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Empowering Business in **Real Time.**

PI Infrastructure for the Enterprise.

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PI in LNG Processing and Transmission: RasGas

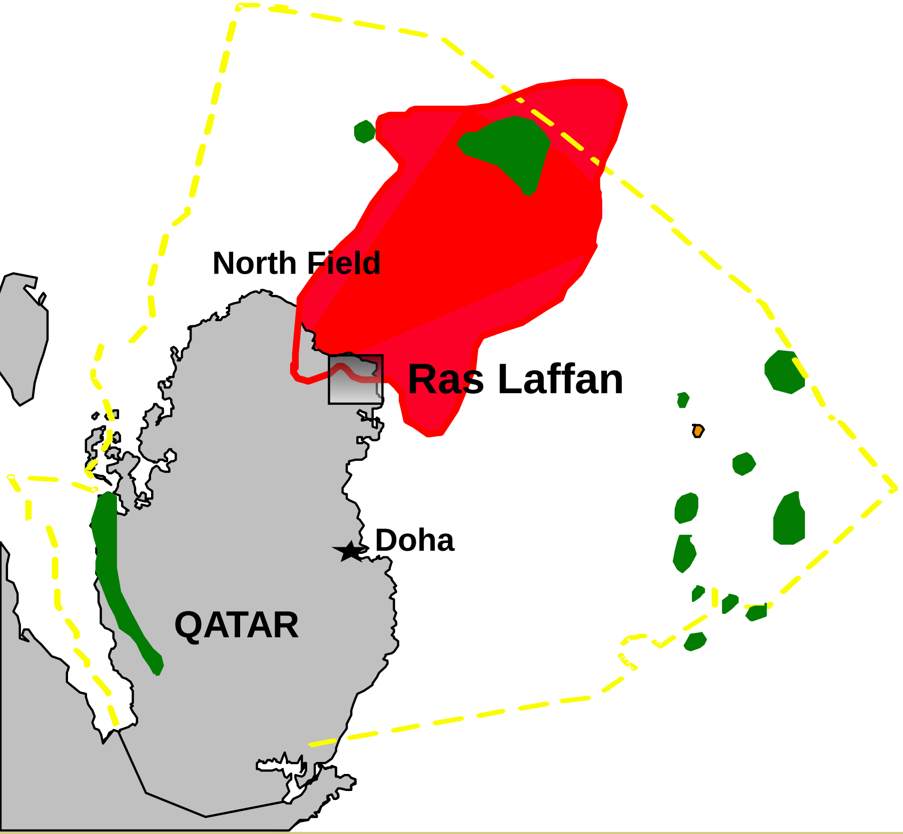
Sarah Al-Aqaily

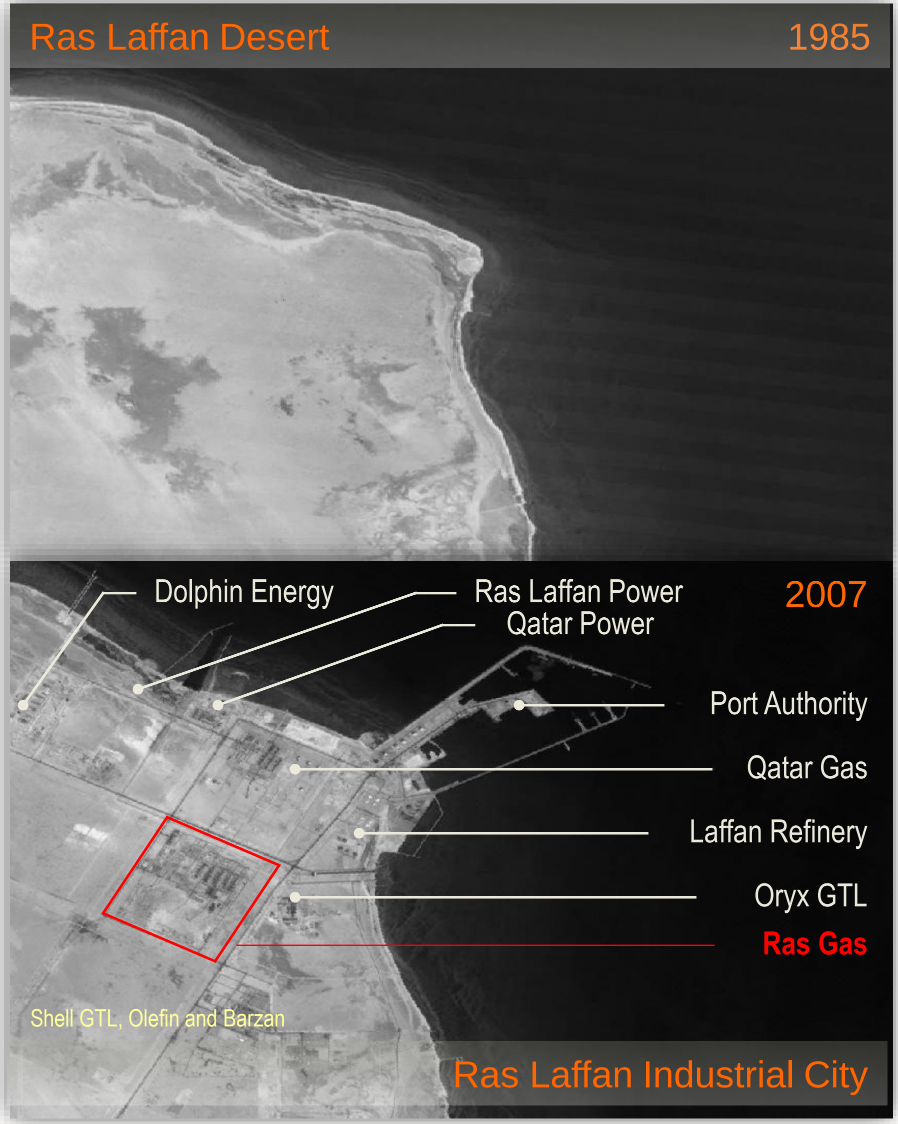
OUTLINE

- About RasGas
- RasGas ICIMS
- PI (RTIS) at RasGas
- RTIS Applications and Future

