Baby Steps – Learning to Balance

How much did I make?

Where did it go?

Does it agree with SAP?

ATOFINA
Calvert City, Kentucky

ATOFINA Chemicals, Inc. Calvert City, Kentucky Plant

- Products
  - Refrigerants
    - HFC Forane® F-134a
    - HCFC's Forane® F-141b, F-142b
  - Kynar® PVDF high performance plastic
  - HCl
- Batch & Continuous Processes
- PI Since 9/97

ATOFINA Worldwide

- Chemicals branch of TotalFinaElf
- 72,000 employees
- World's 5th largest chemical company
- Petrochemicals & Commodity Polymers
- Intermediates & Performance Polymers
- Specialty Chemicals

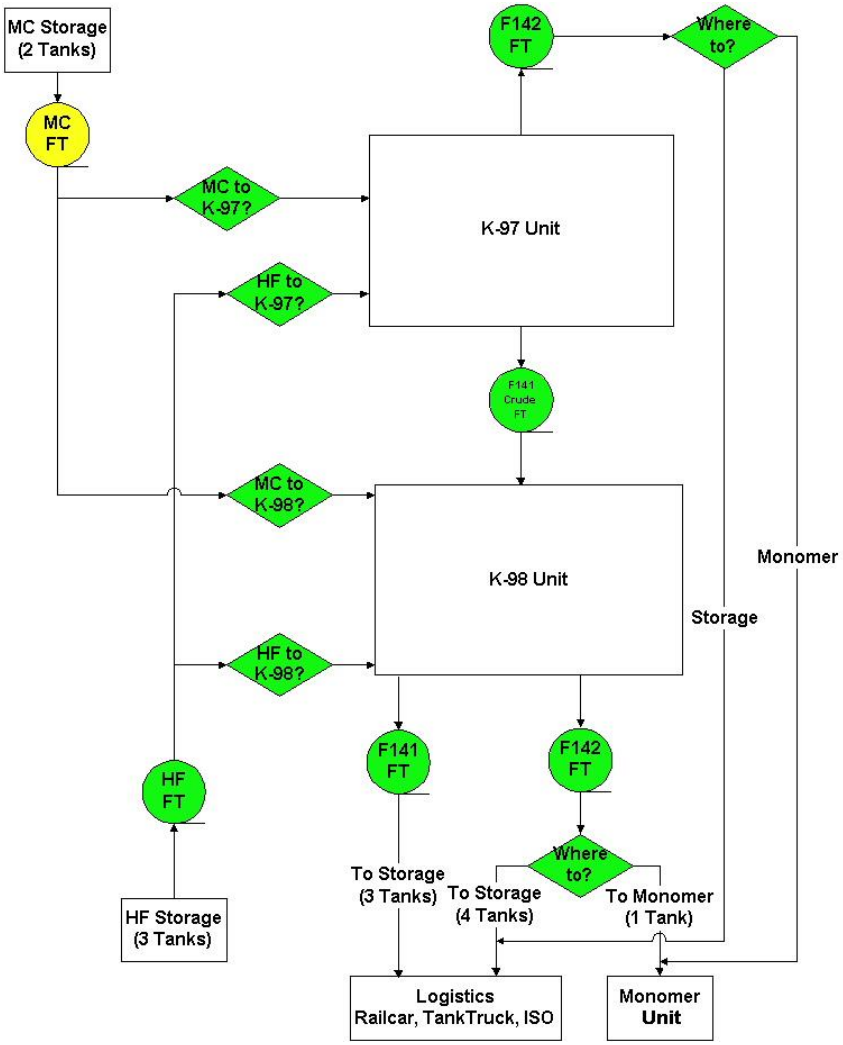
In the Beginning

- Poor yield calculation accuracy
- Difficult to determine source of loss
- Raw material and finished product transfers measured by level change
- Few level/temperature transmitters for finished product storage
- Manual data entry from log sheets to production/inventory spreadsheet

Where is the problem? Who's responsible?

- In the production unit?
  - Non-optimum process operation
  - Leaks
- In logistics?
  - Loading accuracy
  - Leaks
- Historically the production unit held responsible for all yield problems
- First step in improvement is knowing where the problem is located

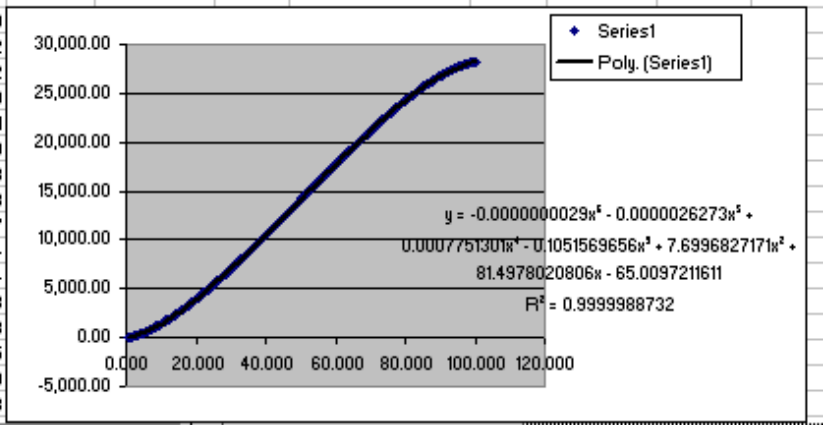
HCFC Units


MC Storage (2 Tanks)
MC FT
MC to K-97?
HF to K-97?
K-97 Unit
F142 FT
Where to?
F141 Crude FT
MC to K-98?
HF to K-98?
K-98 Unit
Storage
Monomer
HF FT
HF Storage (3 Tanks)
F141 FT
F142 FT
To Storage (3 Tanks)
Where to?
To Storage (4 Tanks)
To Monomer (1 Tank)
Logistics Railcar, TankTruck, ISO
Monomer Unit

