	0.05076	0.1702	2.719
24_Main Tower	17.86	0.05093	0.05093	0.1704	2.713
23_Main Tower	17.84	0.05098	0.05098	0.1704	2.71
22_Main Tower	17.84	0.05099	0.05099	0.1704	2.71
21_Main Tower	17.84	0.05098	0.05098	0.1704	2.71
20_Main Tower	17.85	0.05094	0.05094	0.1703	2.711
19_Main Tower	17.87	0.05089	0.05089	0.1703	2.713
18_Main Tower	17.91	0.0508	0.0508	0.1702	2.716
17_Main Tower	17.98	0.0506	0.0506	0.17	2.724
16_Main Tower	18.15	0.05011	0.05011	0.1695	2.743
15_Main	18.72	0.04858	0.04858	0.1681	2.806

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

Tray Number	Center downcomer apparent residence time (seconds)	Center downcomer velocity from top (m/s)	Center downcomer velocity from bottom (m/s)	Off-center downcomer volume (m3)	Off-center downcomer residence time (seconds)
Tower					
14_Main Tower	20.8	0.04374	0.04374	0.1643	3.046
13_Main Tower	7.21	0.1262	0.1262	0.2153	1.384
12_Main Tower	7.192	0.1265	0.1265	0.2155	1.382
11_Main Tower	7.178	0.1267	0.1267	0.2157	1.381
10_Main Tower	7.168	0.1269	0.1269	0.2159	1.38
9_Main Tower	7.158	0.1271	0.1271	0.2161	1.379
8_Main Tower	7.148	0.1272	0.1272	0.2162	1.378
7_Main Tower	7.137	0.1274	0.1274	0.2164	1.377
6_Main Tower	7.123	0.1277	0.1277	0.2166	1.375
5_Main Tower	7.103	0.1281	0.1281	0.2169	1.374
4_Main Tower	7.073	0.1286	0.1286	0.2174	1.371
3_Main Tower	7.029	0.1294	0.1294	0.2182	1.367
2_Main Tower	6.965	0.1306	0.1306	0.2193	1.362
1_Main Tower	6.878	0.1322	0.1322	0.2208	1.354

CS-1 Hydraulic results (9)

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

Tray Number	Off-center downcomer apparent residence time (seconds)	Off-center downcomer velocity from top (m/s)	Off-center downcomer velocity from bottom (m/s)
30_Main Tower	19.09	0.04764	0.04764
29_Main Tower	18.53	0.0491	0.0491
28_Main Tower	17.88	0.05087	0.05087
27_Main Tower	18.32	0.04964	0.04964
26_Main Tower	18.05	0.05039	0.05039
25_Main Tower	17.92	0.05076	0.05076
24_Main Tower	17.86	0.05093	0.05093
23_Main Tower	17.84	0.05098	0.05098
22_Main Tower	17.84	0.05099	0.05099
21_Main Tower	17.84	0.05098	0.05098
20_Main Tower	17.85	0.05094	0.05094
19_Main Tower	17.87	0.05089	0.05089
18_Main Tower	17.91	0.0508	0.0508
17_Main Tower	17.98	0.0506	0.0506
16_Main Tower	18.15	0.05011	0.05011
15_Main Tower	18.72	0.04858	0.04858
14_Main Tower	20.8	0.04374	0.04374
13_Main Tower	7.21	0.1262	0.1262
12_Main Tower	7.192	0.1265	0.1265
11_Main Tower	7.178	0.1267	0.1267
10_Main Tower	7.168	0.1269	0.1269
9_Main Tower	7.158	0.1271	0.1271
8_Main Tower	7.148	0.1272	0.1272
7_Main Tower	7.137	0.1274	0.1274

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

Tray Number	Off-center downcomer apparent residence time (seconds)	Off-center downcomer velocity from top (m/s)	Off-center downcomer velocity from bottom (m/s)
6_Main Tower	7.123	0.1277	0.1277
5_Main Tower	7.103	0.1281	0.1281
4_Main Tower	7.073	0.1286	0.1286
3_Main Tower	7.029	0.1294	0.1294
2_Main Tower	6.965	0.1306	0.1306
1_Main Tower	6.878	0.1322	0.1322

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

3.4.2. State Conditions

CS-1 State conditions

Tray Number	Liquid temperature (C)	Vapor temperature (C)	Liquid mass flow (kg/h)	Vapor mass flow (kg/h)	Liquid volume flow (m3/h)	Vapor volume flow (m3/h)
30_Main Tower	60.96	72.19	2.326E+05	2.289E+05	423	1.658E+04
29_Main Tower	72.19	80.07	2.385E+05	2.385E+05	436	1.676E+04
28_Main Tower	80.07	85.19	2.465E+05	2.465E+05	451.6	1.694E+04
27_Main Tower	85.19	88.04	2.399E+05	2.521E+05	440.7	1.71E+04
26_Main Tower	88.04	89.58	2.431E+05	2.553E+05	447.4	1.72E+04
25_Main Tower	89.58	90.46	2.446E+05	2.568E+05	450.7	1.724E+04
24_Main Tower	90.46	91.02	2.453E+05	2.575E+05	452.2	1.725E+04
23_Main Tower	91.02	91.43	2.455E+05	2.576E+05	452.7	1.724E+04
22_Main Tower	91.43	91.78	2.454E+05	2.576E+05	452.8	1.722E+04
21_Main Tower	91.78	92.11	2.453E+05	2.575E+05	452.6	1.72E+04
20_Main Tower	92.11	92.47	2.451E+05	2.573E+05	452.3	1.718E+04
19_Main Tower	92.47	92.92	2.449E+05	2.57E+05	451.9	1.715E+04
18_Main Tower	92.92	93.57	2.444E+05	2.566E+05	451	1.711E+04
17_Main Tower	93.57	94.7	2.437E+05	2.559E+05	449.3	1.705E+04
16_Main Tower	94.7	97.08	2.418E+05	2.54E+05	444.9	1.691E+04

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

Tray Number	Liquid temperature (C)	Vapor temperature (C)	Liquid mass flow (kg/h)	Vapor mass flow (kg/h)	Liquid volume flow (m3/h)	Vapor volume flow (m3/h)
15_Main Tower	97.08	103.5	2.357E+05	2.479E+05	431.3	1.656E+04
14_Main Tower	103.5	123.8	2.162E+05	2.283E+05	388.4	1.544E+04
13_Main Tower	123.8	124.1	6.511E+05	2.724E+05	1120	1.837E+04
12_Main Tower	124.1	124.3	6.525E+05	2.738E+05	1123	1.842E+04
11_Main Tower	124.3	124.5	6.535E+05	2.747E+05	1125	1.845E+04
10_Main Tower	124.5	124.7	6.542E+05	2.755E+05	1127	1.847E+04
9_Main Tower	124.7	124.9	6.549E+05	2.762E+05	1128	1.849E+04
8_Main Tower	124.9	125.2	6.556E+05	2.769E+05	1130	1.85E+04
7_Main Tower	125.2	125.6	6.565E+05	2.777E+05	1132	1.852E+04
6_Main Tower	125.6	126.3	6.576E+05	2.789E+05	1134	1.855E+04
5_Main Tower	126.3	127.4	6.593E+05	2.805E+05	1137	1.859E+04
4_Main Tower	127.4	129.5	6.618E+05	2.831E+05	1142	1.867E+04
3_Main Tower	129.5	133.3	6.659E+05	2.872E+05	1149	1.878E+04
2_Main Tower	133.3	141.2	6.721E+05	2.934E+05	1160	1.891E+04
1_Main Tower	141.2	158.3	6.817E+05	3.03E+05	1174	1.896E+04

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

3.4.3. Physical Properties

CS-1 Physical properties

Tray Number	Liquid molecular weight	Vapor molecular weight	Liquid mass density (kg/m3)	Vapor mass density (kg/m3)	Liquid viscosity (cP)	Vapor viscosity (cP)	Surface tension (dyne/cm)
30_Main Tower	64.2038	64.2038	549.9	13.81	0.1362	0.008492	8.857
29_Main Tower	67.2803	67.2803	547.2	14.23	0.1305	0.008489	8.448
28_Main Tower	69.4557	69.4557	545.7	14.55	0.127	0.008484	8.205
27_Main Tower	70.7636	70.6992	544.3	14.74	0.1248	0.008477	8.041
26_Main Tower	71.4325	71.3356	543.3	14.85	0.1237	0.008474	7.951
25_Main Tower	71.7566	71.644	542.8	14.9	0.1232	0.008473	7.909
24_Main Tower	71.911	71.7909	542.4	14.93	0.1231	0.008474	7.893
23_Main Tower	71.9862	71.8623	542.2	14.95	0.1231	0.008475	7.888
22_Main Tower	72.0272	71.9013	542.1	14.96	0.1232	0.008477	7.889
21_Main Tower	72.0578	71.9303	541.9	14.97	0.1234	0.008479	7.892
20_Main Tower	72.0943	71.9648	541.9	14.98	0.1235	0.008483	7.896

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

Tray Number	Liquid molecular weight	Vapor molecular weight	Liquid mass density (kg/m3)	Vapor mass density (kg/m3)	Liquid viscosity (cP)	Vapor viscosity (cP)	Surface tension (dyne/cm)
19_Main Tower	72.1547	72.022	541.9	14.99	0.1237	0.008487	7.901
18_Main Tower	72.2693	72.1306	542	15	0.124	0.008495	7.908
17_Main Tower	72.501	72.3499	542.4	15.01	0.1244	0.00851	7.92
16_Main Tower	73.0044	72.8259	543.4	15.02	0.1253	0.008545	7.947
15_Main Tower	74.2651	74.0132	546.5	14.97	0.1273	0.008648	8.019
14_Main Tower	78.2884	77.7607	556.6	14.79	0.134	0.008981	8.26
13_Main Tower	91.3703	77.9008	581.3	14.83	0.1501	0.00898	8.829
12_Main Tower	91.3892	77.9904	581	14.86	0.1498	0.00898	8.81
11_Main Tower	91.4025	78.0536	580.8	14.89	0.1496	0.008945	8.796
10_Main Tower	91.4151	78.1073	580.6	14.91	0.1495	0.008947	8.784
9_Main Tower	91.4323	78.1656	580.4	14.94	0.1493	0.008949	8.773
8_Main Tower	91.4611	78.2447	580.3	14.97	0.1492	0.008951	8.763

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:

Tray Number	Liquid molecular weight	Vapor molecular weight	Liquid mass density (kg/m3)	Vapor mass density (kg/m3)	Liquid viscosity (cP)	Vapor viscosity (cP)	Surface tension (dyne/cm)
7_Main Tower	91.5129	78.3689	580.1	15	0.1491	0.008955	8.752
6_Main Tower	91.608	78.5795	580	15.03	0.1489	0.008961	8.738
5_Main Tower	91.7844	78.9518	579.8	15.09	0.1487	0.008971	8.721
4_Main Tower	92.1169	79.631	579.6	15.17	0.1483	0.00899	8.696
3_Main Tower	92.7641	80.918	579.5	15.29	0.1479	0.009026	8.659
2_Main Tower	94.1049	83.5226	579.7	15.52	0.1471	0.009102	8.602
1_Main Tower	97.1518	89.4421	580.6	15.98	0.146	0.009256	8.508

Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

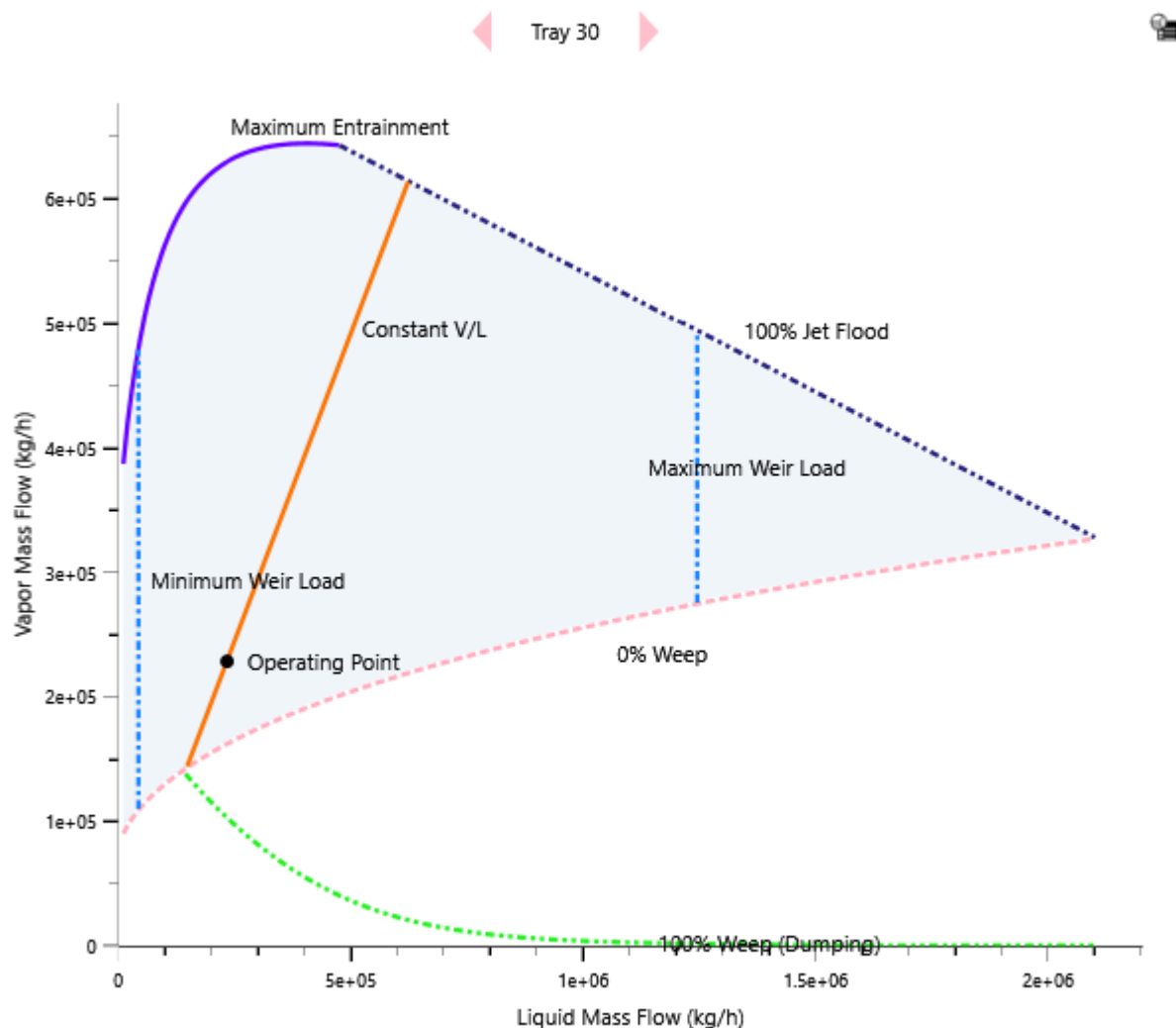
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Job Code:

Project:

Description:

3.5. Hydraulic Plots



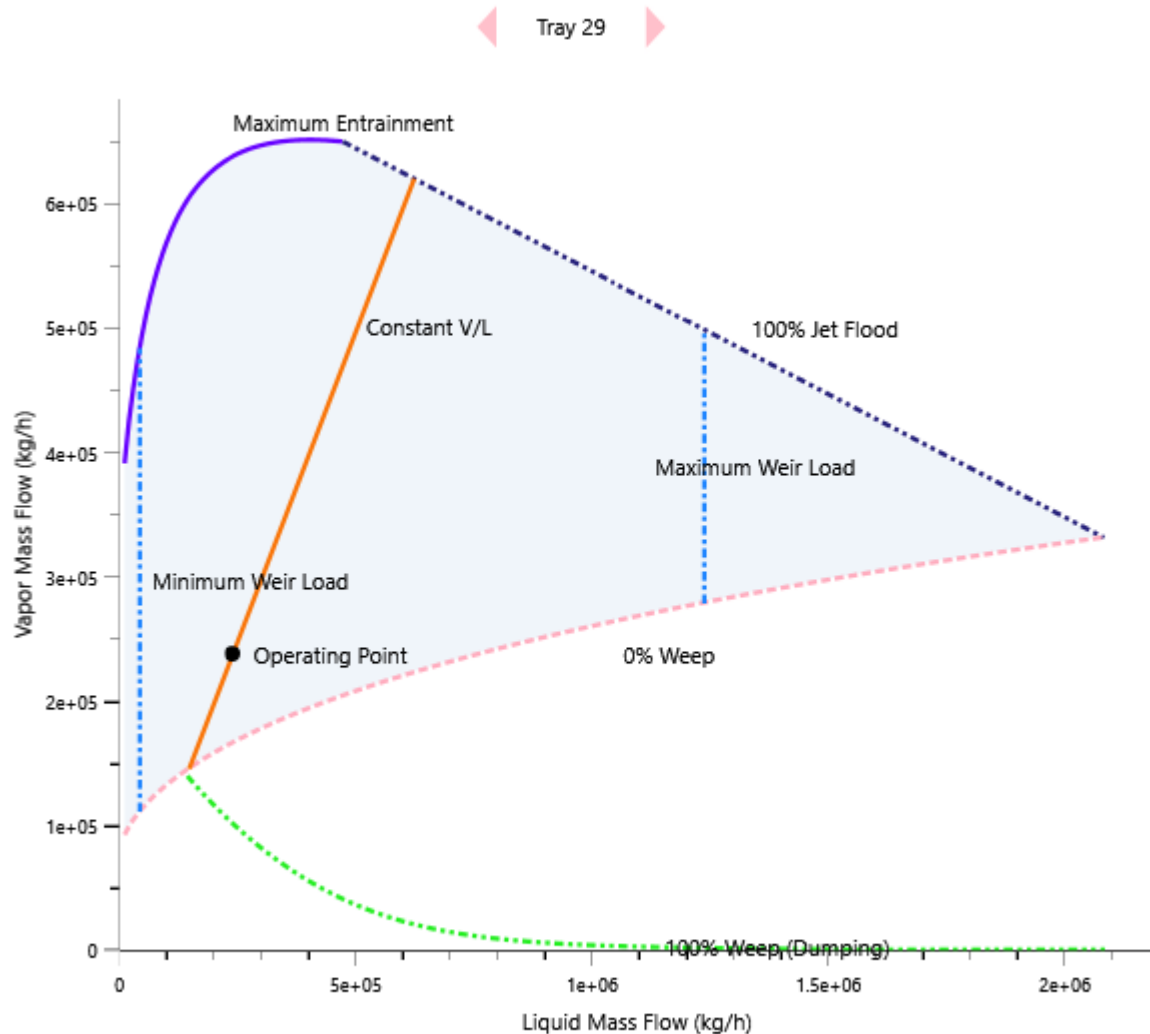
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Job Code:

Project:

Description:



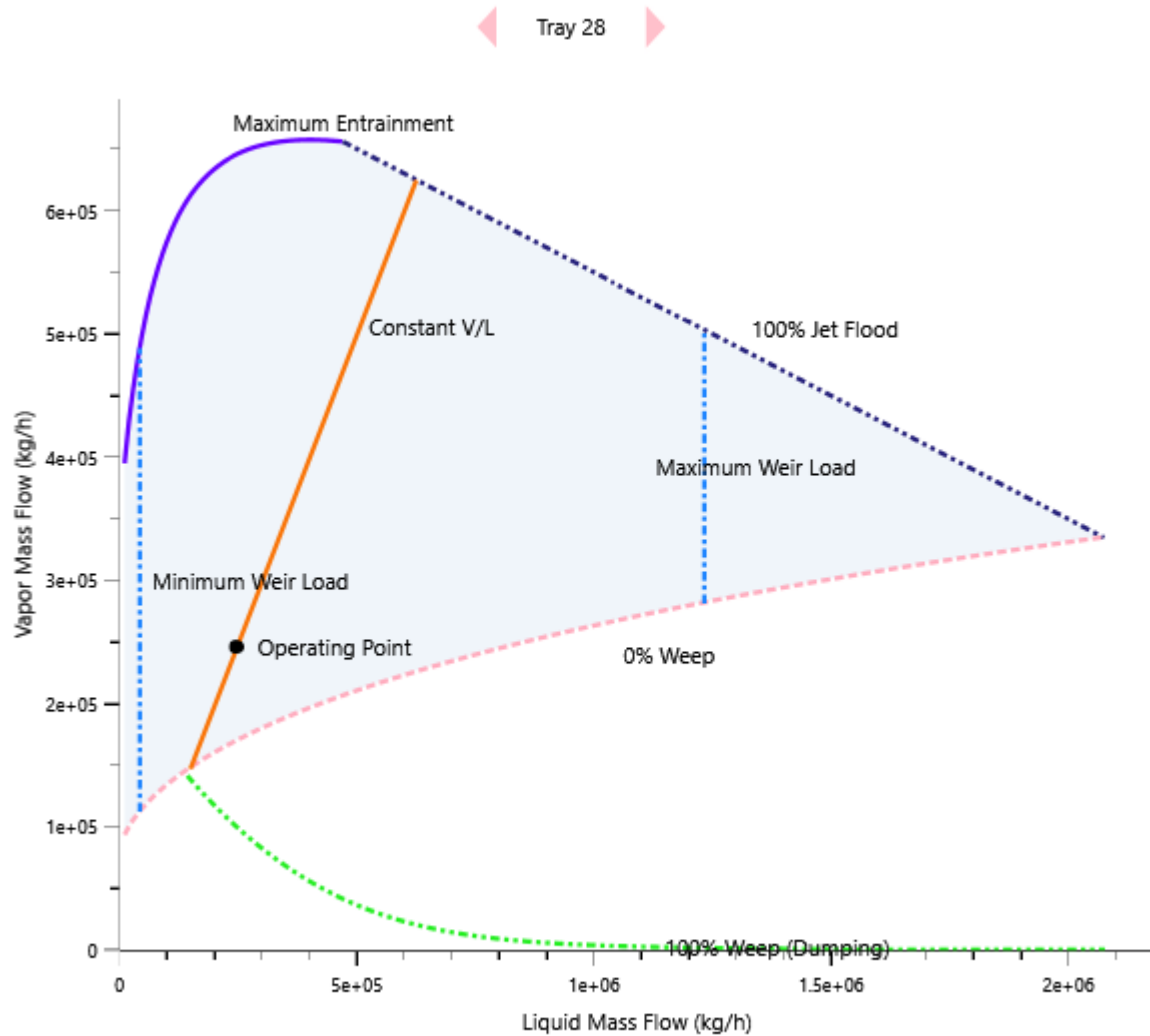
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Job Code:

Project:

Description:



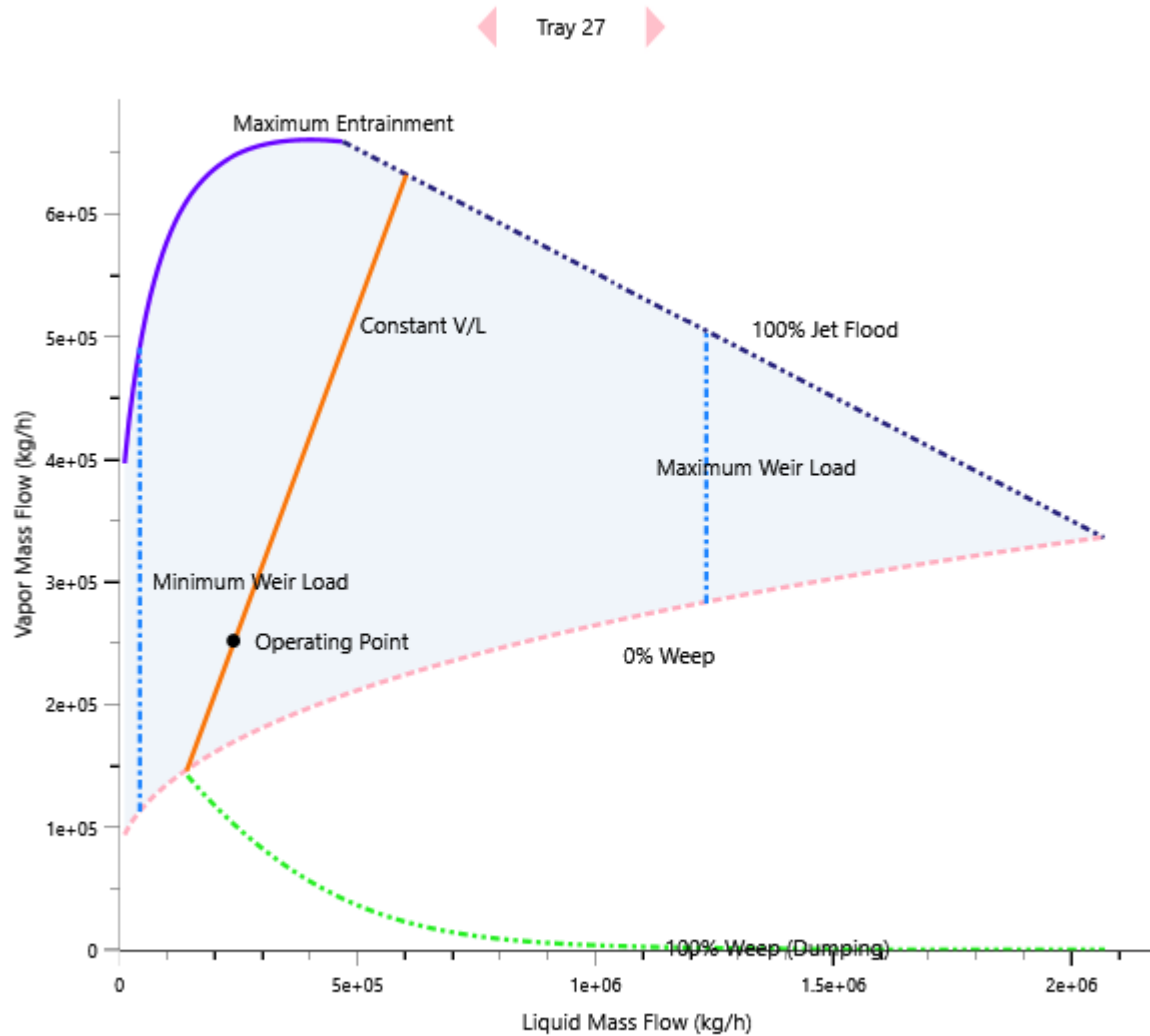
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Project:

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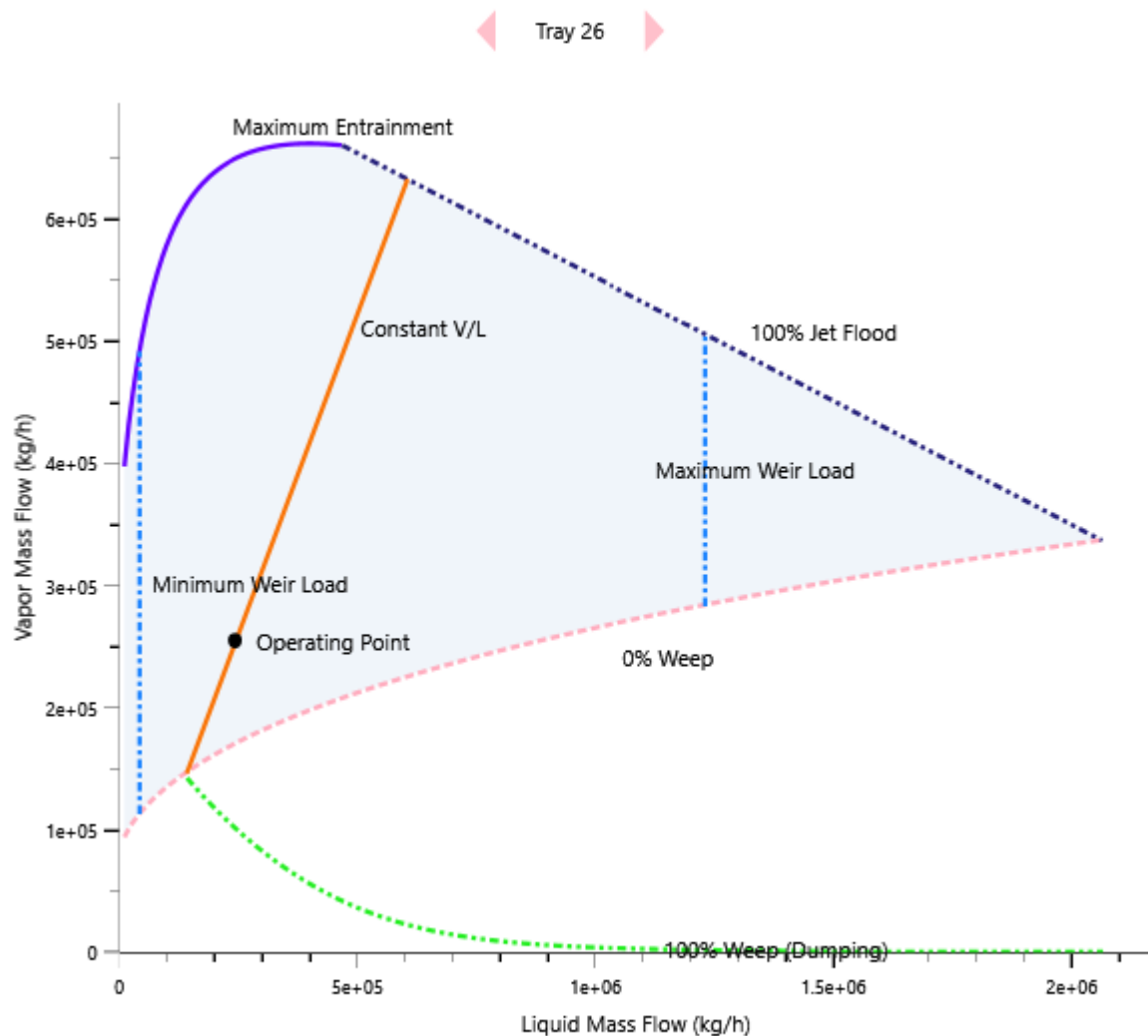
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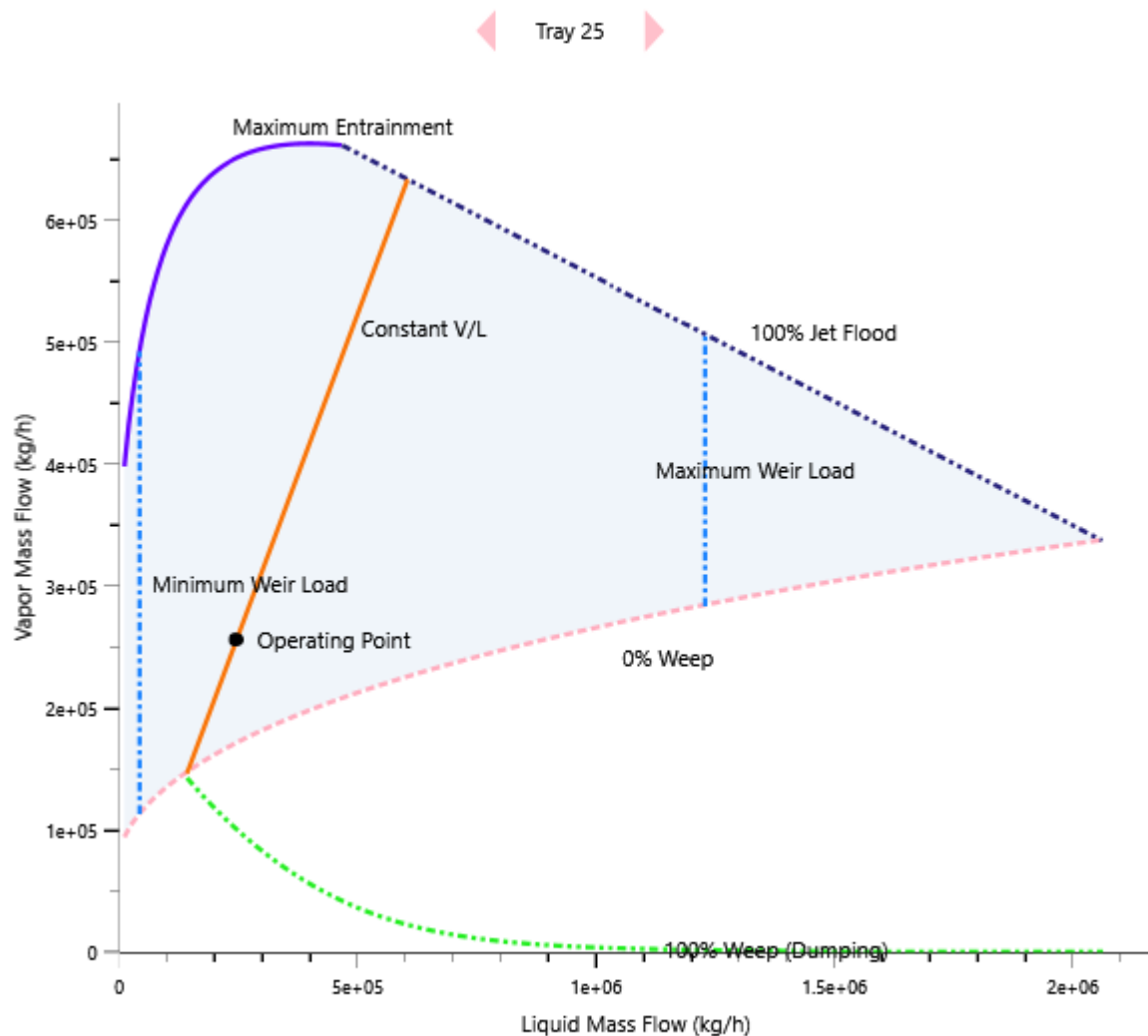
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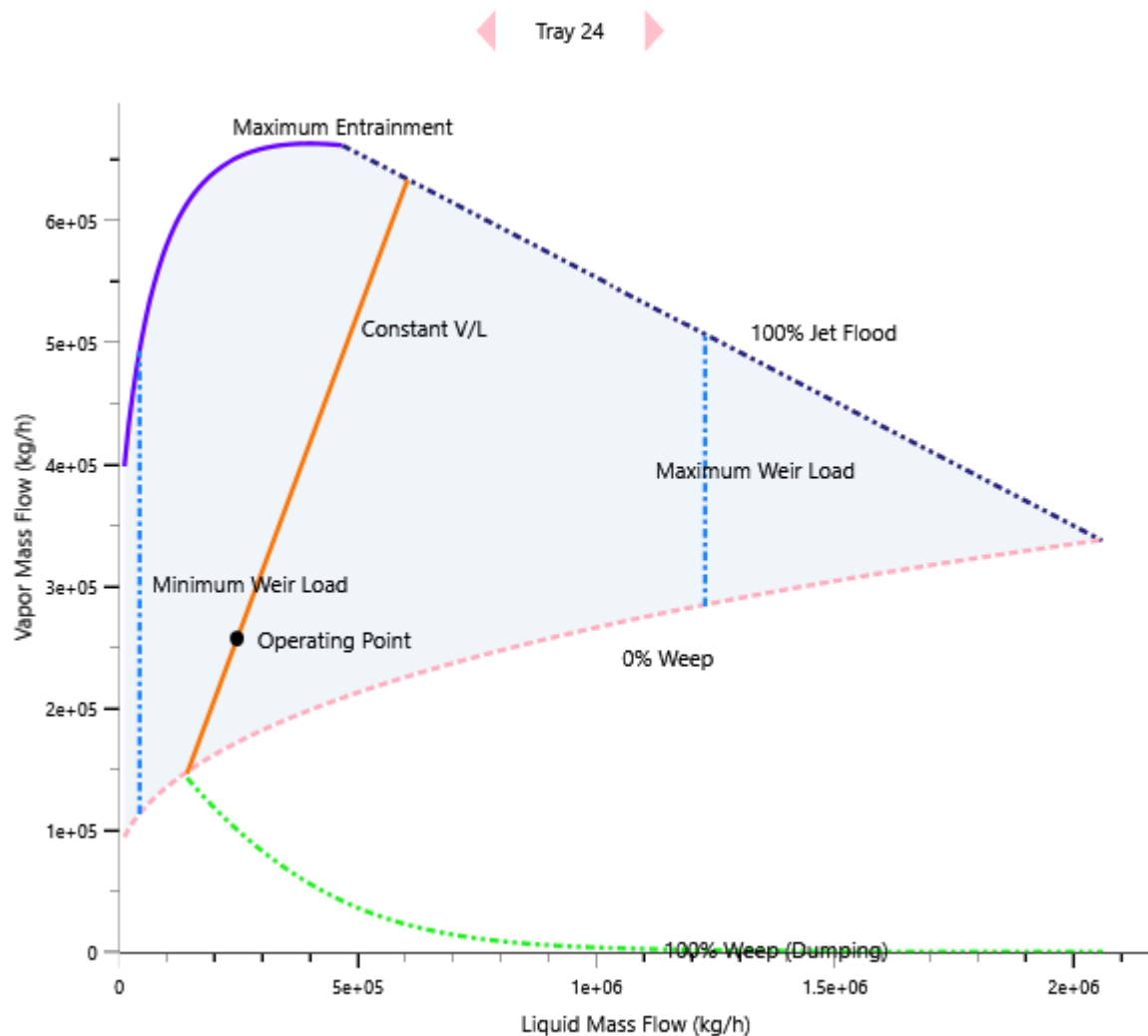
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Job Code:

Project:

Description:



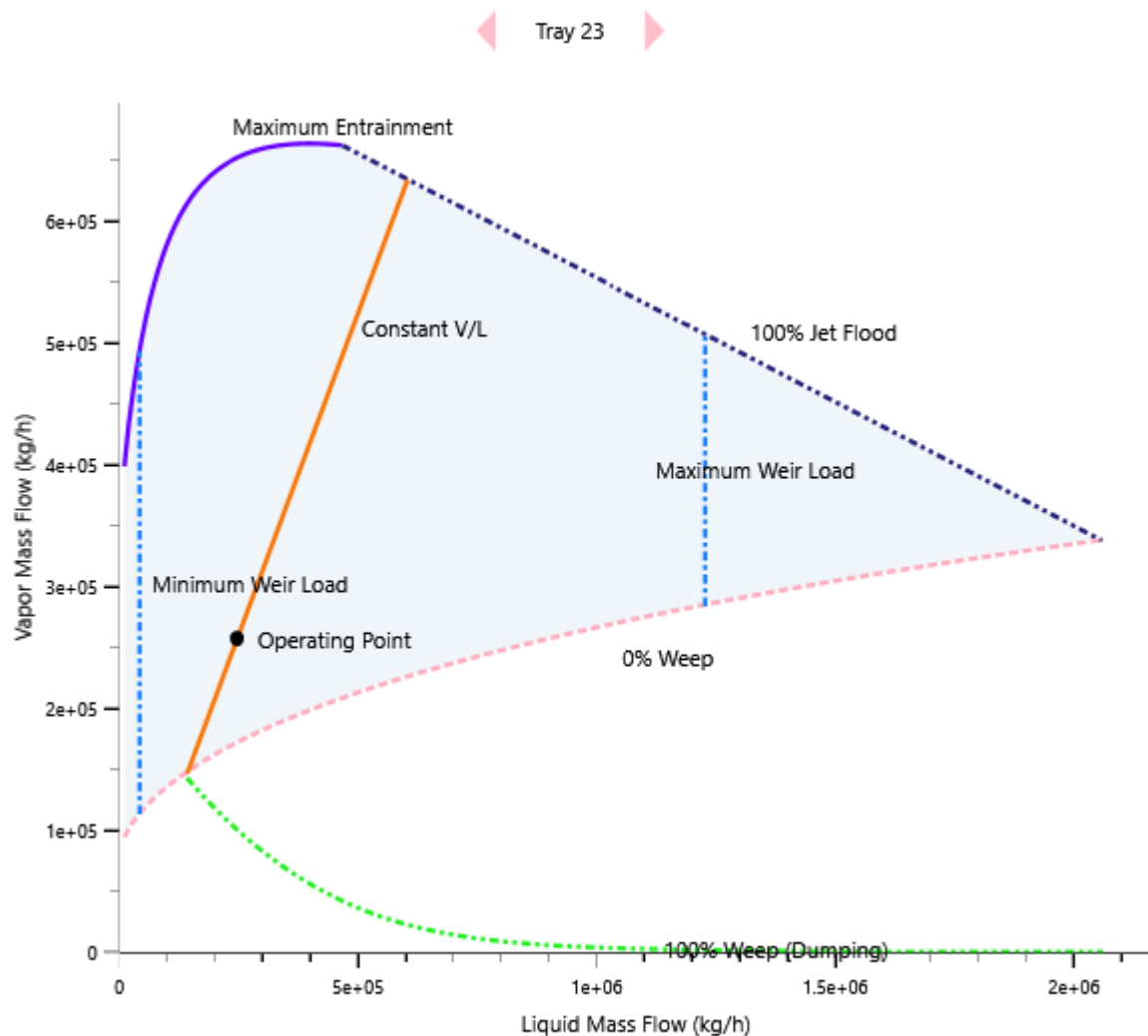
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Job Code:

Project:

Description:



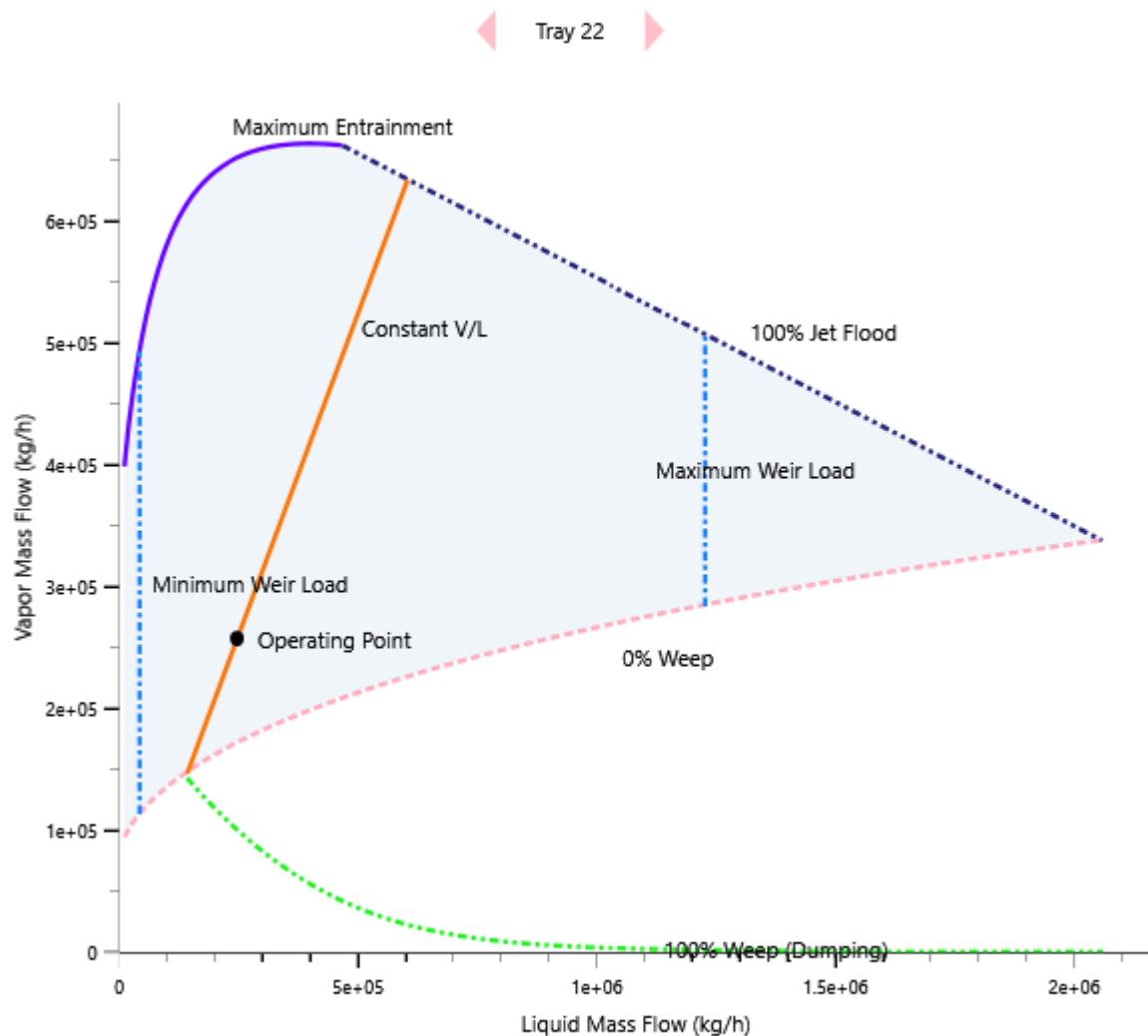
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User Name:

Job Code:

Project:

Description:



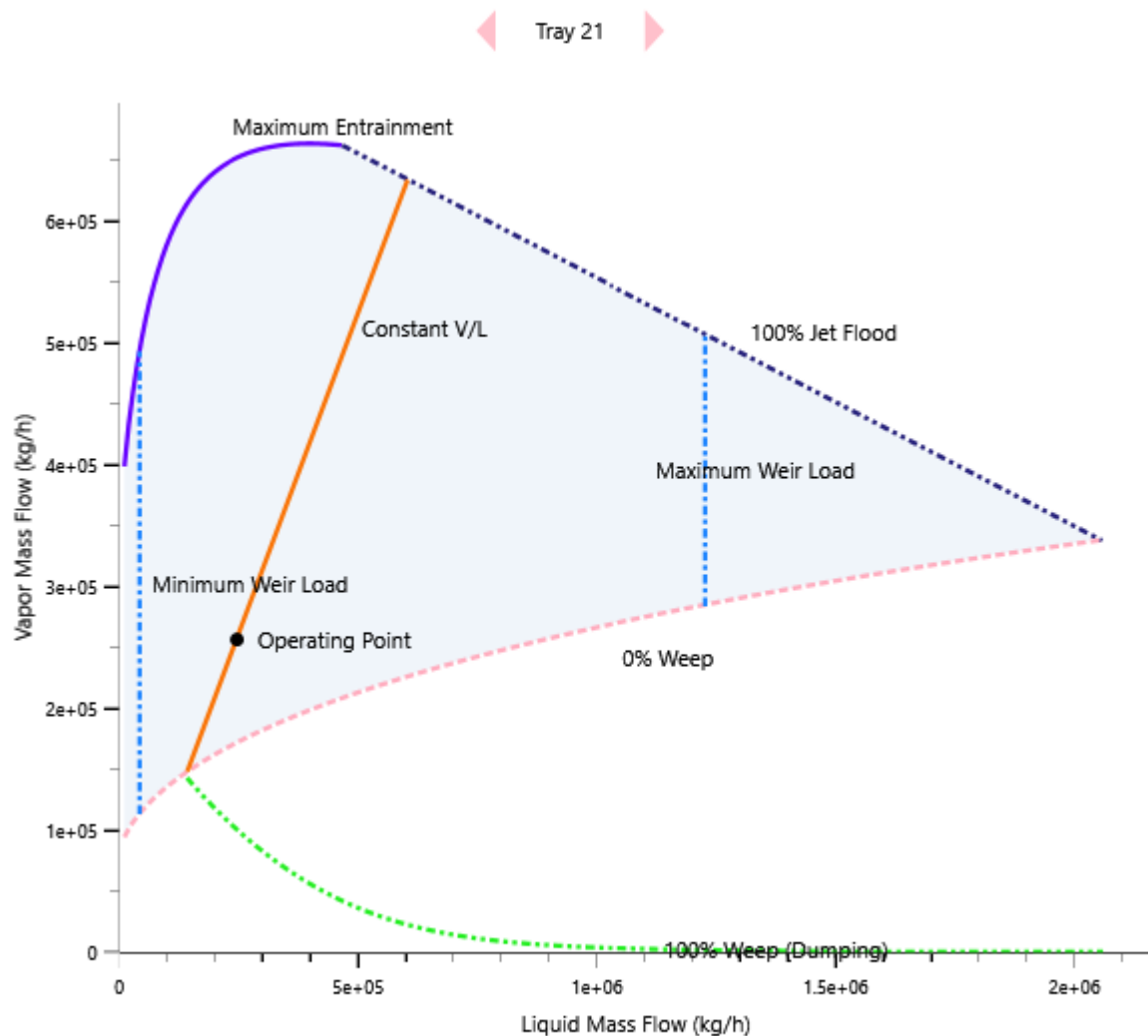
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User Name:

Job Code:

Project:

Description:



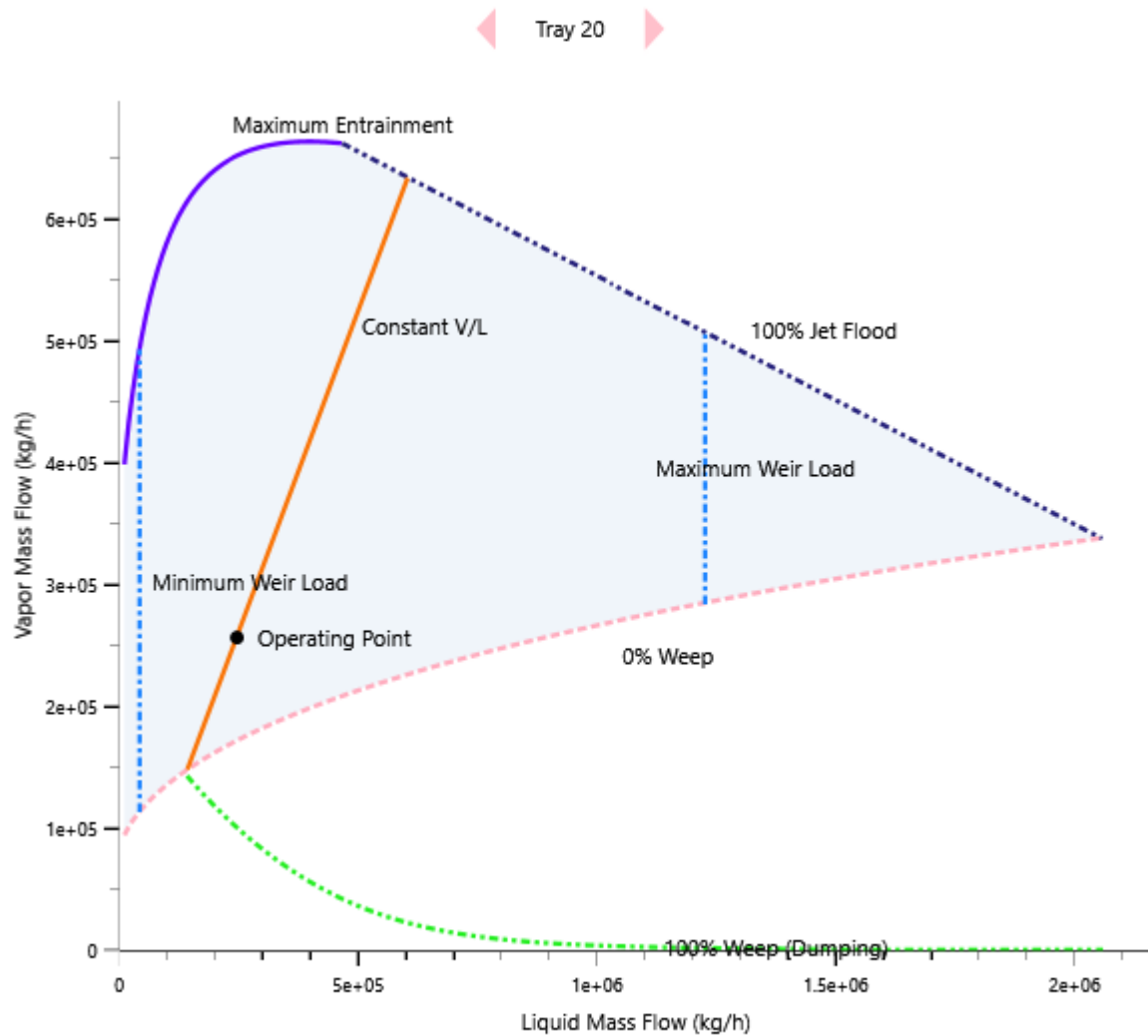
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User Name:

Job Code:

Project:

Description:



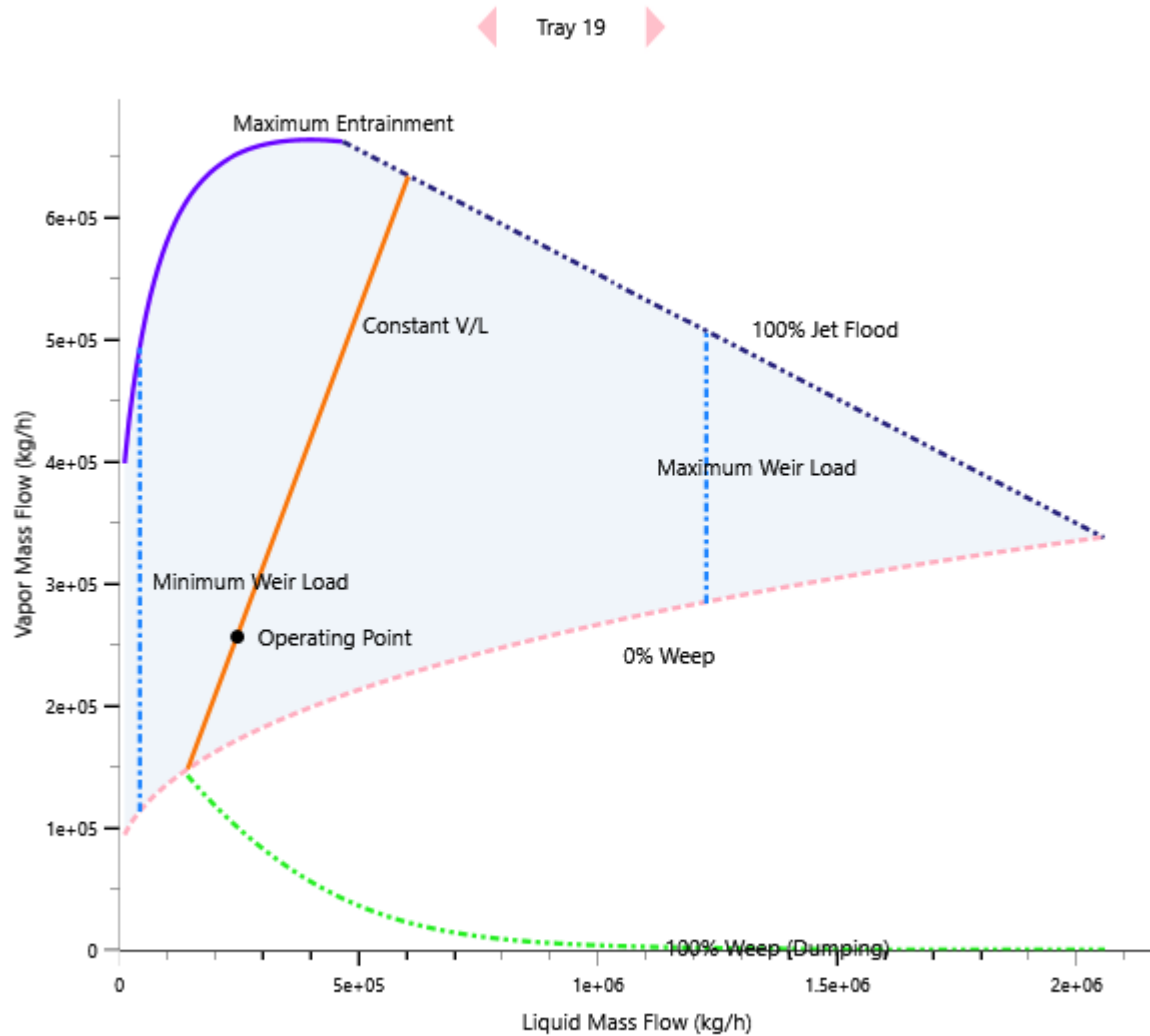
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User Name:

Job Code:

Project:

Description:



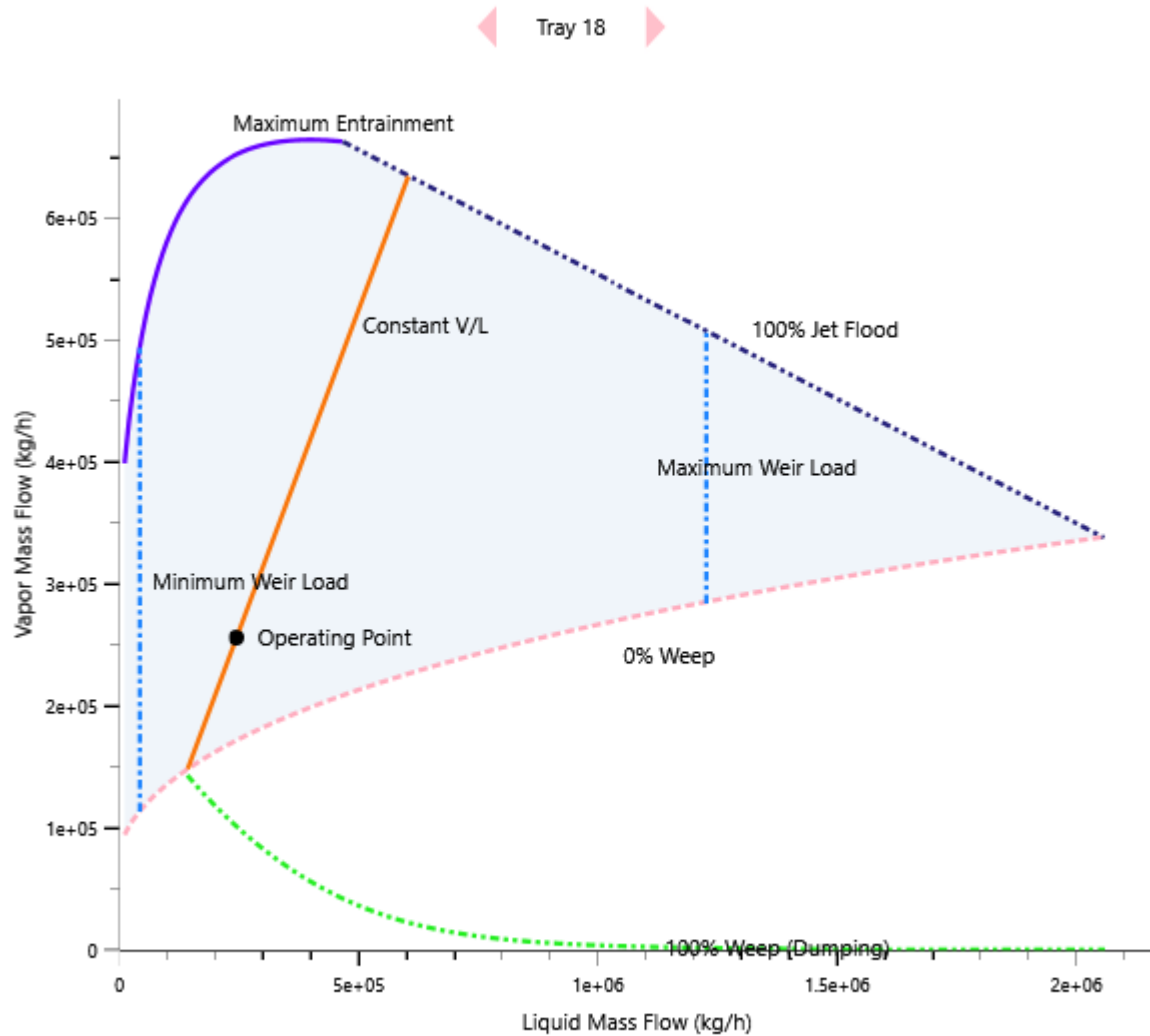
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User Name:

Job Code:

Project:

Description:



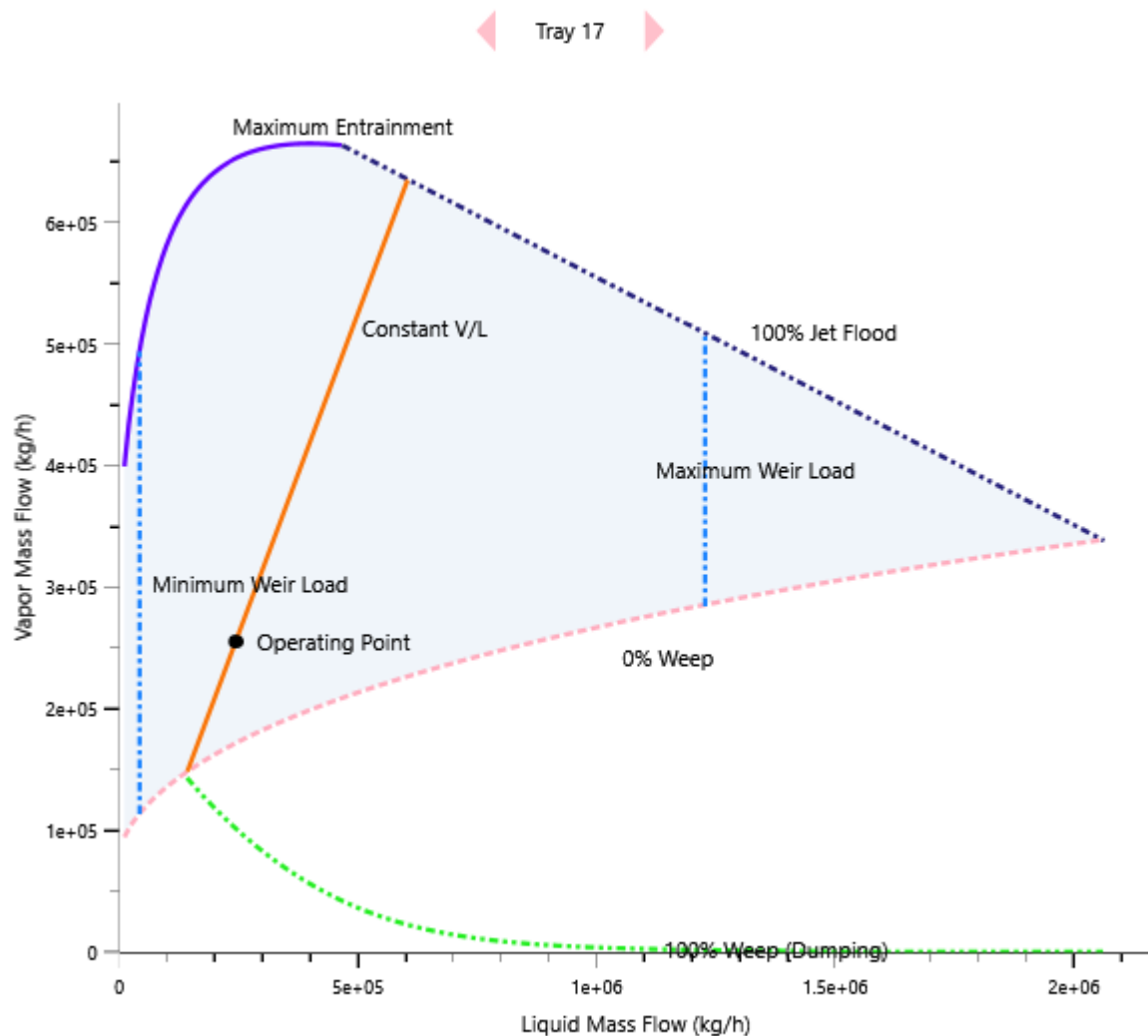
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User Name:

Job Code:

Project:

Description:



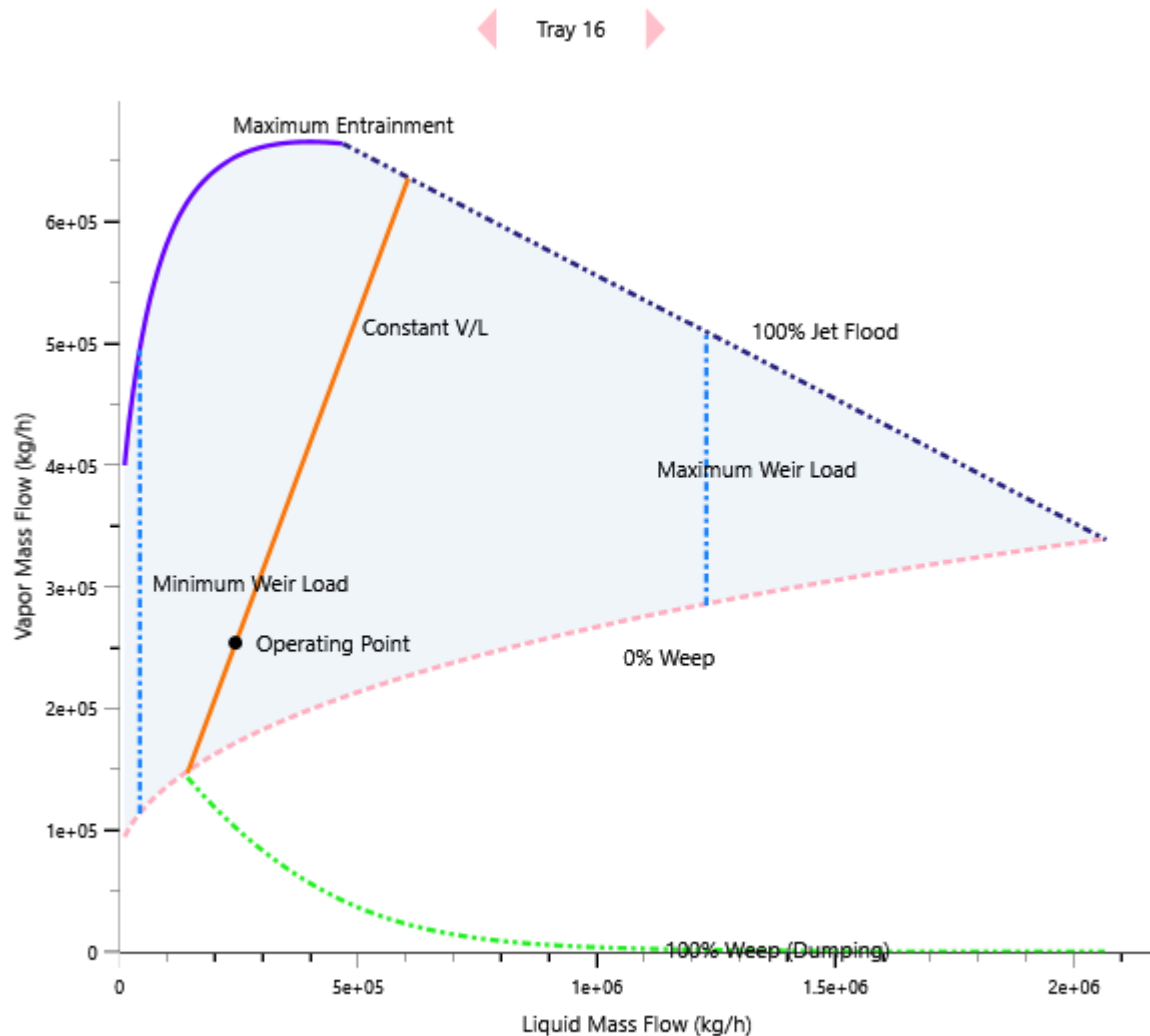
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User Name:

Job Code:

Project:

Description:



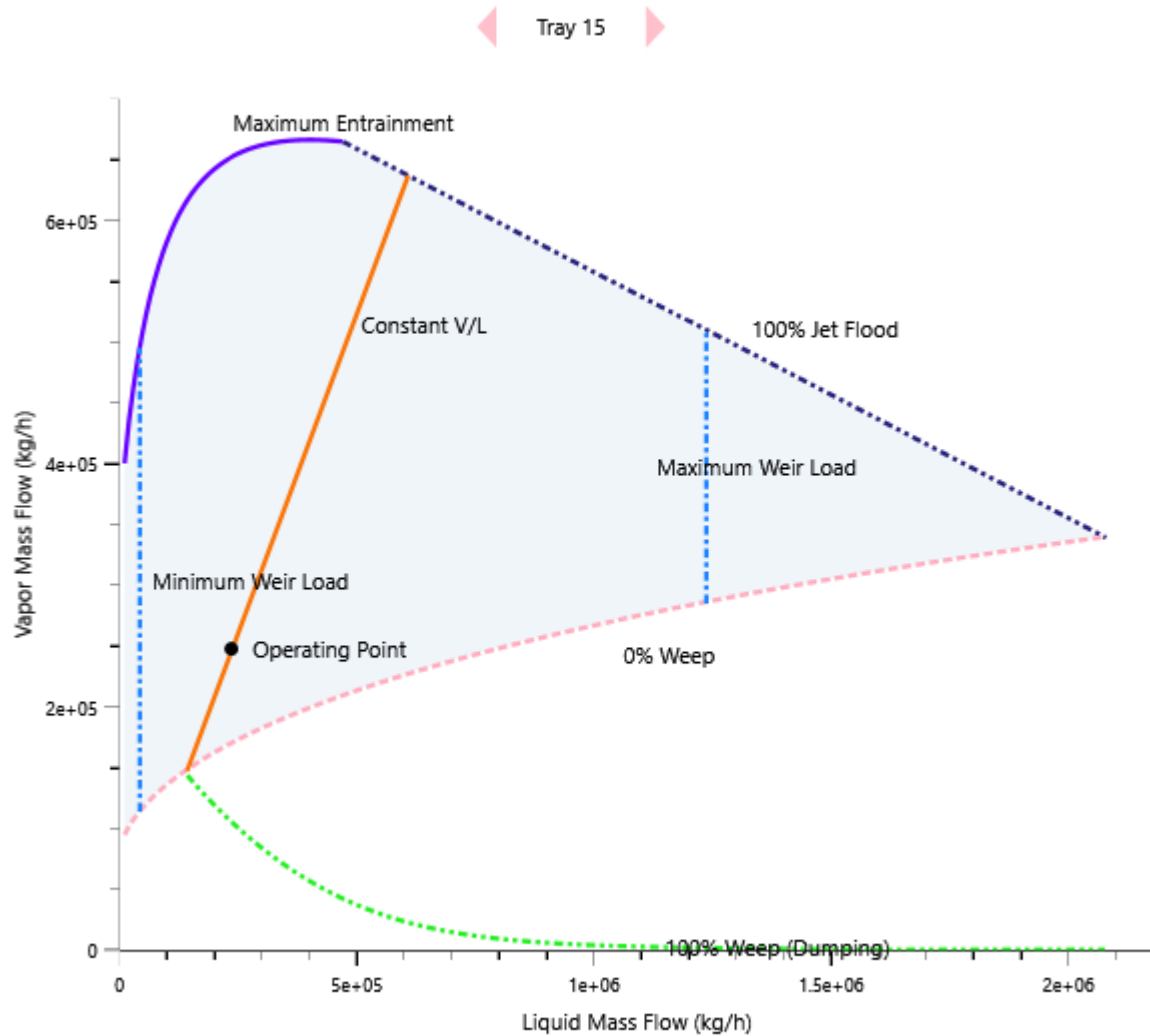
Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

User Name:

Job Code:

Project:

Description:



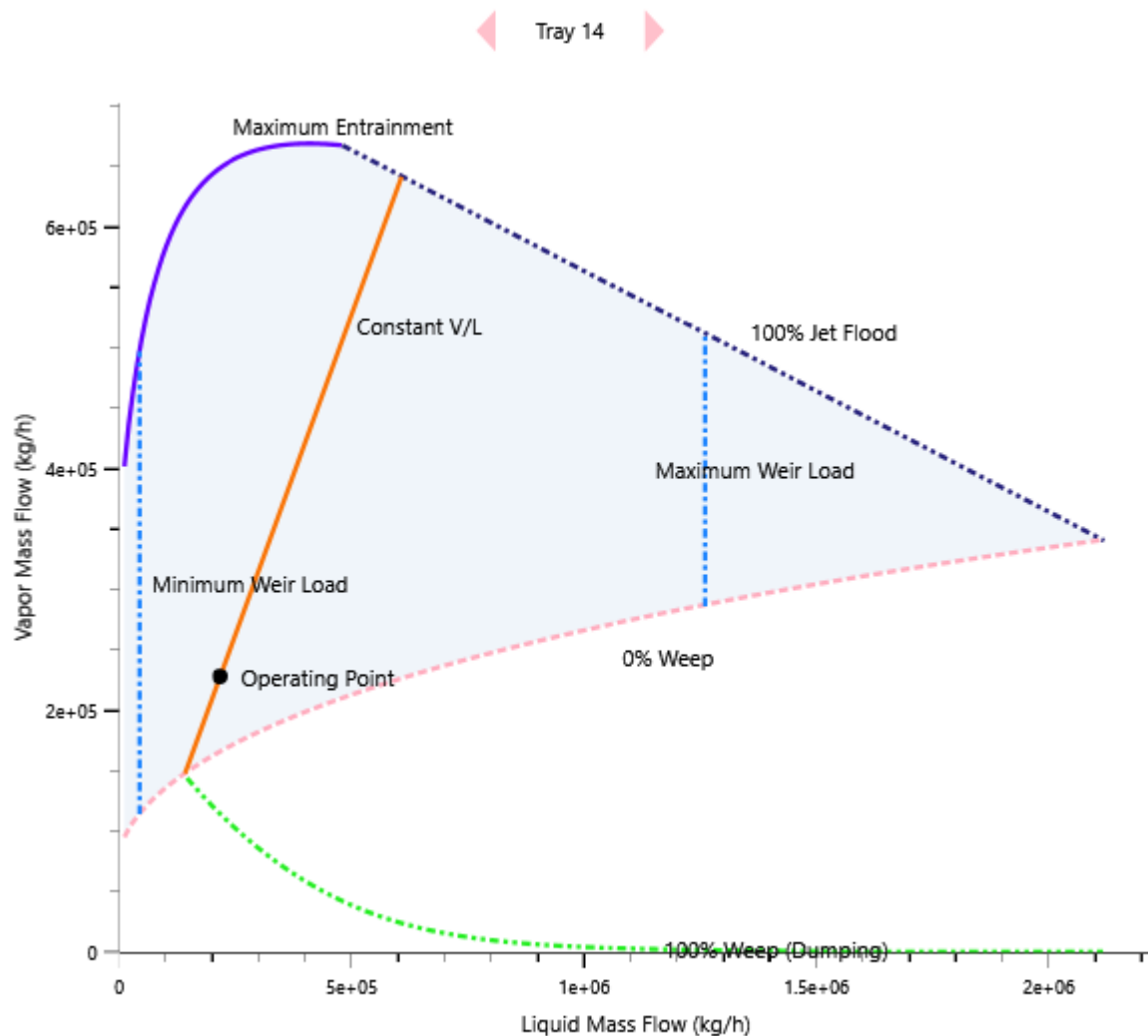
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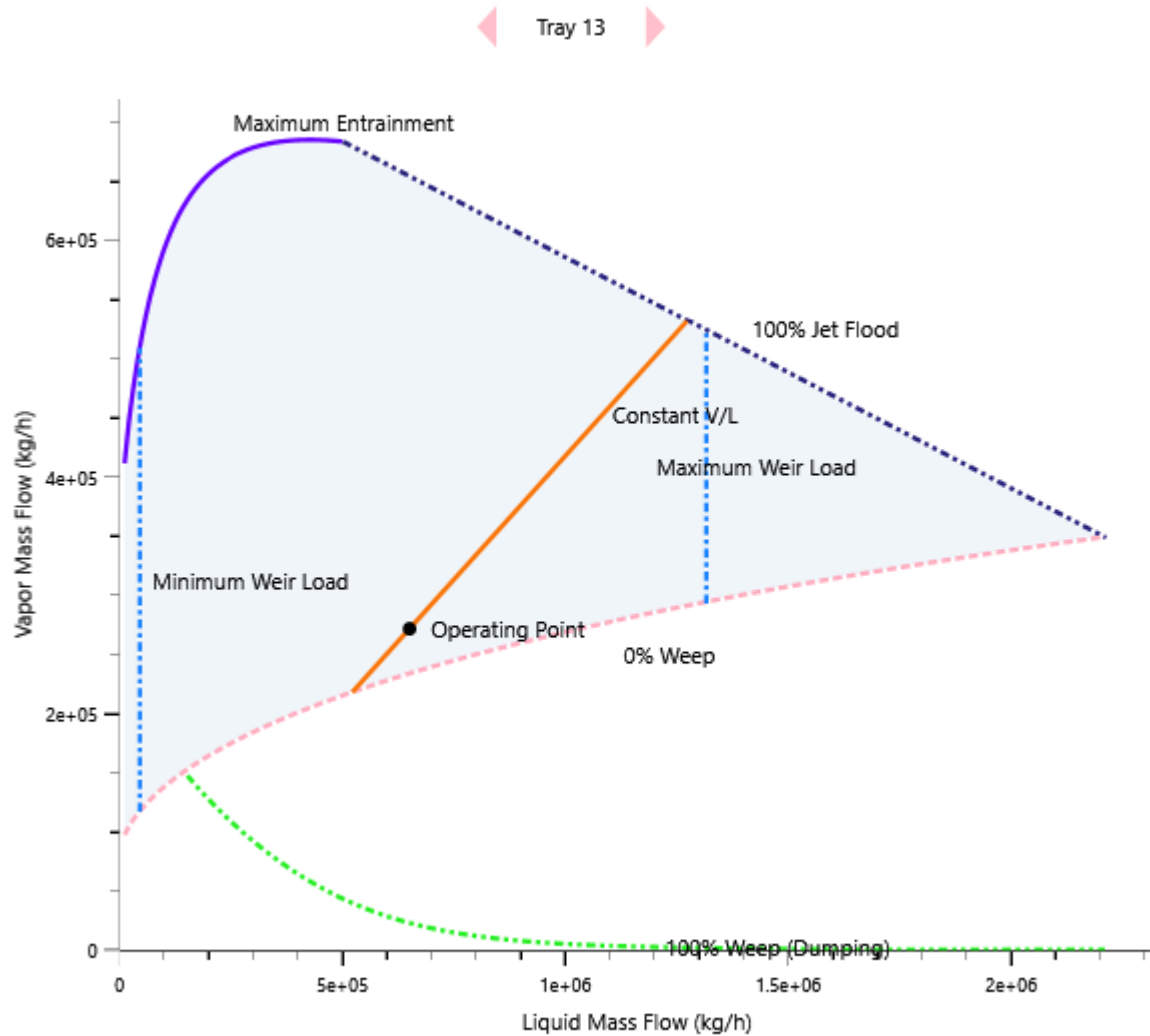
Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

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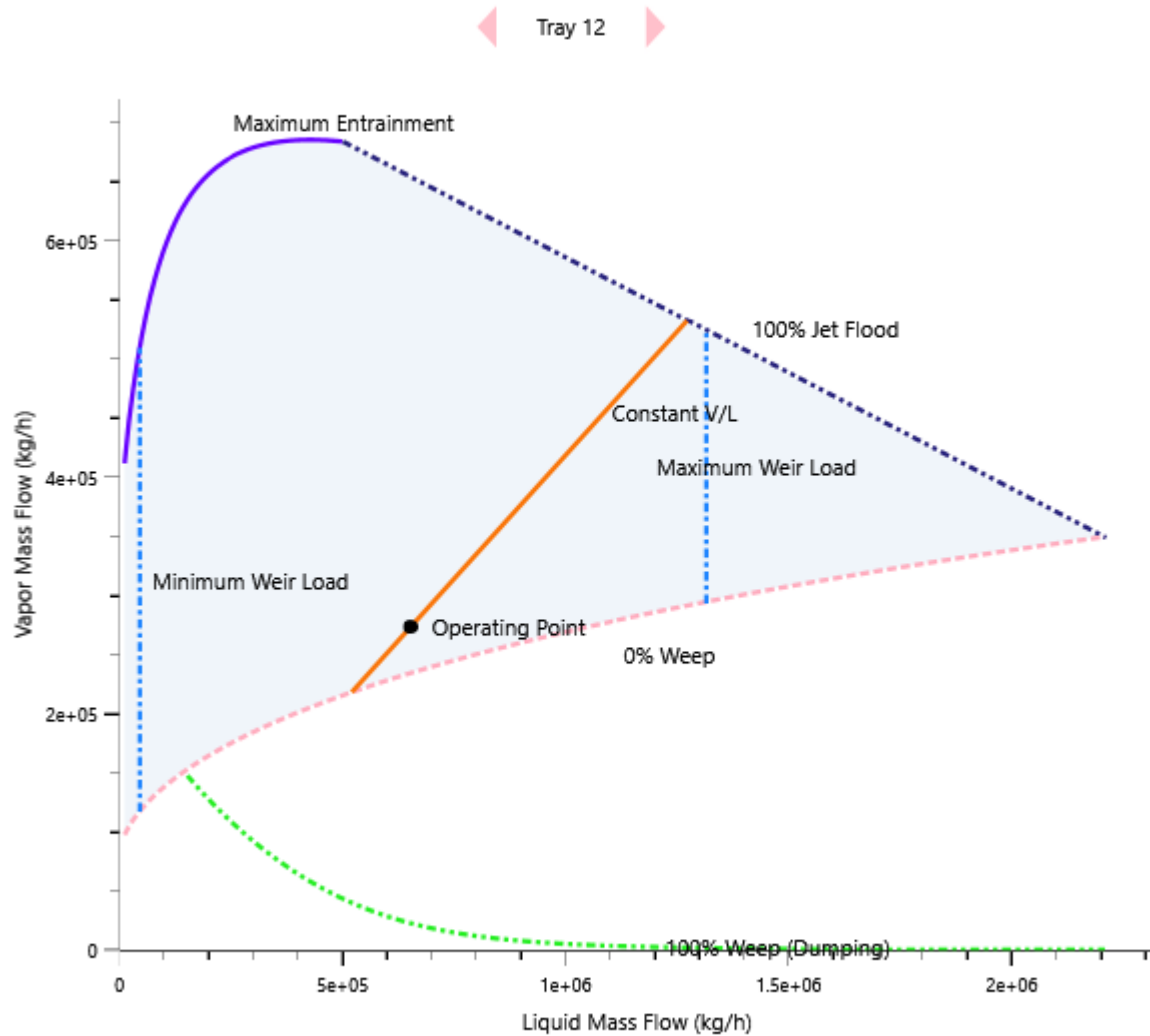
Hydraulic Analysis Report - T-1101 : Internals-1@Main Tower@COL1