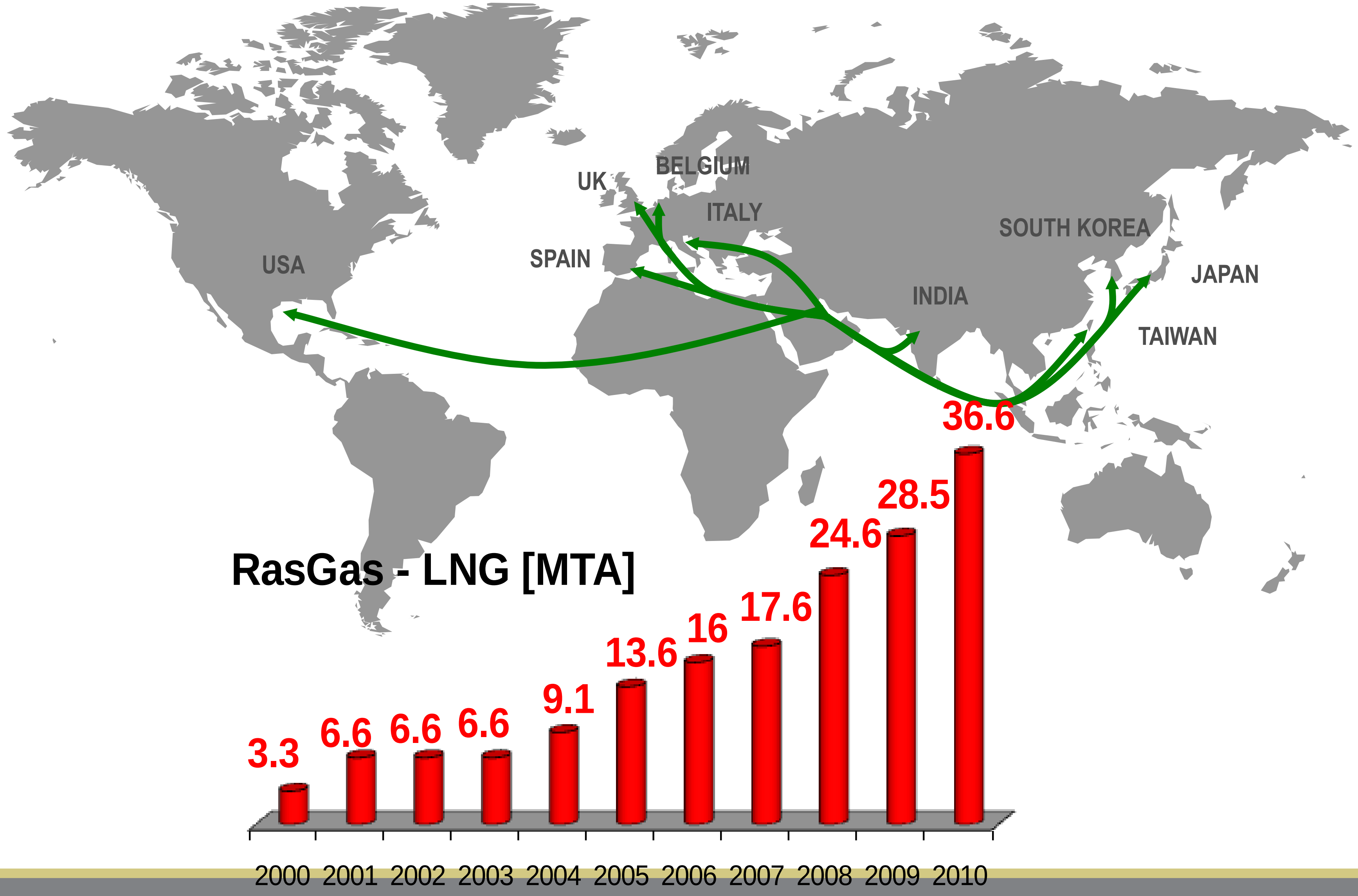
RasGas Profile

- One of the largest LNG producer & Transmitter in the world
- The Field covers an area of 6000 Km2
- Estimated natural gas reserves of 900+ TCF
- Sustainable reserves up to 100+ yrs