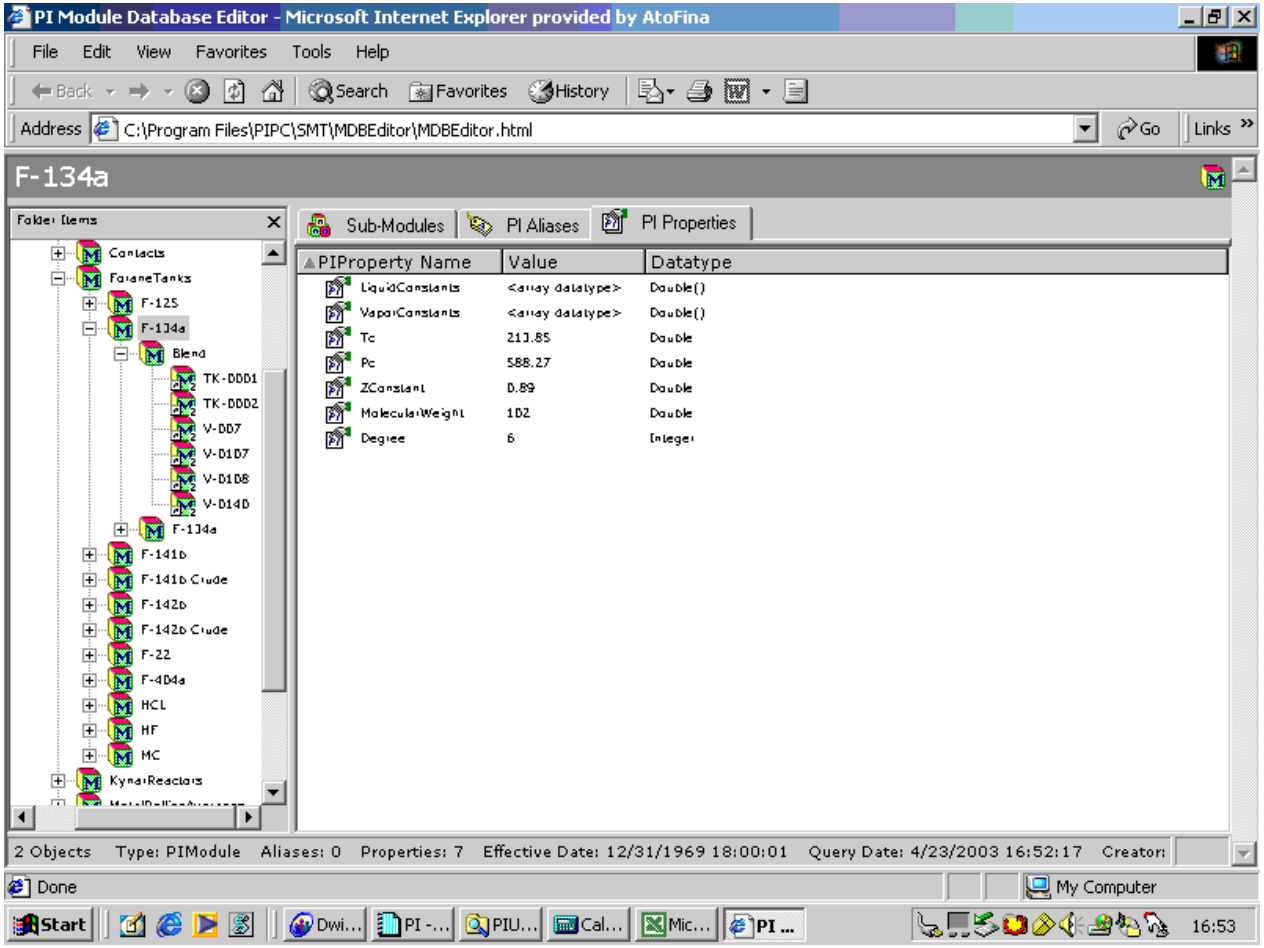
Instrumentation Added

- Mass Flowmeters to measure transfers
  - PI-Totalizers for daily/monthly totals
- Level transmitters and RTD's added
- Accurate strapping tables developed
  - Many horizontal tanks with various heads
- Liquid and vapor density calculations developed to provide tank mass
- Calculations implemented in PI-ACE & MDB
- New production/inventory spreadsheet with PI providing majority of input automatically