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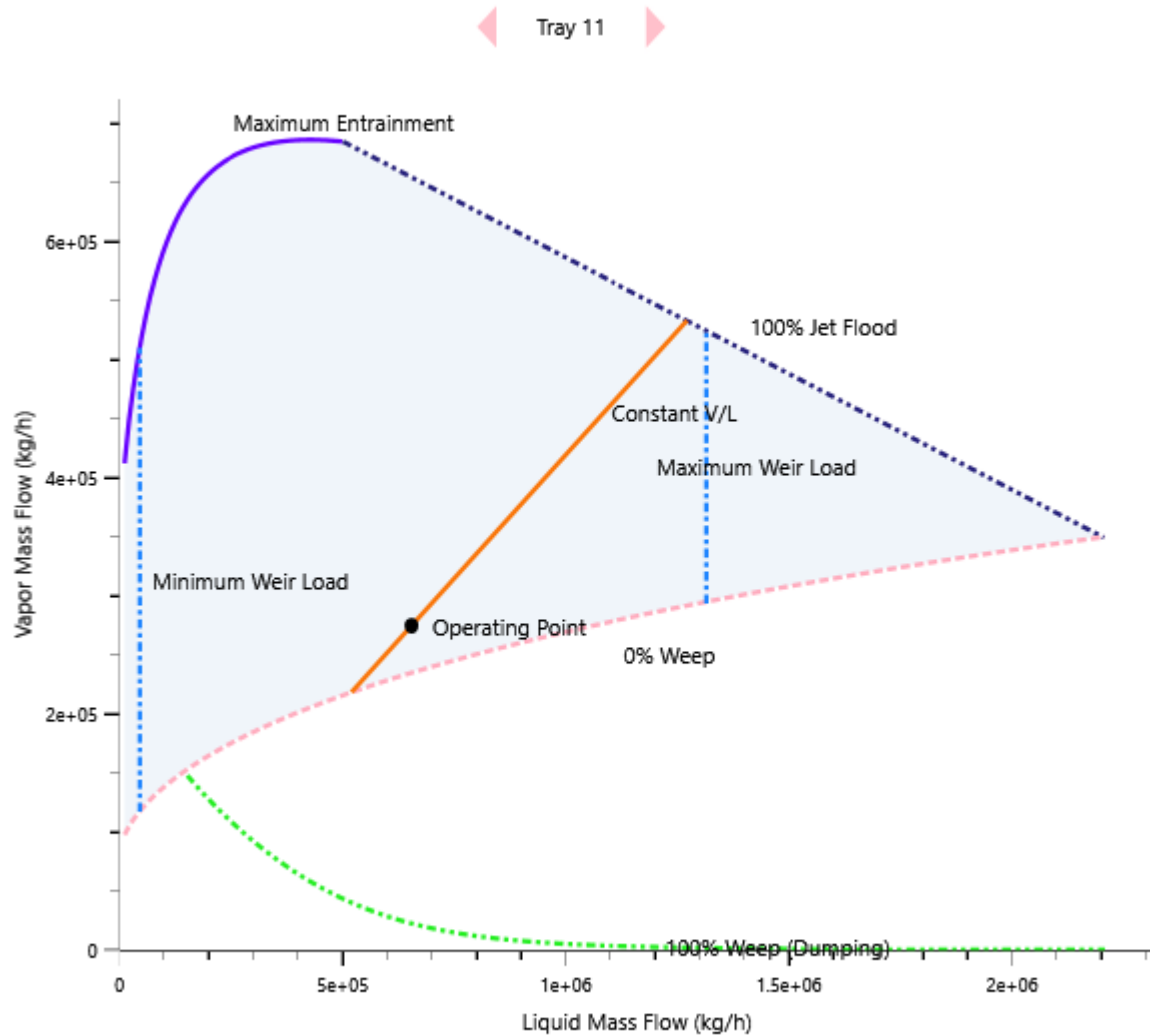
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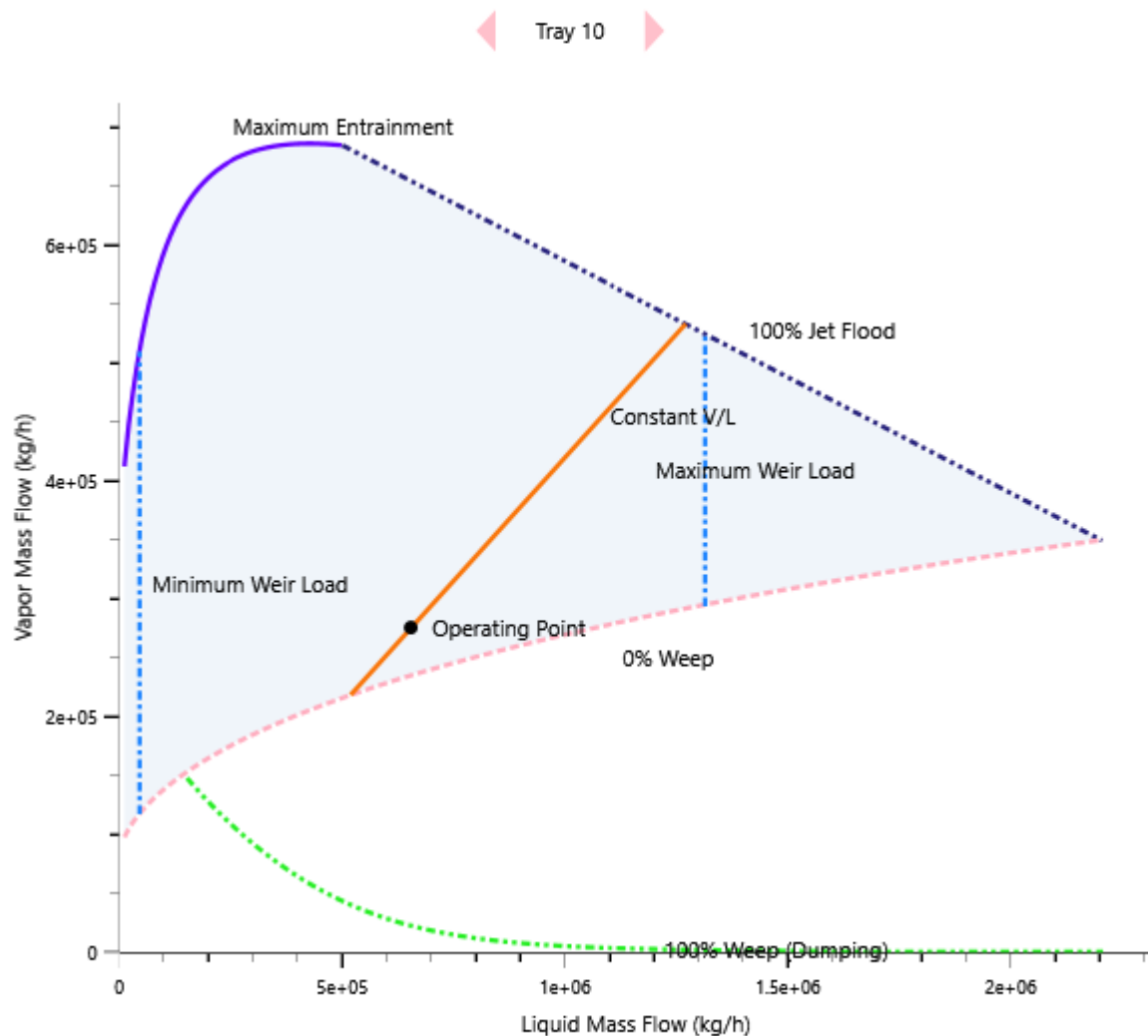
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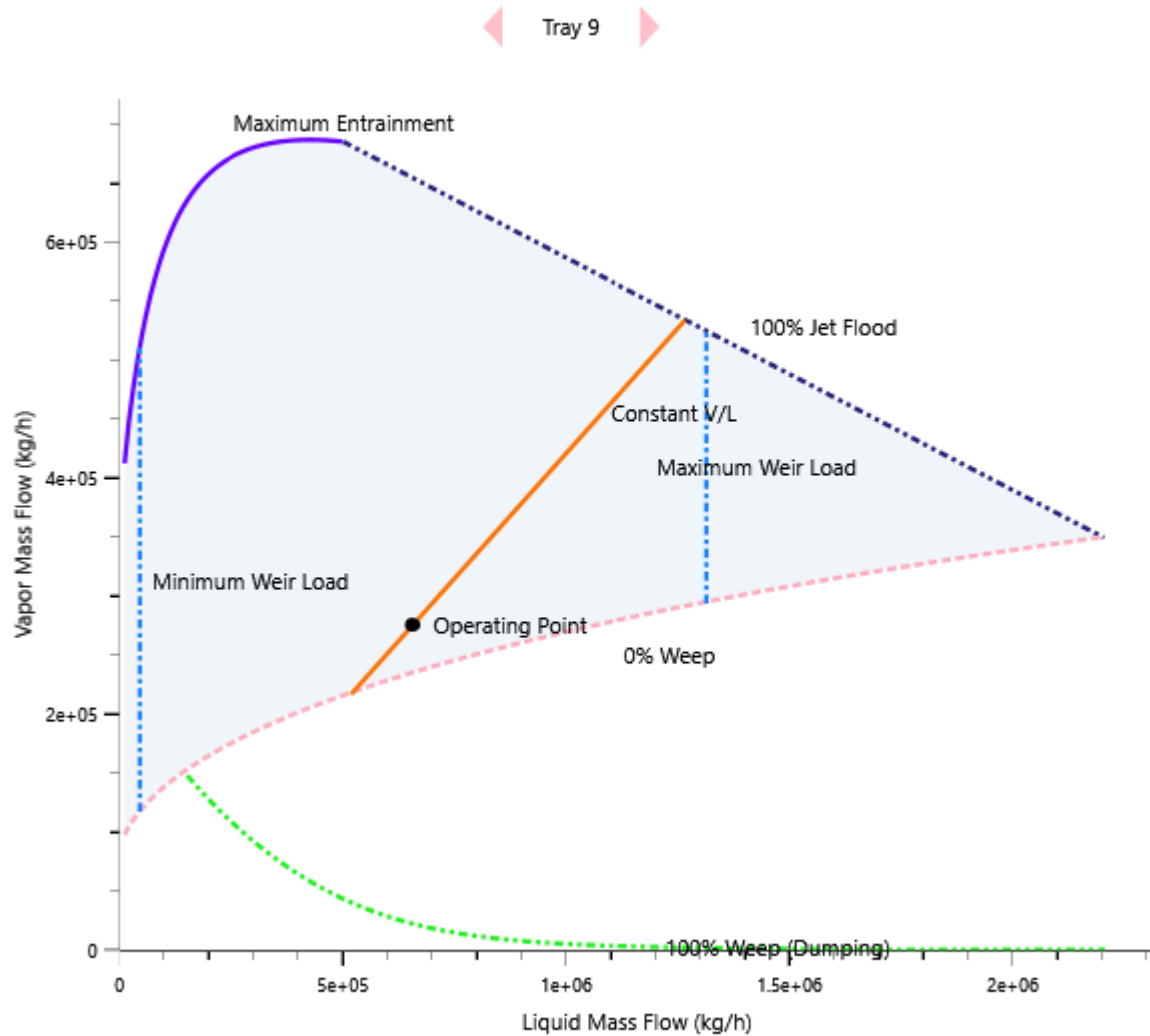
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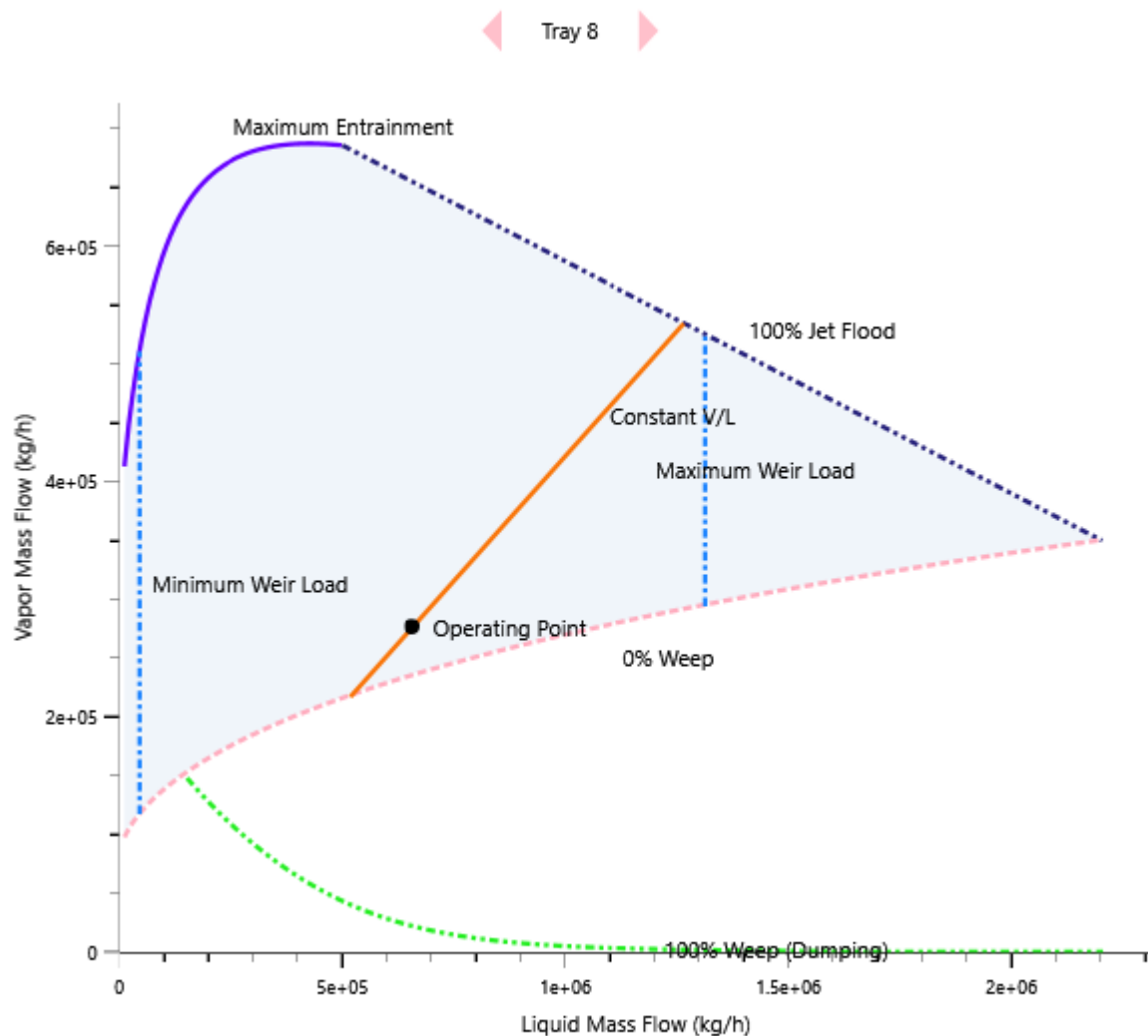
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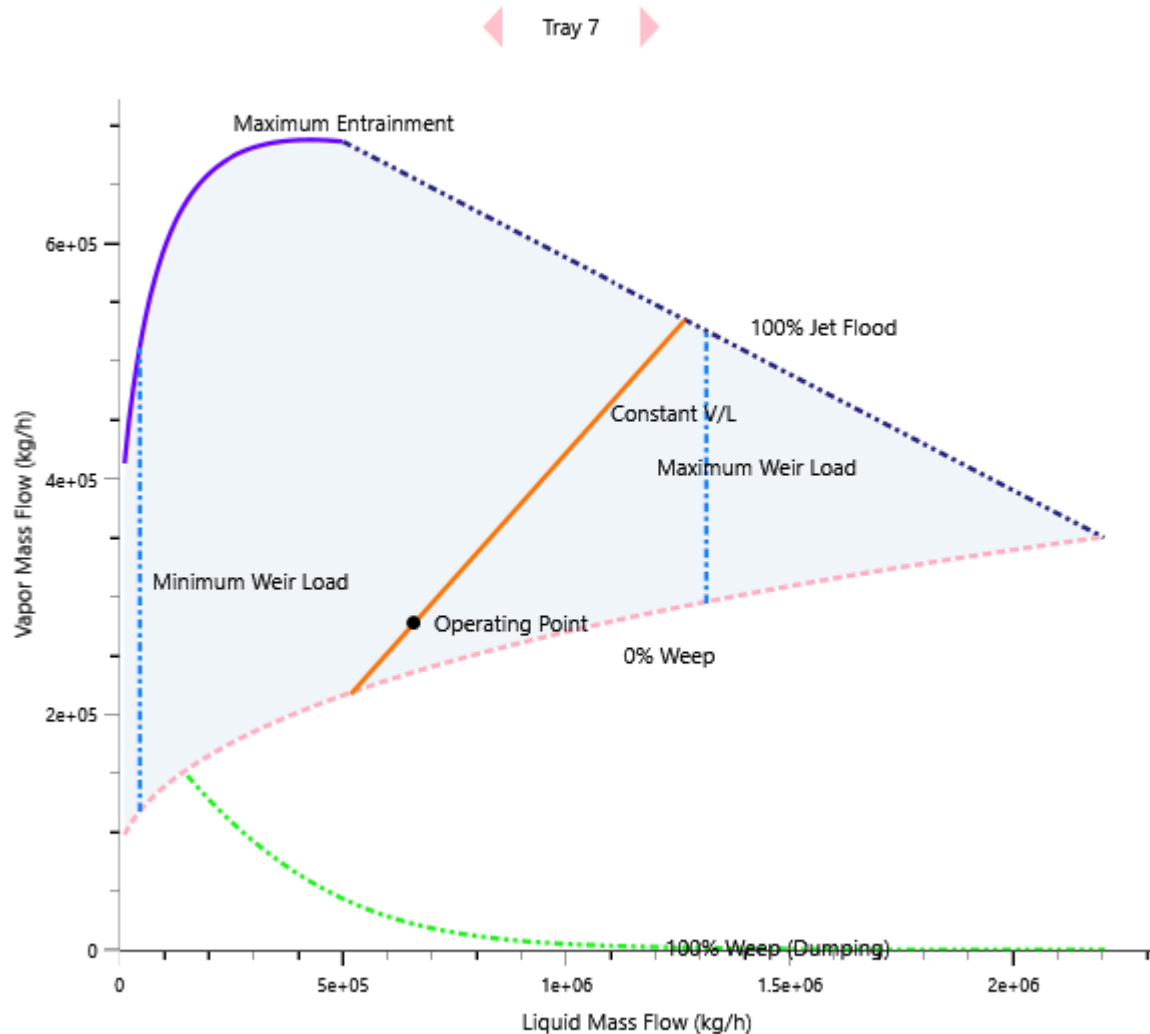
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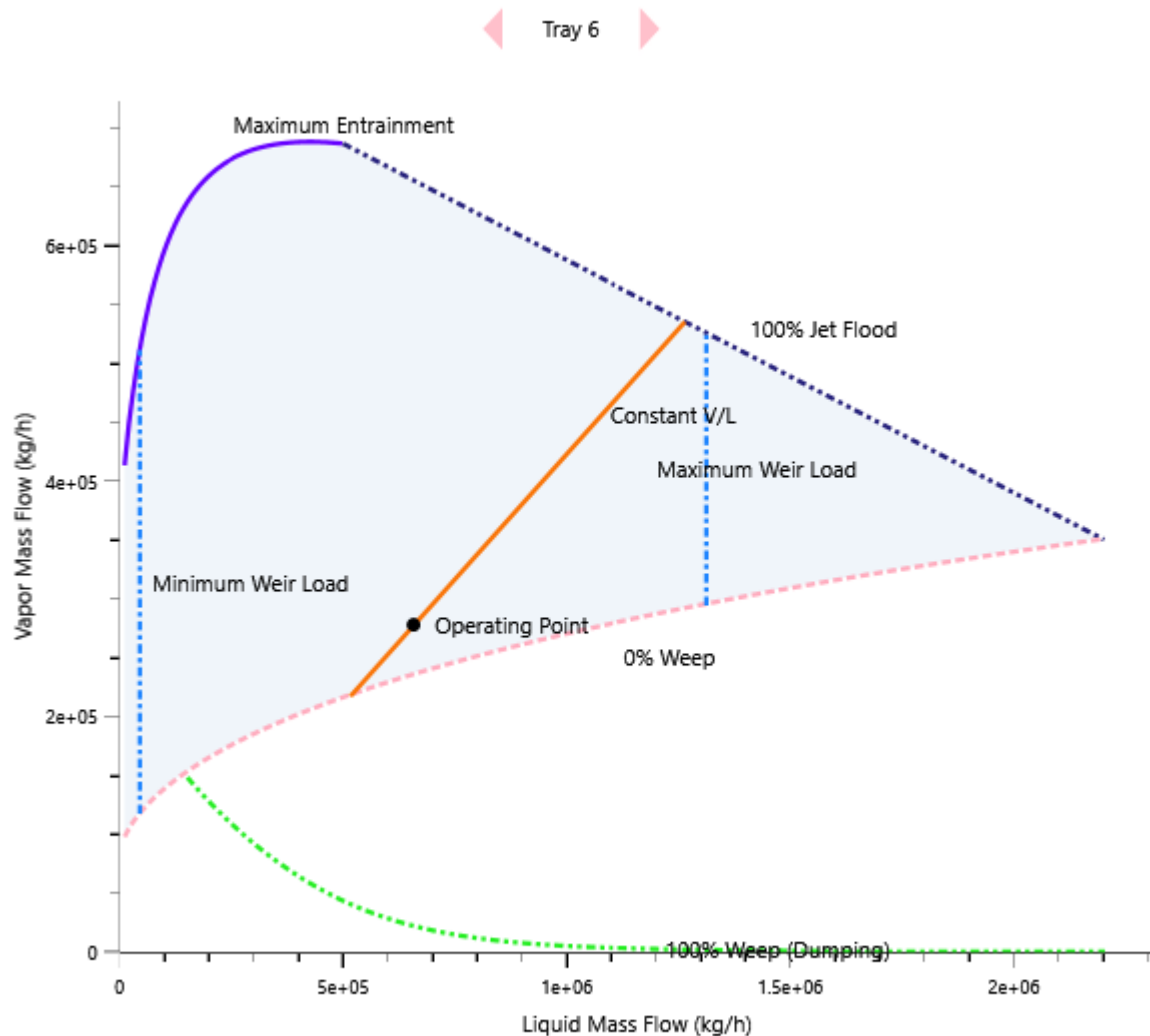