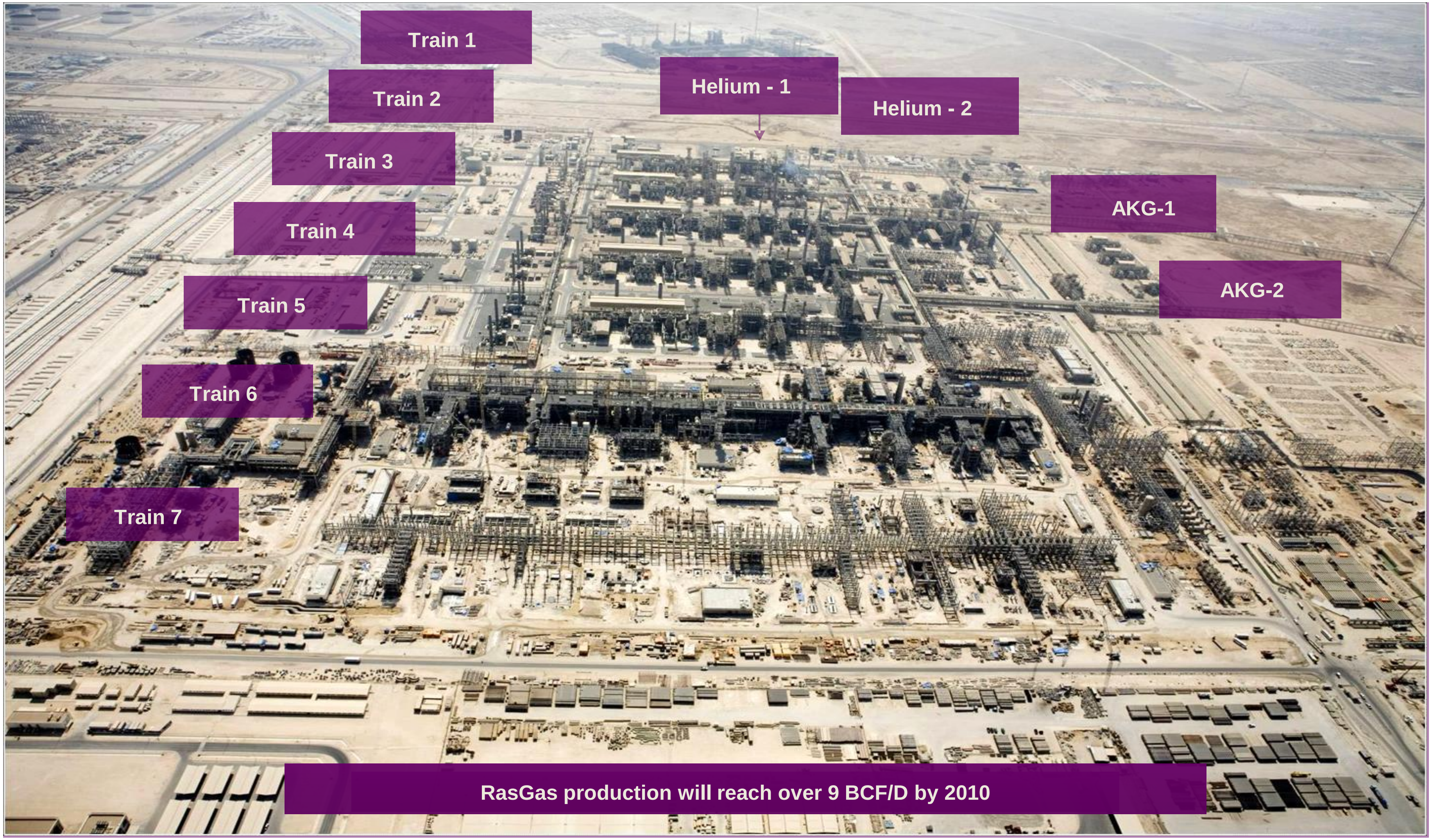

North Field
Ras Laffan
Doha
QATAR


Ras Laffan Desert
1985
Dolphin Energy
Ras Laffan Power
Qatar Power
2007
Port Authority
Qatar Gas
Laffan Refinery
Oryx GTL
Ras Gas
Shell GTL, Olefin and Barzan
Ras Laffan Industrial City