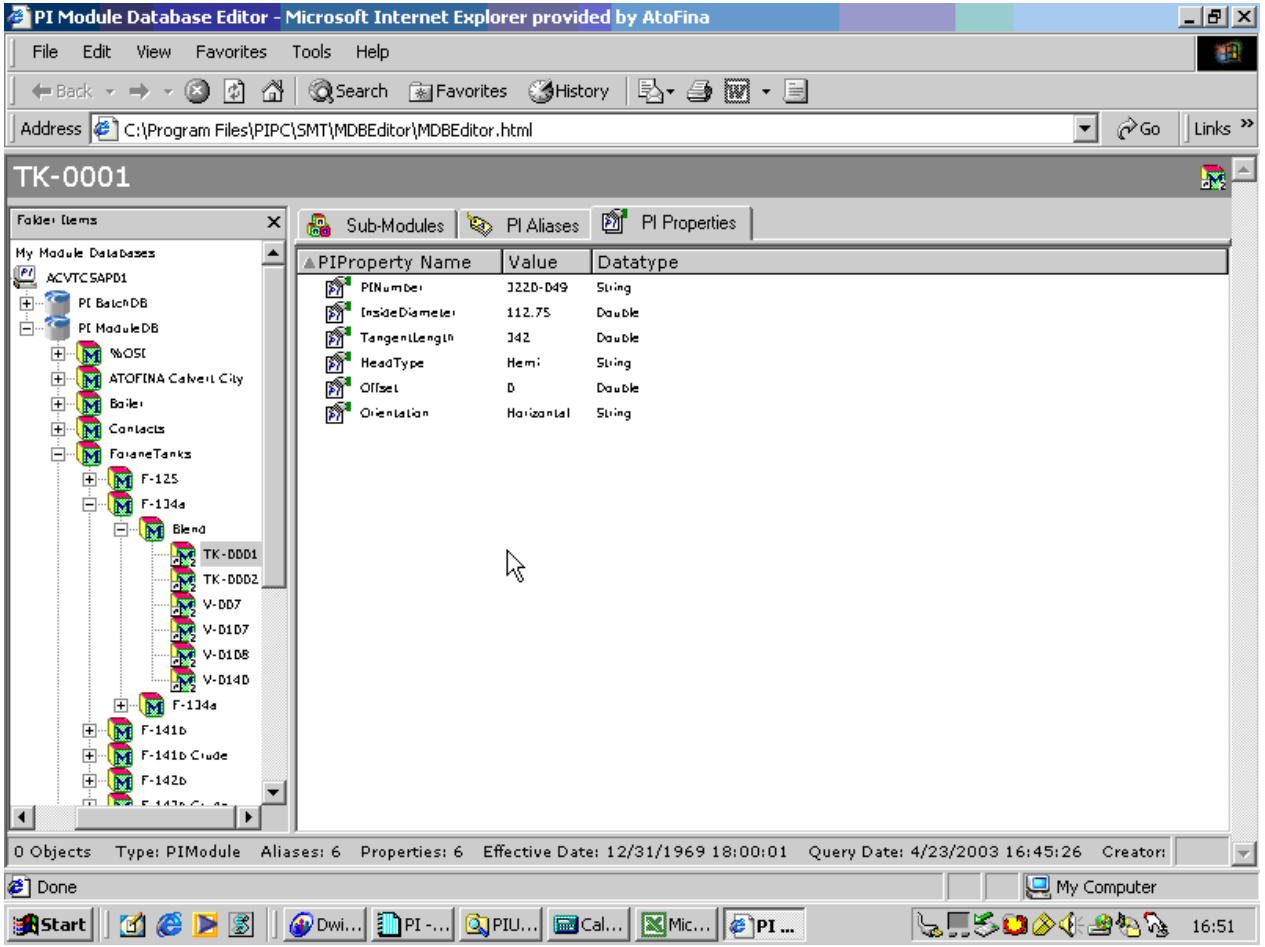
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	**Vessel**	E-V-0150		**ID**	126	Inches		**Calculate**	**Calculate**	**Calculated**	**alculated**		**Lvl Xmit**	**Penberthy**	**0.375"**	
2	**PI No.**	3250-060		**S-to-S**	480	Inches		**Liquid**	**Liquid**	**Vapor**	**Total**		**Uncertain**	1632		
3	**Product**	F22		**Head Type**	2:1 Ellip			**Gallons**	**Pounds**	**Pounds**	**Pounds**					
4	**Temperature**	60.945313	E-TE-5025	**Liquid lb/gal**	10.2269			-36	-364	7,989	7,625	4/25/2003 15:06				
5	**Present Level (%)**	0.3499985	E-LT-5025	**Vapor lb/gal**	**0.283**						8,061	E-WI-5025(CALC)				
6											-436	**Curve Fit - PI ACE**				
7				**Liquid**	**Vapor**	**Total**	**Calculated**									
8	**Inches**	**%**	**Gallons**	**Pounds**	**Pounds**	**Pounds**	**Gallons**	**Error**	**Liquid Density**							
9	0.50	**0.397**	16.50	169	7,974	8,143	-31	47.961	A	B	C					
10	1.00	**0.794**	36.78	376	7,968	8,345	4	32.306	1.5963	0.26566	369.3					
11	1.50	**1.190**	63.14	646	7,961	8,607	43	20.395								
12	2.00	1.587	94.44	966	7,952	8,918	83	11.105	Temp (K)	Kmoles/m3	D					
13	2.50	1.984	129.99	1,329	7,942	9,271	126	3.799	289.2307	14.17219664	0.2845					
14	3.00	2.381	169.34	1,732	7,931	9,663	171	-1.943								
15	3.50	2.778	212.15	2,170	7,919	10,088	219	-6.423	**Vapor Density**							
16	4.00	3.175	258.16	2,640	7,906	10,546	268	-9.868	A	B	C	D	E	F		
17	4.50	3.571	307.14	3,141	7,892	11,033	320	-12.457	116.912	-8799.12	0	0	-16.486	1.51E-02		
18	5.00	3.968	358.93	3,671	7,877	11,548	373	-14.333								
19	5.50	4.365	413.36	4,227	7,862	12,089	429	-15.611	Pc (psia)	Tc (F)	Pr	Z	MW	G		
20	6.00	4.762	470.32	4,810	7,846	12,656	487	-16.388	720.98	205.07	0.1632	0.86	86.468	1		
21	6.50	5.159	529.68	5,417	7,829	13,246	546	-16.747								
22	7.00	5.556	591.34	6,048	7,811	13,859	608	-16.756	Temp (R)		PSIA					
23	7.50	5.952	655.21	6,701	7,793	14,494	672	-16.473	520.6453		117.67					
24	8.00	6.349	721.20	7,376	7,775	15,150	737	-15.950								
25	8.50	6.746	789.24	8,071	7,755	15,827	804	-15.229								
26	9.00	7.143	859.26	8,787	7,736	16,523	874	-14.349								
27	9.50	7.540	931.19	9,523	7,715	17,238	945	-13.344								
28	10.00	7.937	1,004.97	10,278	7,694	17,972	1,017	-12.239								
29	10.50	8.333	1,080.55	11,051	7,673	18,724	1,092	-11.062								
30	11.00	8.730	1,157.88	11,842	7,651	19,493	1,168	-9.832								
31	11.50	9.127	1,236.91	12,650	7,629	20,278	1,245	-8.570								
32	12.00	9.524	1,317.58	13,475	7,606	21,081	1,325	-7.291								
33	12.50	9.921	1,399.87	14,316	7,582	21,899	1,406	-6.009								
34	13.00	10.317	1,483.71	15,174	7,559	22,732	1,488	-4.738								
35	13.50	10.714	1,569.09	16,047	7,535	23,581	1,573	-3.488								
36	14.00	11.111	1,655.95	16,935	7,510	24,445	1,658	-2.267								
37	14.50	11.508	1,744.26	17,838	7,485	25,323	1,745	-1.084								
38	15.00	11.905	1,834.00	18,756	7,460	26,216	1,834	0.054								
39	15.50	12.302	1,925.11	19,688	7,434	27,122	1,924	1.143								
40	16.00	12.698	2,017.59	20,634	7,408	28,041	2,015	2.178								
41	16.50	13.095	2,111.38	21,593	7,381	28,974	2,108	3.155								
42	17.00	13.492	2,206.48	22,565	7,354	29,919	2,202	4.070								
43	17.50	13.889	2,302.84	23,551	7,327	30,878	2,298	4.923								