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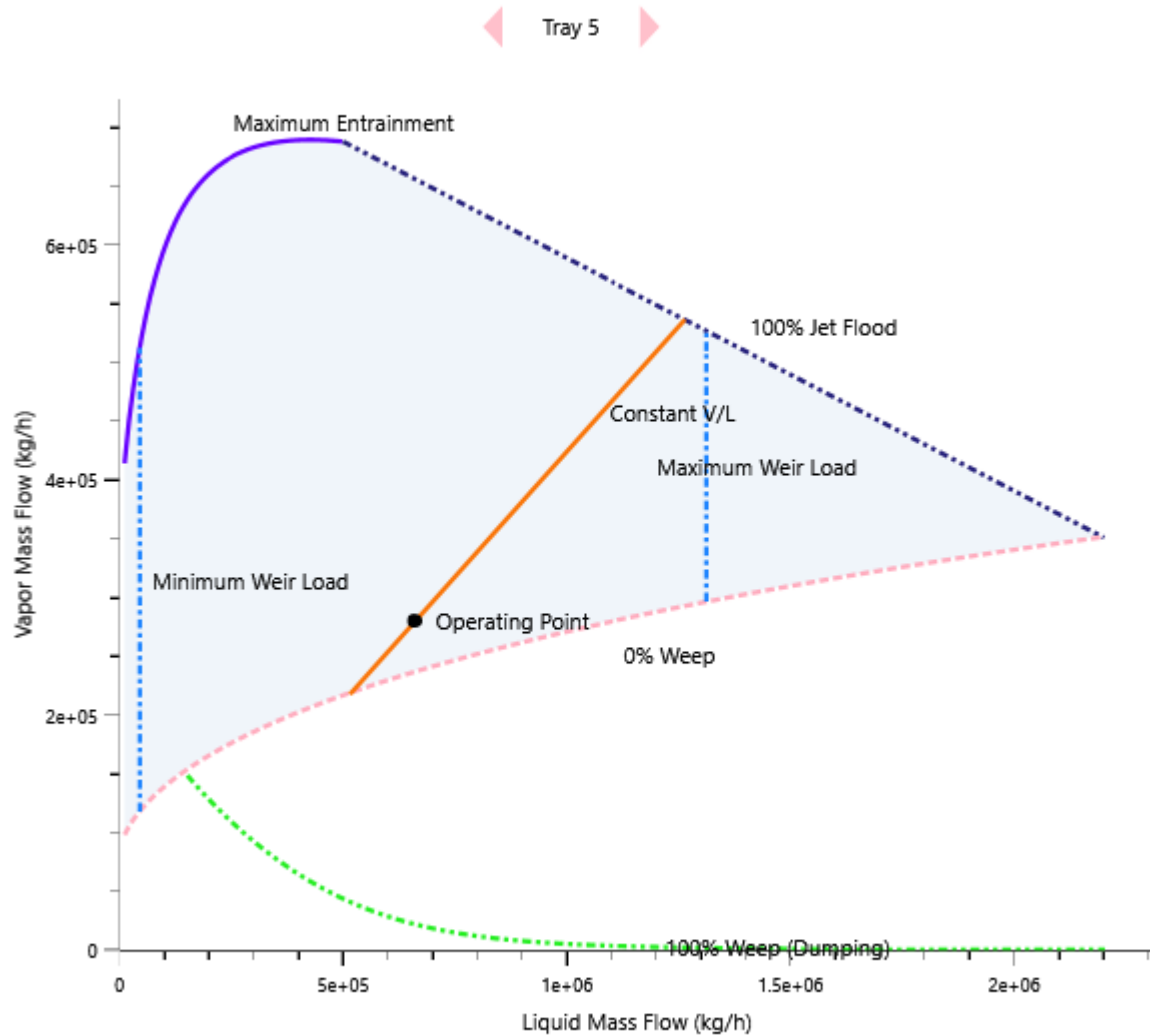
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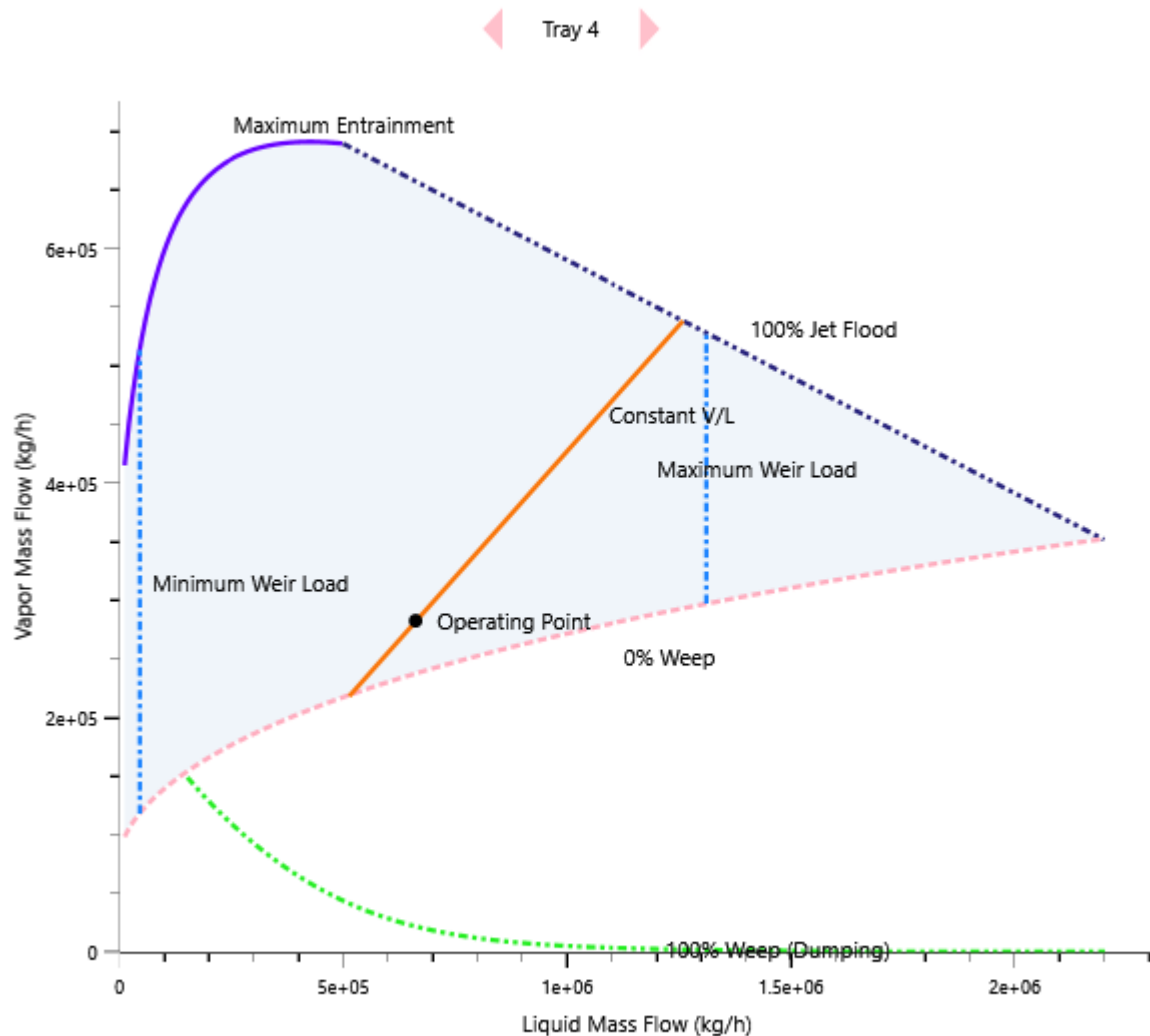
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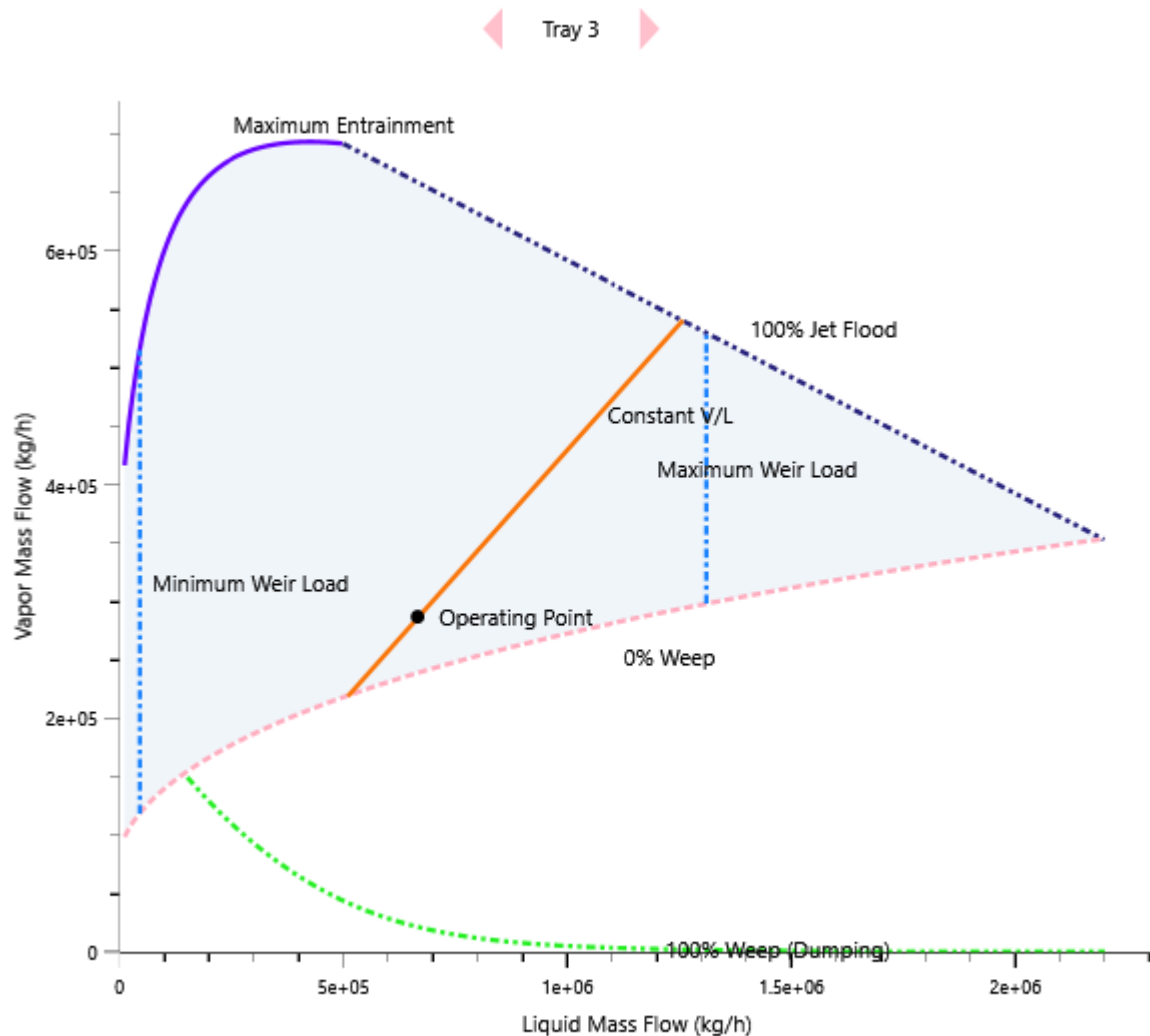
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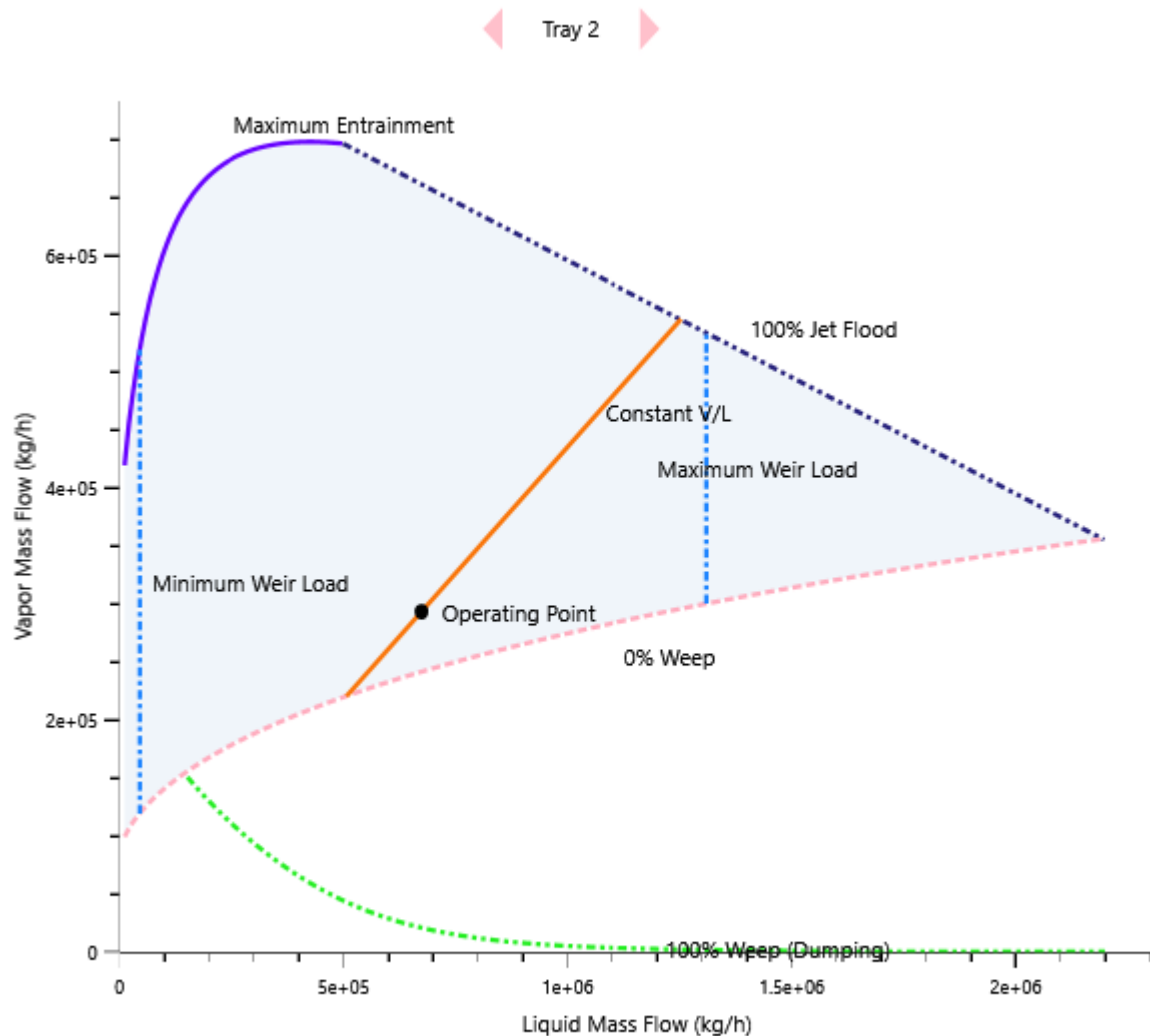
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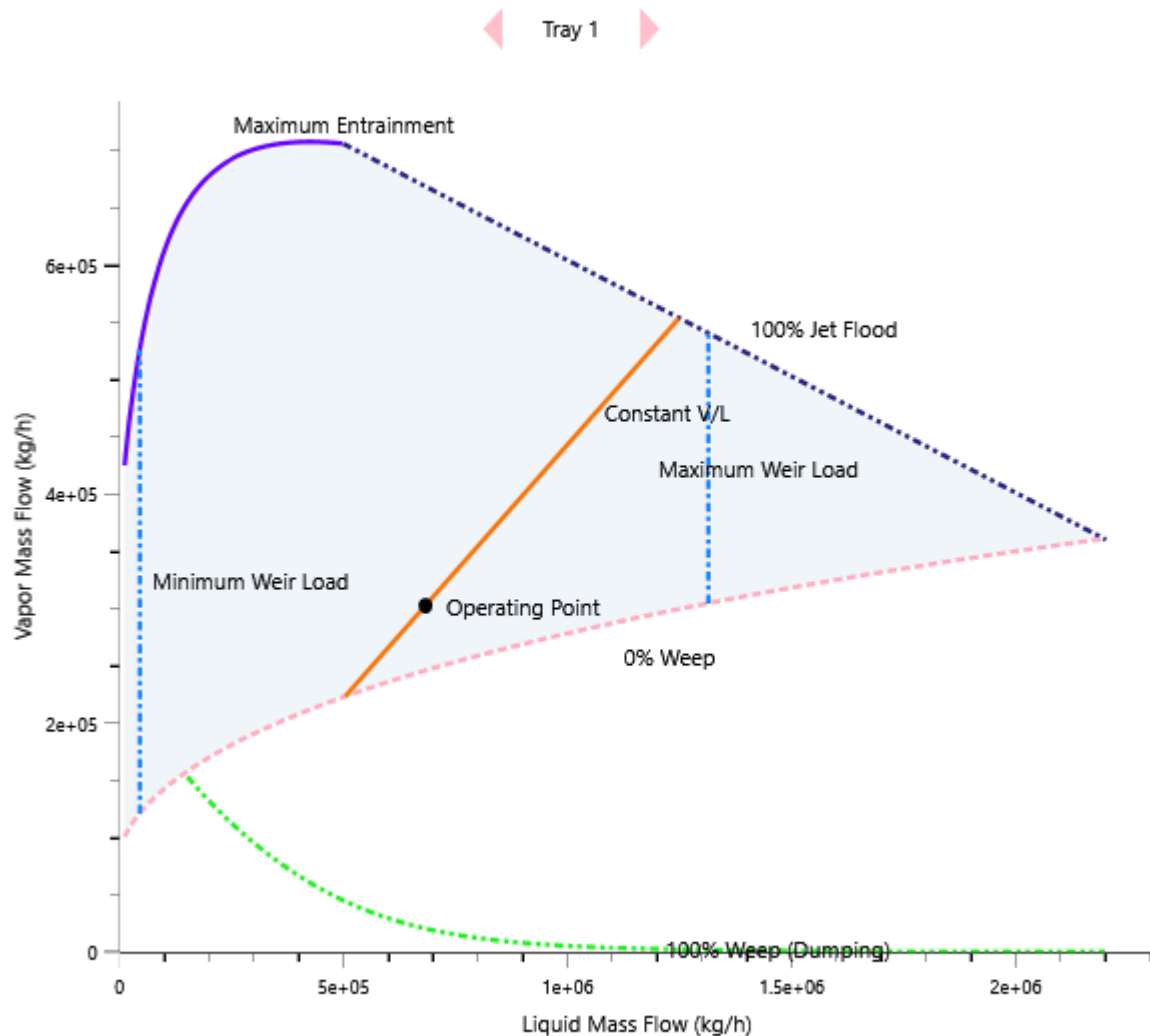
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4. Column Profile