RasGas Sales


RasGas - LNG [MTA]

RasGas Development Plan


Train 1
Train 2
Train 3
Train 4
Train 5
Train 6
Train 7
Helium - 1
Helium - 2
AKG-1
AKG-2

RasGas production will reach over 9 BCF/D by 2010

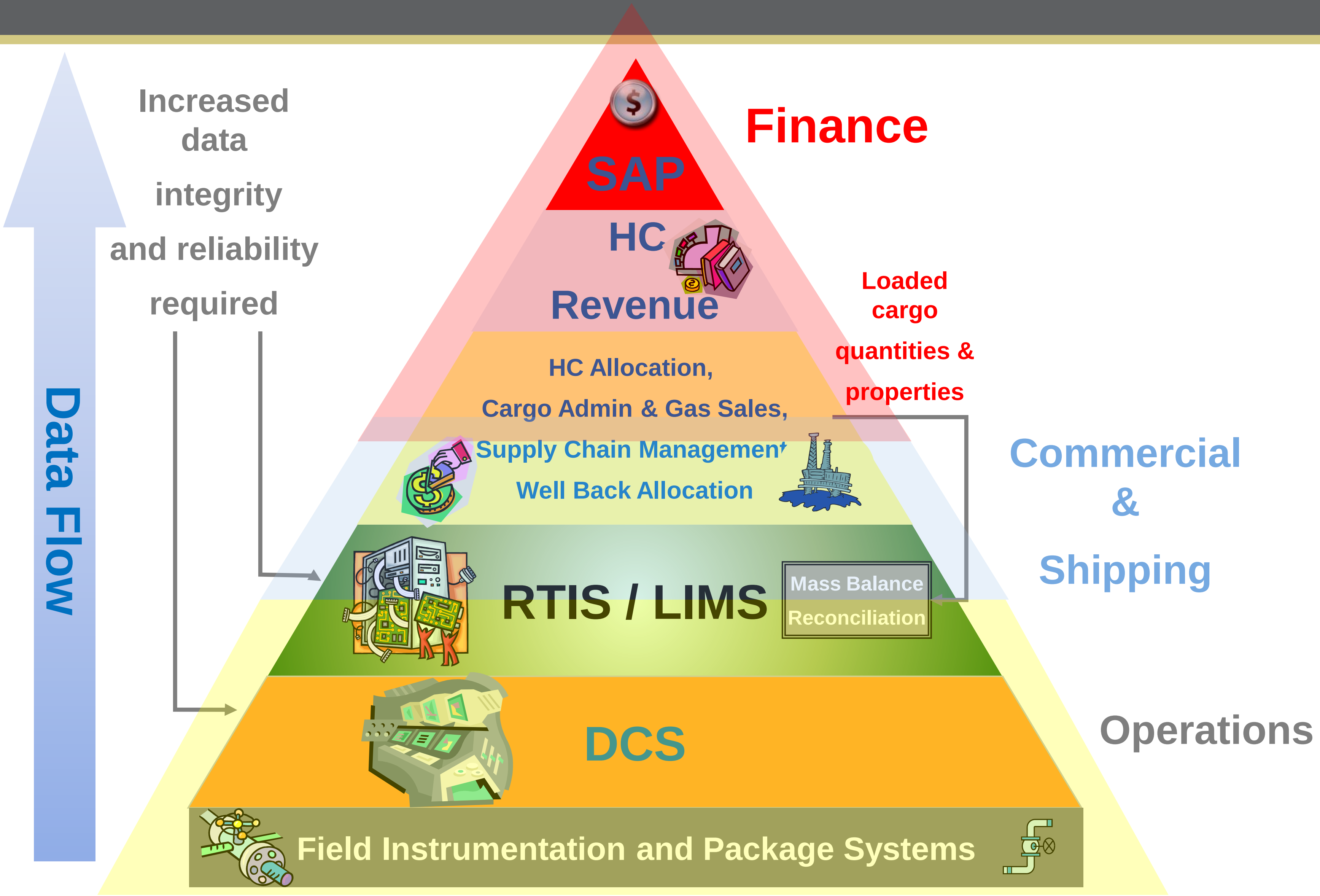
What is ICIMS?