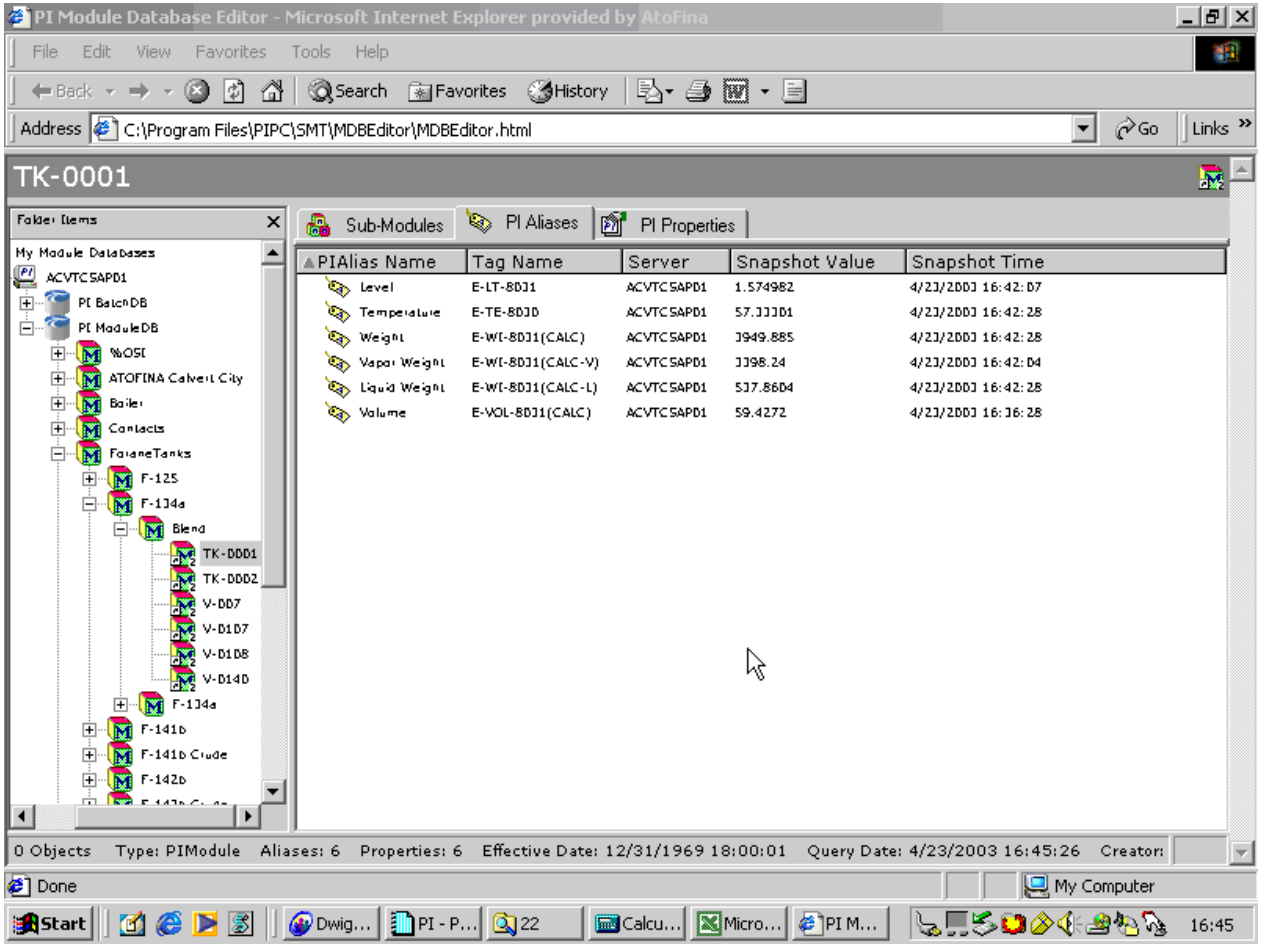
Product Properties



Vessel Properties



Vessel Aliases



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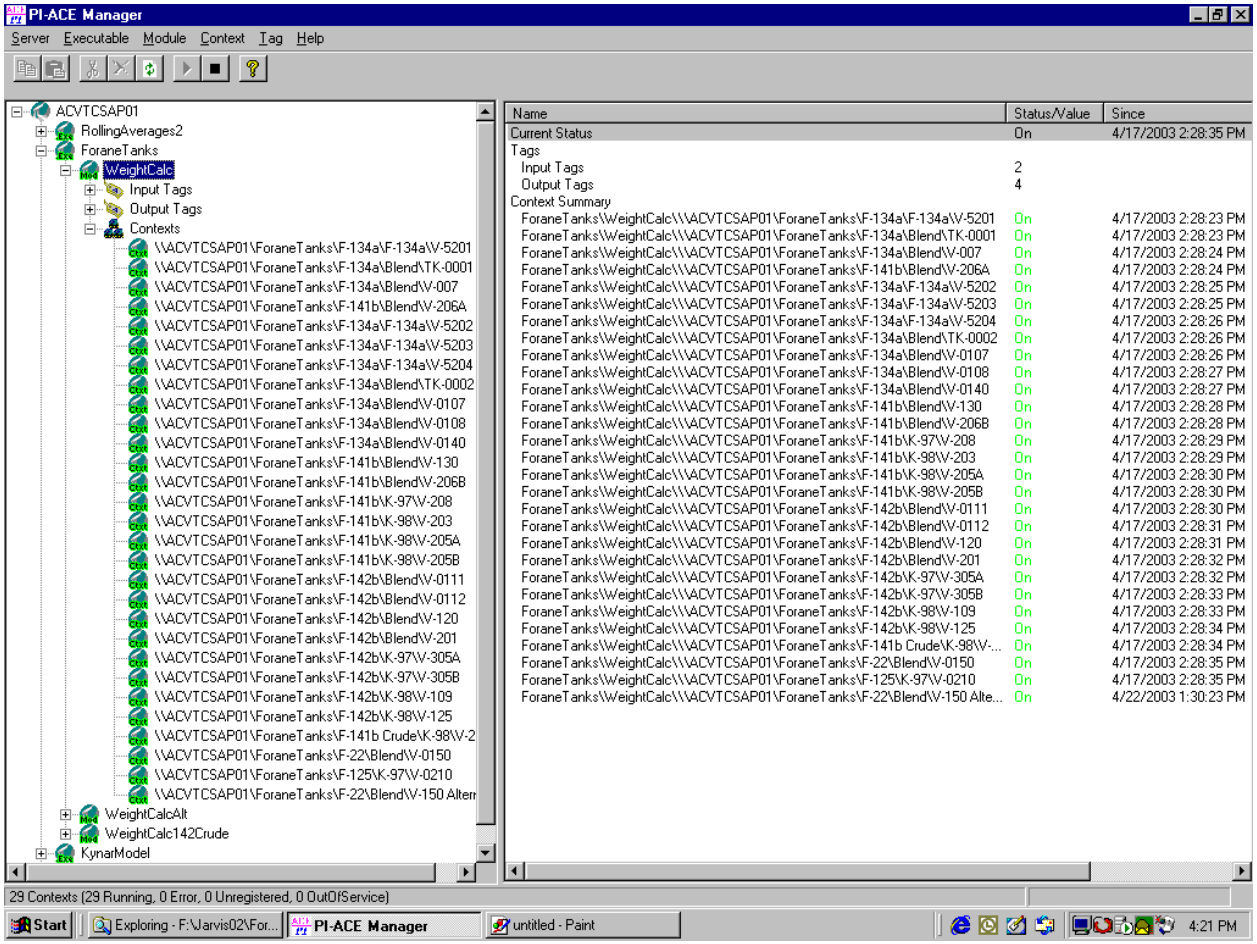
Calvert City, Kentucky

PI-ACE Manager



Inventory Input

K-98 Area Vessel Inventory (Input)
April 8, 2003

Leave Level/Temperature/Ratio blank to use value from PI. Arrows at left indicate values currently unavailable from PI. Entering a value overrides any PI value and uses calculated weight, even if archive weight exists.

	Function #	Tank	Level (%)	PI	Temp (°F)	PI	Volume (GAL)	Calculated Weight (LBS)	PI - Ar Weight (
F-141b	G-V-203	F-141b Surge Tank		49.86		62.56	5,692.22	59,469.28	59,4
	G-V-205A	F-141b Day Tank A		6.66		52.91	1,357.76	14,472.72	14,4
	G-V-205B	F-141b Day Tank B		58.42		78.84	6,632.68	68,332.05	68,3
F-142b	G-V-109	F-142b Holdup		44.96		48.18	5,835.35	56,565.57	56,3
	G-V-125	F-142b Holdup		14.02		48.18	1,218.06	12,753.40	12,8
HF	G-V-101	HF Day Tank		58.14		48.18	6,493.13	53,723.27	54,1
Methyl Chloroform	G-V-110	Methyl Chloroform Feed Tank		41.56		48.18	14,236.11	157,733.40	159,9
HCL	G-TK-103	N HCL SHIFT TANK		60.68		48.18	9,240.10	90,799.69	90,6
	G-TK-104	S HCL SHIFT TANK		7.57		48.18	1,153.55	11,335.59	11,4
F-141b Crude	G-V-211	F-141b Crude		78.44		68.81	18,193.27	188,717.27	190,2
F-142b Crude	G-M-104R	Phase Separator		4.01		-14.89	79.38	953.84	41,3
	G-V-105	Organic Phase Surge Tank		55.91		38.87	15,841.74	154,356.53	162,1

Leave cell C16 blank to use ratio from PI (cell C17).