Main Tower Profile (1)

Tray/Stage	Liquid temperature (C)	Vapor temperature (C)	Liquid mass flow (kg/h)	Vapor mass flow (kg/h)	Liquid volume flow (m3/h)
1	60.96	72.19	2.326E+05	2.289E+05	423
2	72.19	80.07	2.385E+05	2.385E+05	436
3	80.07	85.19	2.465E+05	2.465E+05	451.6
4	85.19	88.04	2.399E+05	2.521E+05	440.7
5	88.04	89.58	2.431E+05	2.553E+05	447.4

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Tray/Stage	Liquid temperature (C)	Vapor temperature (C)	Liquid mass flow (kg/h)	Vapor mass flow (kg/h)	Liquid volume flow (m3/h)
6	89.58	90.46	2.446E+05	2.568E+05	450.7
7	90.46	91.02	2.453E+05	2.575E+05	452.2
8	91.02	91.43	2.455E+05	2.576E+05	452.7
9	91.43	91.78	2.454E+05	2.576E+05	452.8
10	91.78	92.11	2.453E+05	2.575E+05	452.6
11	92.11	92.47	2.451E+05	2.573E+05	452.3
12	92.47	92.92	2.449E+05	2.57E+05	451.9
13	92.92	93.57	2.444E+05	2.566E+05	451
14	93.57	94.7	2.437E+05	2.559E+05	449.3
15	94.7	97.08	2.418E+05	2.54E+05	444.9
16	97.08	103.5	2.357E+05	2.479E+05	431.3
17	103.5	123.8	2.162E+05	2.283E+05	388.4
18	123.8	124.1	6.511E+05	2.724E+05	1120
19	124.1	124.3	6.525E+05	2.738E+05	1123
20	124.3	124.5	6.535E+05	2.747E+05	1125
21	124.5	124.7	6.542E+05	2.755E+05	1127
22	124.7	124.9	6.549E+05	2.762E+05	1128
23	124.9	125.2	6.556E+05	2.769E+05	1130
24	125.2	125.6	6.565E+05	2.777E+05	1132
25	125.6	126.3	6.576E+05	2.789E+05	1134
26	126.3	127.4	6.593E+05	2.805E+05	1137
27	127.4	129.5	6.618E+05	2.831E+05	1142
28	129.5	133.3	6.659E+05	2.872E+05	1149
29	133.3	141.2	6.721E+05	2.934E+05	1160

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Description:

Tray/Stage	Liquid temperature (C)	Vapor temperature (C)	Liquid mass flow (kg/h)	Vapor mass flow (kg/h)	Liquid volume flow (m3/h)
30	141.2	158.3	6.817E+05	3.03E+05	1174

Main Tower Profile (2)

Tray/Stage	Vapor volume flow (m3/h)	Liquid molecular weight	Vapor molecular weight	Liquid mass density (kg/m3)	Vapor mass density (kg/m3)
1	1.658E+04	64.2	64.2	549.9	13.81
2	1.676E+04	67.28	67.28	547.2	14.23
3	1.694E+04	69.46	69.46	545.7	14.55
4	1.71E+04	70.76	70.7	544.3	14.74
5	1.72E+04	71.43	71.34	543.3	14.85
6	1.724E+04	71.76	71.64	542.8	14.9
7	1.725E+04	71.91	71.79	542.4	14.93
8	1.724E+04	71.99	71.86	542.2	14.95
9	1.722E+04	72.03	71.9	542.1	14.96
10	1.72E+04	72.06	71.93	541.9	14.97
11	1.718E+04	72.09	71.96	541.9	14.98
12	1.715E+04	72.15	72.02	541.9	14.99
13	1.711E+04	72.27	72.13	542	15
14	1.705E+04	72.5	72.35	542.4	15.01
15	1.691E+04	73	72.83	543.4	15.02
16	1.656E+04	74.27	74.01	546.5	14.97
17	1.544E+04	78.29	77.76	556.6	14.79
18	1.837E+04	91.37	77.9	581.3	14.83
19	1.842E+04	91.39	77.99	581	14.86
20	1.845E+04	91.4	78.05	580.8	14.89

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Tray/Stage	Vapor volume flow (m3/h)	Liquid molecular weight	Vapor molecular weight	Liquid mass density (kg/m3)	Vapor mass density (kg/m3)
21	1.847E+04	91.42	78.11	580.6	14.91
22	1.849E+04	91.43	78.17	580.4	14.94
23	1.85E+04	91.46	78.24	580.3	14.97
24	1.852E+04	91.51	78.37	580.1	15
25	1.855E+04	91.61	78.58	580	15.03
26	1.859E+04	91.78	78.95	579.8	15.09
27	1.867E+04	92.12	79.63	579.6	15.17
28	1.878E+04	92.76	80.92	579.5	15.29
29	1.891E+04	94.1	83.52	579.7	15.52
30	1.896E+04	97.15	89.44	580.6	15.98

Main Tower Profile (3)

Tray/Stage	Liquid viscosity (cP)	Vapor viscosity (cP)	Surface tension (dyne/cm)
1	0.1362	0.008492	8.857
2	0.1305	0.008489	8.448
3	0.127	0.008484	8.205
4	0.1248	0.008477	8.041
5	0.1237	0.008474	7.951
6	0.1232	0.008473	7.909
7	0.1231	0.008474	7.893
8	0.1231	0.008475	7.888
9	0.1232	0.008477	7.889
10	0.1234	0.008479	7.892
11	0.1235	0.008483	7.896

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Tray/Stage	Liquid viscosity (cP)	Vapor viscosity (cP)	Surface tension (dyne/cm)
12	0.1237	0.008487	7.901
13	0.124	0.008495	7.908
14	0.1244	0.00851	7.92
15	0.1253	0.008545	7.947
16	0.1273	0.008648	8.019
17	0.134	0.008981	8.26
18	0.1501	0.00898	8.829
19	0.1498	0.00898	8.81
20	0.1496	0.008945	8.796
21	0.1495	0.008947	8.784
22	0.1493	0.008949	8.773
23	0.1492	0.008951	8.763
24	0.1491	0.008955	8.752
25	0.1489	0.008961	8.738
26	0.1487	0.008971	8.721
27	0.1483	0.00899	8.696
28	0.1479	0.009026	8.659
29	0.1471	0.009102	8.602
30	0.146	0.009256	8.508