- ICIMS stands for Integrated Control and Information Management Systems
- ICIMS provides integration of information across the enterprise
- The VISION was to extend the span of automation and information management to encompass all activities across the enterprise

Role of ICIMS

- The information systems serve or process information needed for
  - facility operation,
  - equipment monitoring,
  - maintenance management,
  - production allocation, planning & accounting
  - shipping cargos and
  - access to electronic documentation
- The data flow in the ICIMS is designed for integrity and to prevent any duplication of data
- For the security of control systems, data flow from DCS is normally outbound only. Other systems are not able to write to DCS

ICIMS Hierarchy and Data Flow


Increased data integrity and reliability required
Data Flow
SAP
Finance
HC Revenue
Loaded cargo quantities & properties
HC Allocation,
Cargo Admin & Gas Sales,
Supply Chain Management
Well Back Allocation
Commercial & Shipping
RTIS / LIMS
Mass Balance Reconciliation
DCS
Operations
Field Instrumentation and Package Systems

Real Time Information System (RTIS)

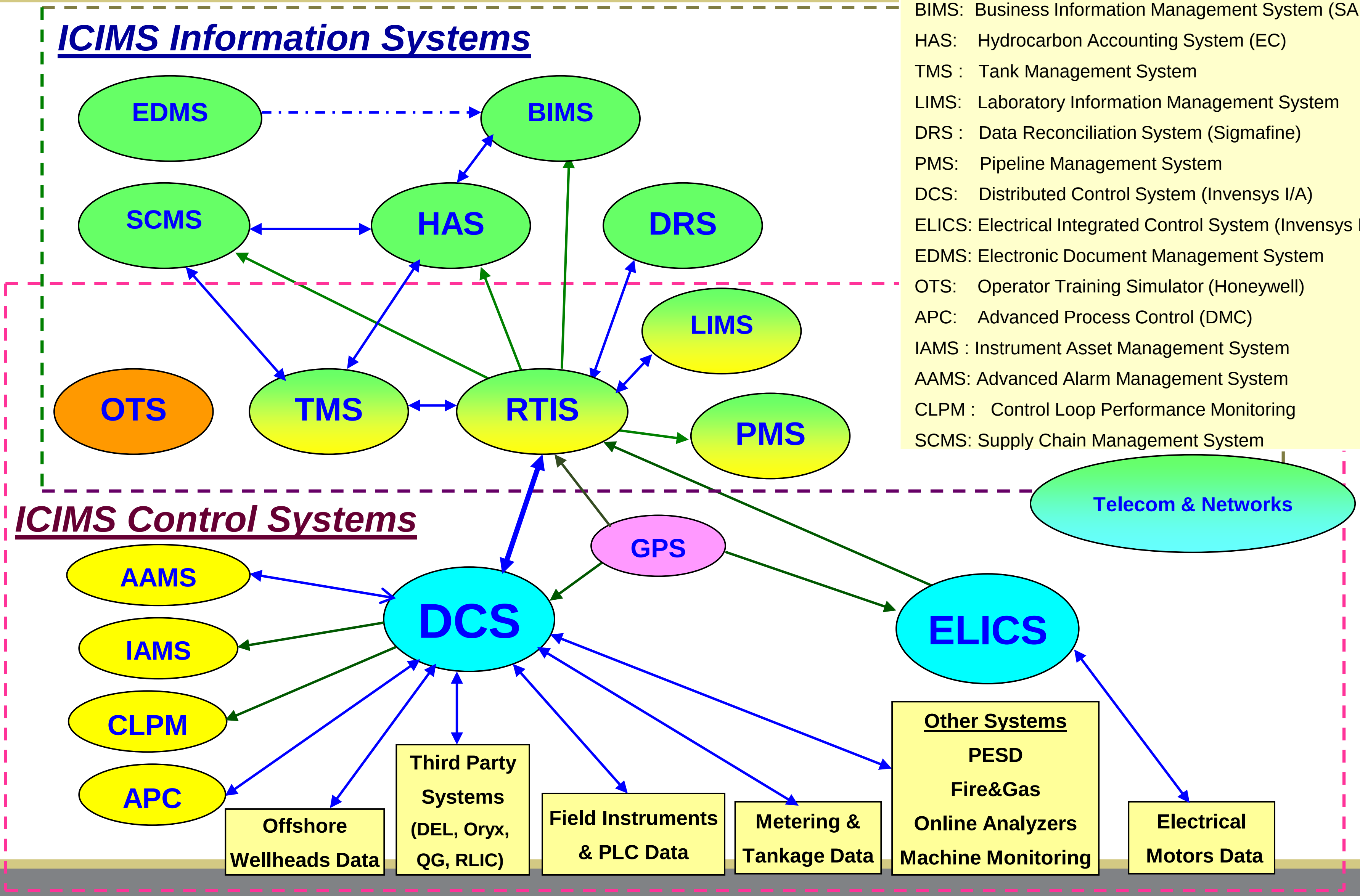
- All offshore and onshore control system process data are collected, and aggregated in the PI database for use by other applications; Analytical information is obtained from online field and traditional laboratory analyzers using Baytek's LIMS system
- It is a time based historical database and it has a calculation engine and client application packages.