F-142b Crude F-141b Content:	
(G-CI-5079):	54.5%

Inventory Report

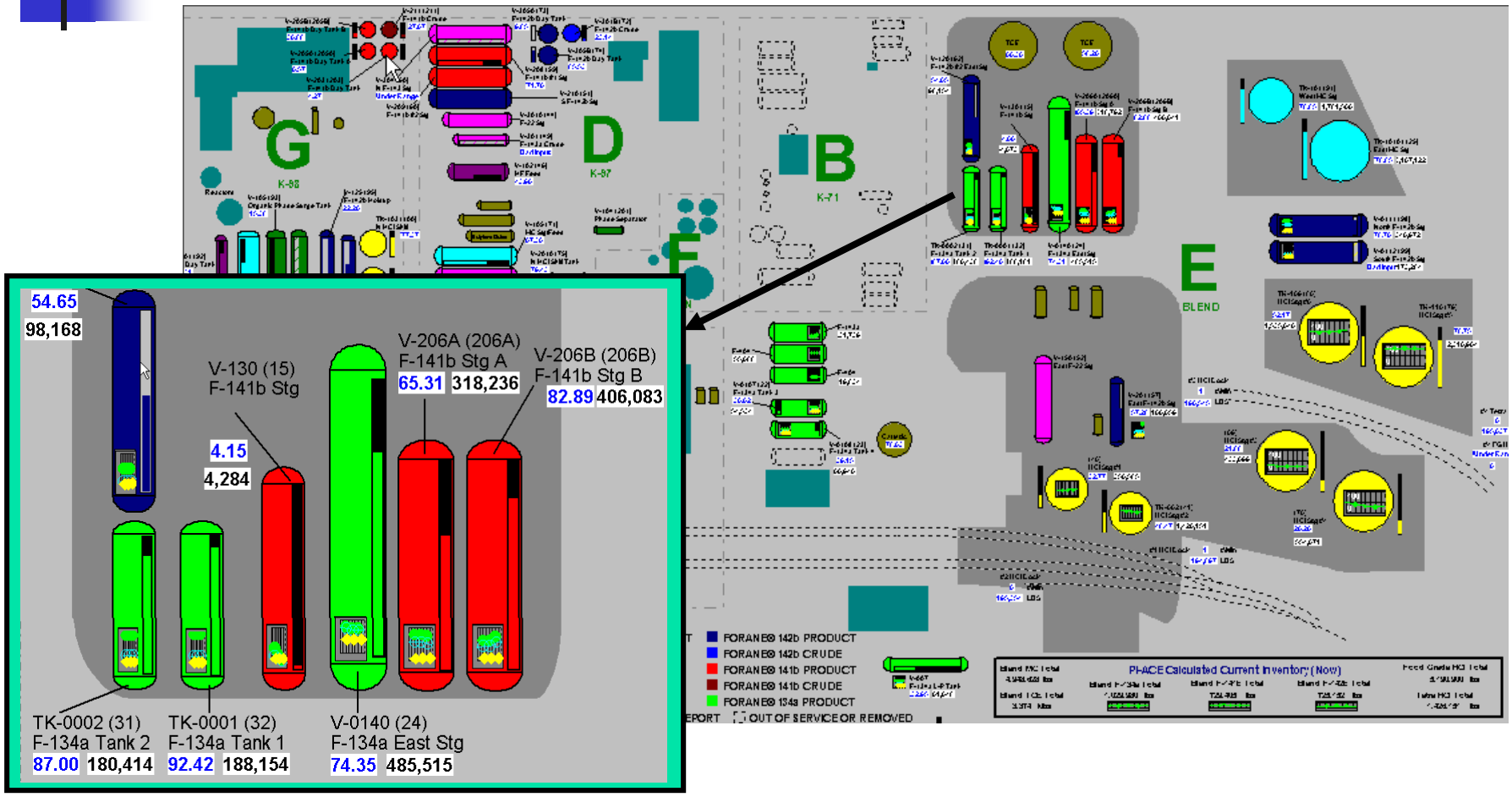
Blend Area & AHF Tank Farm Vessel Inventory