- It receives/send data from/to control and information systems connected to ICIMS network.
- The data is compressed for an efficient storage and can be accessed online for up to 5 years

RTIS Network Connectivity in ICIMS

- RTIS plays a key role in maintaining data accuracy during fiscal data transfer from metering systems to accounting systems

- RTIS is a primary data source for the following RasGas key technical & business systems:
  - PMS – Pipeline Management System
  - DRS – Data Reconciliation System
  - HAS – Hydrocarbon Accounting System
  - SCMS – Supply Chain Management System
  - SAP - Financial System

'ICIMS Architecture' Diagram


ICIMS Information Systems
EDMS
BIMS
SCMS
HAS
DRS
LIMS
OTS
TMS
RTIS
PMS
Telecom & Networks
ICIMS Control Systems
GPS
AAMS
DCS
ELICS
IAMS
CLPM
APC
Offshore Wellheads Data
Third Party Systems (DEL, Oryx, QG, RLIC)
Field Instruments & PLC Data
Metering & Tankage Data
Other Systems
PESD
Fire&Gas
Online Analyzers
Machine Monitoring
Electrical Motors Data

BIMS: Business Information Management System (SAP)
HAS: Hydrocarbon Accounting System (EC)
TMS : Tank Management System
LIMS: Laboratory Information Management System
DRS : Data Reconciliation System (Sigmafine)
PMS: Pipeline Management System
DCS: Distributed Control System (Invensys I/A)
ELICS: Electrical Integrated Control System (Invensys I/A)
EDMS: Electronic Document Management System
OTS: Operator Training Simulator (Honeywell)
APC: Advanced Process Control (DMC)
IAMS : Instrument Asset Management System
AAMS: Advanced Alarm Management System
CLPM : Control Loop Performance Monitoring
SCMS: Supply Chain Management System