April 28, 2003

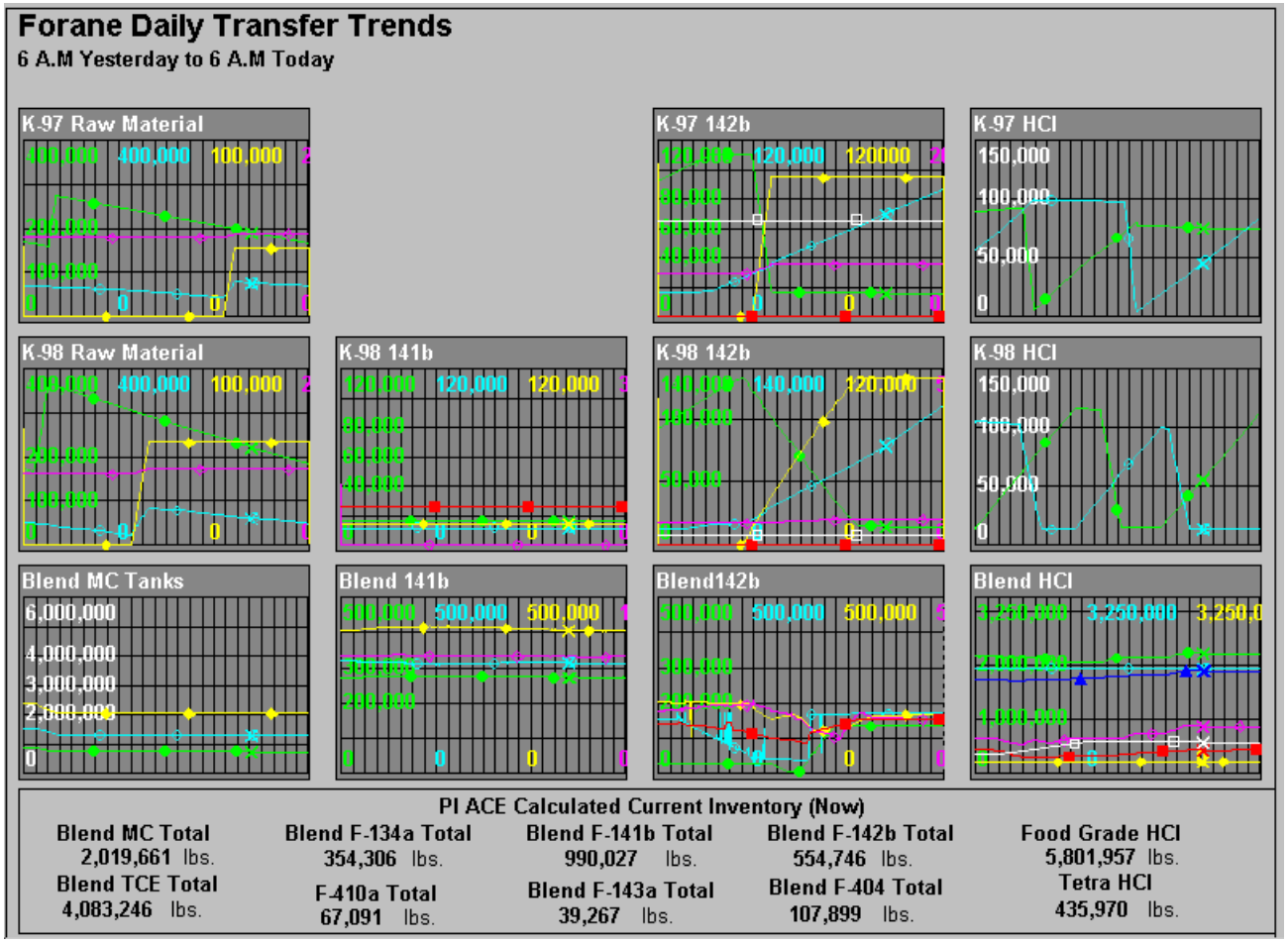
	Function #	Tank	Level (%)	Temp (°F)	Weight (LBS)	Space Available (LBS)
F-22	E-V-0150	F-22 East Storage	86.3	60.5	265,827	22,538
F-134a	E-TK-0001	F-134a Storage 1	1.1	53.7	3,852	184,605
	E-TK-0002	F-134a Storage 2	54.7	60.0	106,587	79,979
	E-V-007	F-134a LP Tank	26.9	59.9	42,697	143,658
	E-V-0107	F-134a Storage 3	22.7	58.2	29,062	131,485
	E-V-0108	F-134a Storage 4	22.3	58.3	28,834	131,680
	E-V-0140	F-134a Storage East	35.4	60.5	201,775	418,530
F-141b	E-V-130	F-141b Storage	88.3	56.9	270,276	17,831
	E-V-206A	F-141b Storage A	66.2	67.6	316,991	130,527
	E-V-206B	F-141b Storage B	84.2	65.0	403,863	44,639
F-142b	E-V-0111	F-142b Storage North	45.6	52.3	178,670	220,287
	E-V-0112	F-142b Storage South	41.1	55.6	155,512	241,897
	E-V-120	F-142b Storage East #2	52.3	57.9	91,062	79,694
	E-V-201	F-142b Storage East	80.0	61.7	147,405	22,822
Methyl	E-TK-101	West Methyl Chloroform Storage	37.3	60.5	841,306	1,366,208
	E-TK-101A	East Methyl Chloroform Storage	37.6	60.5	1,505,424	2,419,045
HCL	E-TK-0001A	HCL STG #1	31.8	60.5	340,461	728,402
	E-TK-002	HCL STG #2	13.9	60.5	431,317	2,510,859
	E-TK-0108	HCL STG #3	11.1	60.5	220,136	1,762,487
	E-TK-0109	HCL STG #4	30.0	60.5	637,997	1,476,801
	E-TK-1110	HCL STG #5	65.6	60.5	1,932,127	1,010,049
	E-TK-1109	HCL STG #6	72.7	60.5	2,144,858	797,318
HF (Tank Farm	O-V-8001	AHF Storage	0.0	69.6	0	390,809
	O-V-8002	AHF Storage	56.7	69.6	230,933	159,876
	O-V-8003	AHF Storage	68.7	68.8	251,883	139,266
	O-V-8004	AHF Storage	15.9	70.5	56,046	334,418

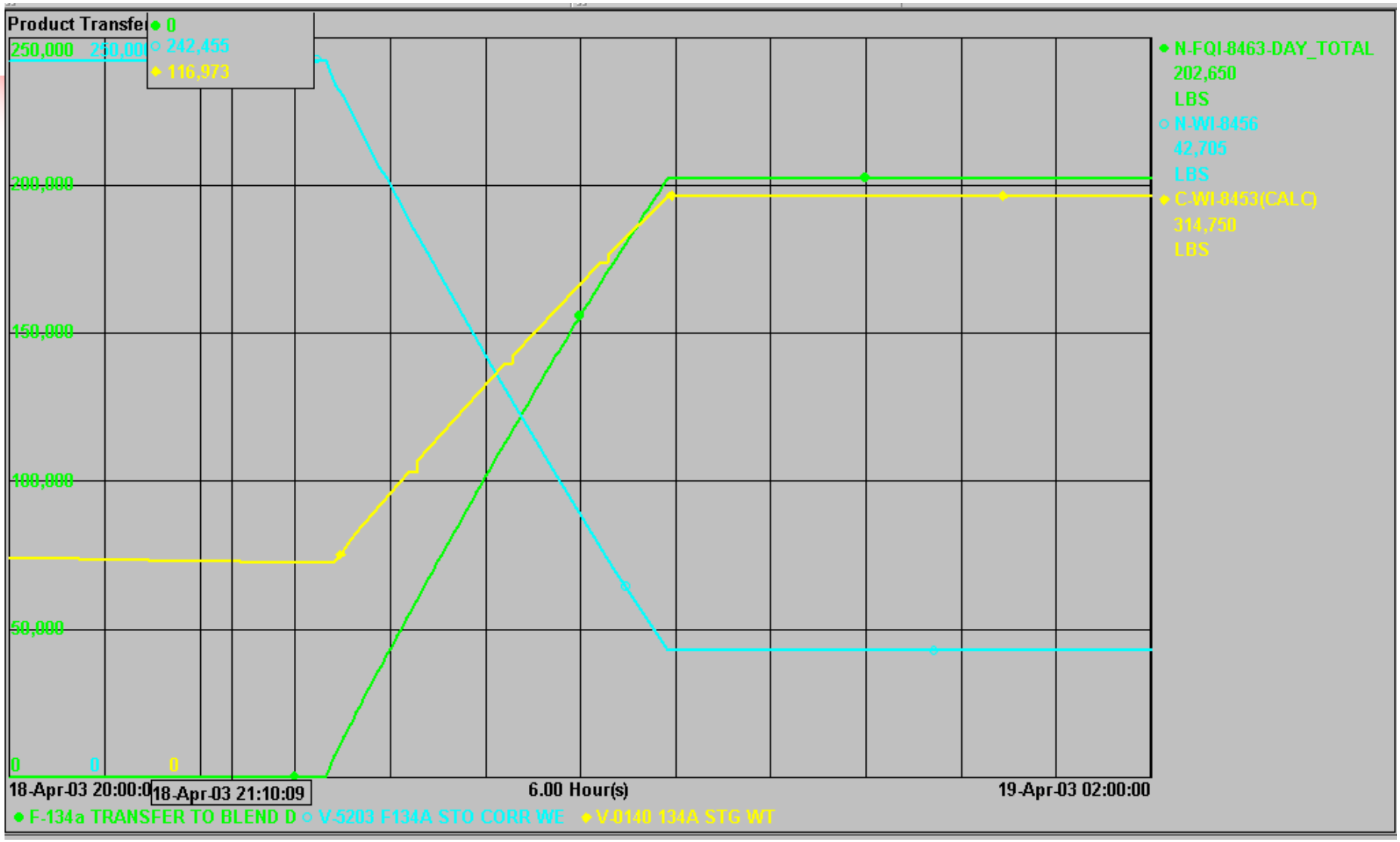
Total F-134a in Blend Area Storage (LBS)	412,807
Total F-141b in Blend Area Storage (LBS)	991,131
Total F-142b in Blend Area Storage (LBS)	572,648
Total F-22 in Blend Area Storage (LBS)	265,827
Total Methyl Chloroform in Blend Area Storage (LBS)	2,346,731
Total Food Grade HCL in Blend Area Storage (LBS)	5,275,580
Total Tetra HCL in Blend Area Storage (LBS)	431,317
Total HF in AHF Tank Farm Storage (LBS)	538,861

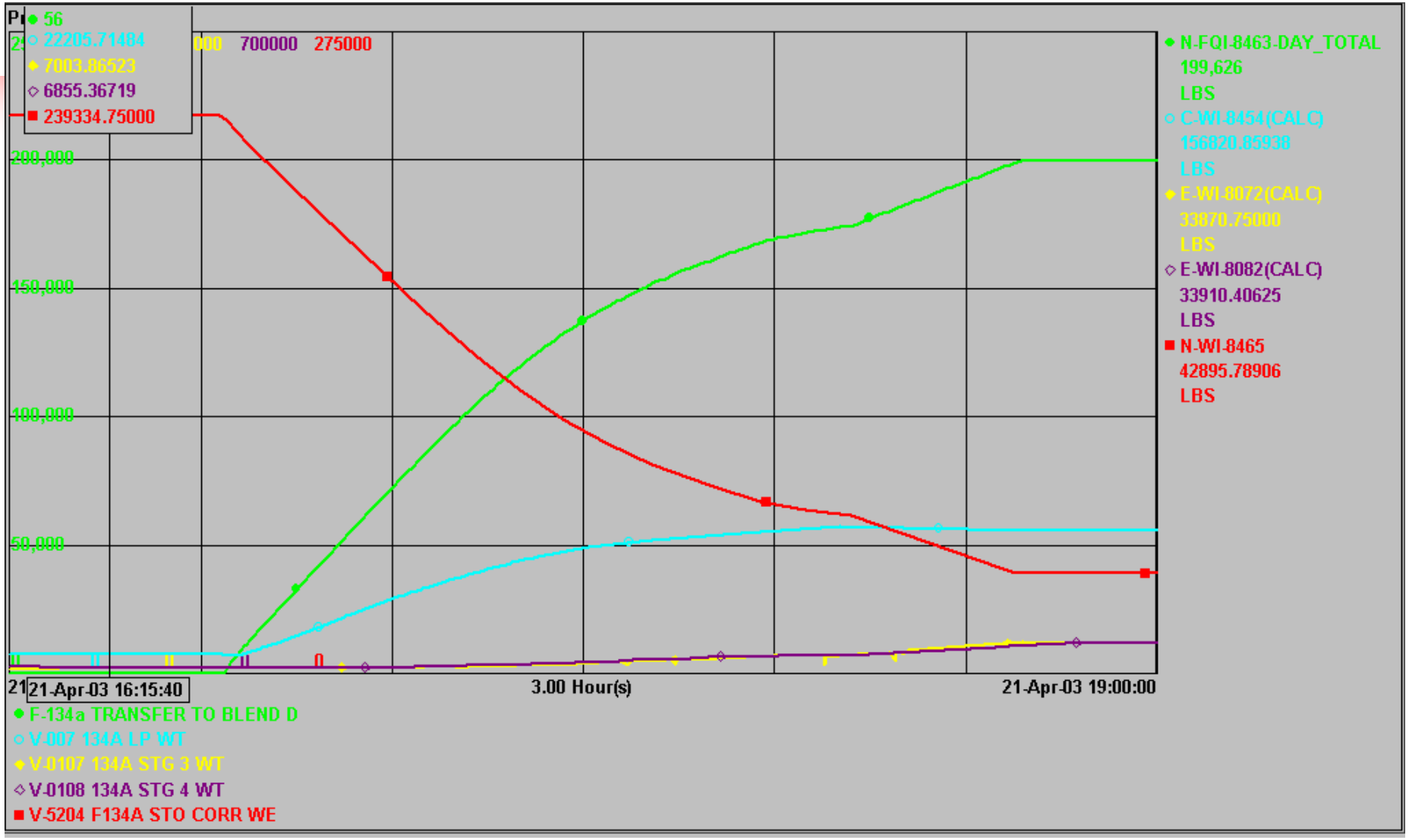
Real Time Inventory



Transfer and Inventory



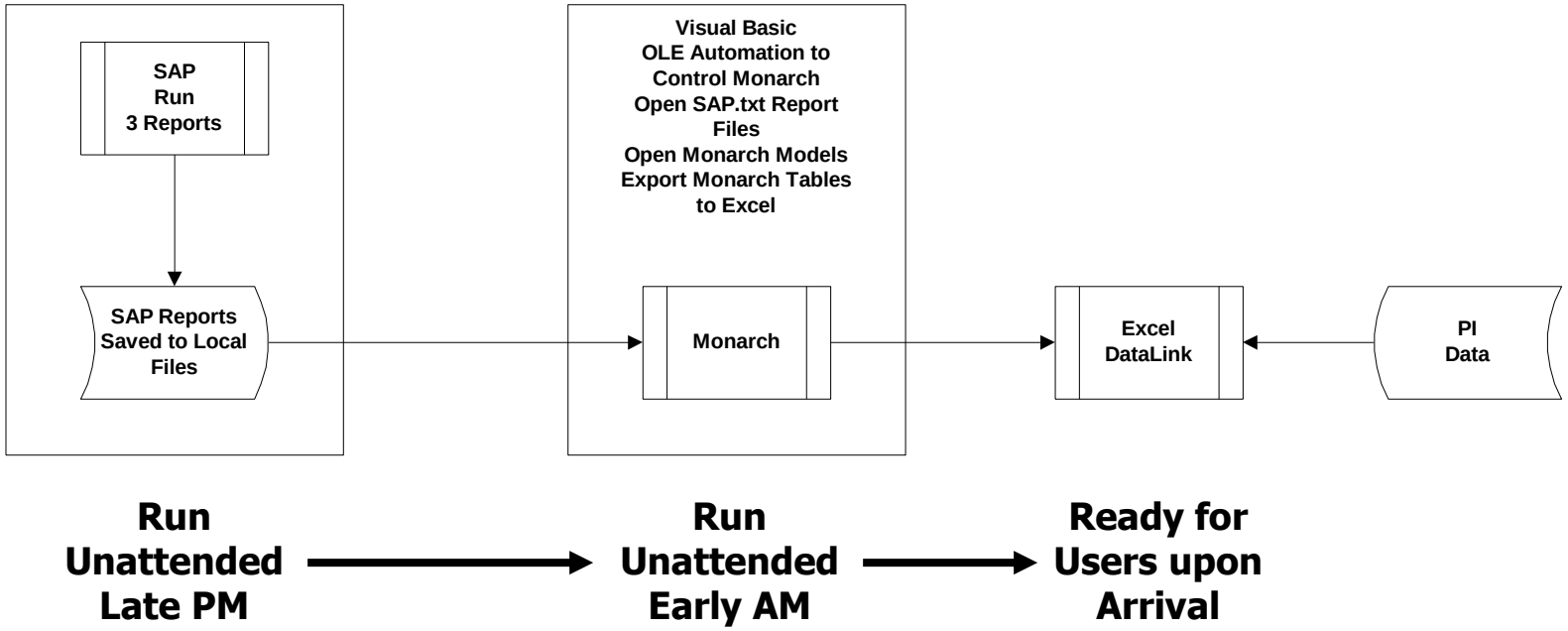

Product Transfe
0
242,455
116,973
250,000
200,000
150,000
100,000
50,000
0
N-FQI-8463-DAY_TOTAL
202,650
LBS
N-WI-8456
42,705
LBS
C-WI-8453(CALC)
314,750
LBS
18-Apr-03 20:00:0
18-Apr-03 21:10:09
6.00 Hour(s)
19-Apr-03 02:00:00
F-134a TRANSFER TO BLEND D
V-5203 F134A STO CORR WE
V-0140 134A STG WT


56
22205.71484
7003.86523
6855.36719
239334.75000
700000
275000
200,000
150,000
100,000
50,000
N-FQI-8463-DAY_TOTAL
199,626
LBS
C-WI-8454(CALC)
156820.85938
LBS
E-WI-8072(CALC)
33870.75000
LBS
E-WI-8082(CALC)
33910.40625
LBS
N-WI-8465
42895.78906
LBS
21-Apr-03 16:15:40
3.00 Hour(s)
21-Apr-03 19:00:00
F-134a TRANSFER TO BLEND D
V-007 134A LP WT
V-0107 134A STG 3 WT
V-0108 134A STG 4 WT
V-5204 F134A STO CORR WE

PI/SAP/GPMate Integration

- Goal is to build bridges between the islands
- Automated daily reports
  - Production
  - Yield
  - Variance
  - Energy
  - Inventory
- Compare PI values to SAP data

Flow


SAP
Run
3 Reports
SAP Reports
Saved to Local
Files
Visual Basic
OLE Automation to
Control Monarch
Open SAP.txt Report
Files
Open Monarch Models
Export Monarch Tables
to Excel
Monarch
Excel
DataLink
PI
Data
Run
Unattended
Late PM
Run
Unattended
Early AM
Ready for
Users upon
Arrival

ATOFINA
Calvert City, Kentucky

PI/SAP Integrated Report

		Location 1	Location 2	Location 3	Location 4	Location 98	Total
Raw Materials							
	HF	5,065,840.000		358,234.000	1,027,821.600	327,746.300	6,779,641.900
	Methyl Cloroform	3,494,018.400					3,494,018.400
	Trichlorethylene	4,263,369.300		687,642.700			4,951,012.000
	Caustic Soda	1,162,091.000			826,776.000		
	Chlorine	177,465.200	8,434.100				
	HFP	29,783.000					
Forane Bulk							
	F125	147,681.000					
	F134a	362,481.000		353,932.000			
	F141b Stockpile	95,327.600					
	F141b	895,802.000					
	F142b	579,323.000	106,823.800				
	F143a	39,035.300					
	F22	219,693.500					
	F404a	135,815.000					
	F410a	40,525.000					
	F410a Purchased	63,020.000					
	HCl Food Grade	5,721,804.500		2,145.800			
	HCl Tetra	443,534.800					

Forane 404a Details	SAP	PI	SAP-PI
F143a Tank	39,035.300	39,206.742	-171.442
F404a Bulk Tank	123,815.000	123,984.141	-169.141
F404a Bulk Other	12,000.000	12,000.000	
	135,815.000	135,984.141	

Unit MTD Energy Summary

Monomer MTD Energy	**Cost**	**Quantity**	**Yield**
Steam		Klbs	Klbs/lb
Natural Gas (Furnace)		MCF	MCF/lb
Electricity		kWh	kWh/lb
Total			

Polymer MTD Energy	**Cost**	**Quantity**	**Yield**
Steam		Klbs	Klbs/lb
Electricity		kWh	kWh/lb
Total			

Kynar Production Summary

	MTD Prod/Used/Var/ LDG Lbs	MTD Usage Factor Lb/Lb	YTD Prod/Used/Var/ LDG Lbs	YTD Usage Factor Lb/Lb	**Yield**	
F1132a Monomer Produced						Klbs/lb
F142b Consumed - Std						kWh/lb
F142b Consumed - Actual						
F142b Consumed - Var #'s						
F142b Consumed - Variance $						
F1132a Loaded - Total					**Yield**	
F1132a Loaded - 100# Cyl						Klbs/lb
F1132a Loaded - 1050# Tons						MCF/lb
F1132a Loaded - Tube Trlrs						kWh/lb
Kynar Homopolymer Bulk						
F1132a Consumed - Std						
F1132a Consumed - Actual						
F1132a Consumed - Var #'s						
F1132a Consumed - Var $						
Kynar 700 Bulk						
F1132a Consumed - Std						
F1132a Consumed - Actual						
F1132a Consumed - Var #'s						
F1132a Consumed - Var $						

Improvements

- Integrated into daily production reports
  - Reduced manual entries by 90%
- Fewer SAP surprises
- Finding where losses occur sooner saves $$$

Is It Finished? Is It Useful?

- NO!
  - Problems to resolve
    - Refine level measurement
    - SAP timing issues
    - Still learning about the mysteries of SAP
    - Enhance reporting of KPI's
- Yes!

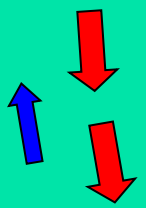
If you get down because you feel like
You're going in circles…

One step forward….

Two steps back…

Don't get upset…

A little
Advice
From Otis



Be thankful for the circle, you'll still get there
Depending on where you start it might take
Twice as long or even much shorter than moving
Constantly in the same direction.

Just remember to look over your shoulder so
You don't pass up the solution when approaching
It from the direction you don't expect!