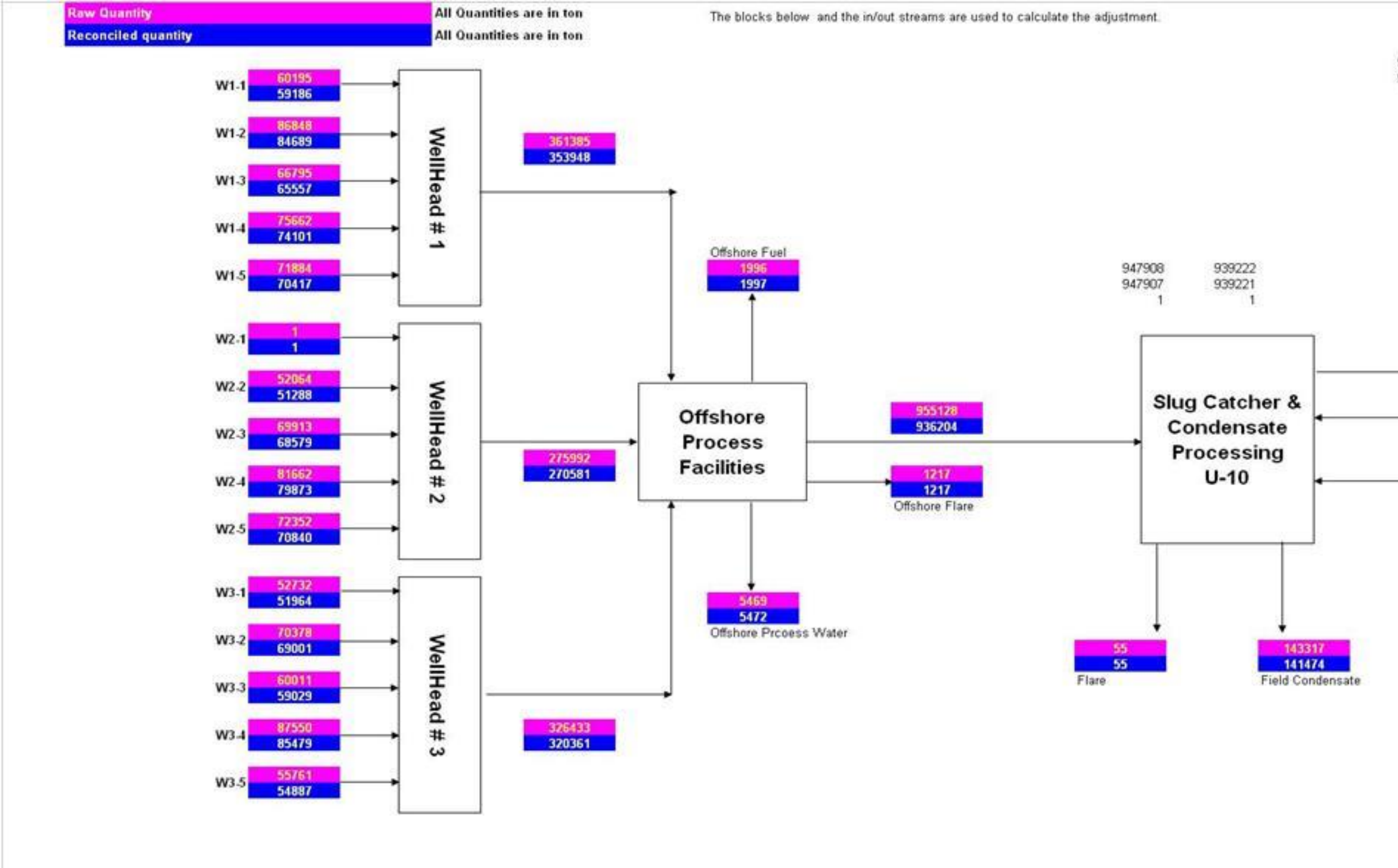
RTIS Hardware Architecture

- Before OSIsoft introduced the High Availability (HA) solution, RasGas used Marathon EveRun FT technology that provided uninterrupted access to data, during scheduled/unscheduled down times without requiring special hardware or clustered environments
- This fault tolerant software boosted the database servers reliability to 99.9%
- RTIS database servers key parameters are:-
  - Hard disk capacity: 1 TeraByte
  - Operating System : Windows 2003 Server Enterprise
  - Licensed for 150,000 tags (total of 64,500 tags utilized)
  - DCS tags made up 81% of the total tags
  - Other point types are Manual Inputs, LIMS, PI-Performance Equations, PI-ACE, Sigmafine and PI Totalizer.

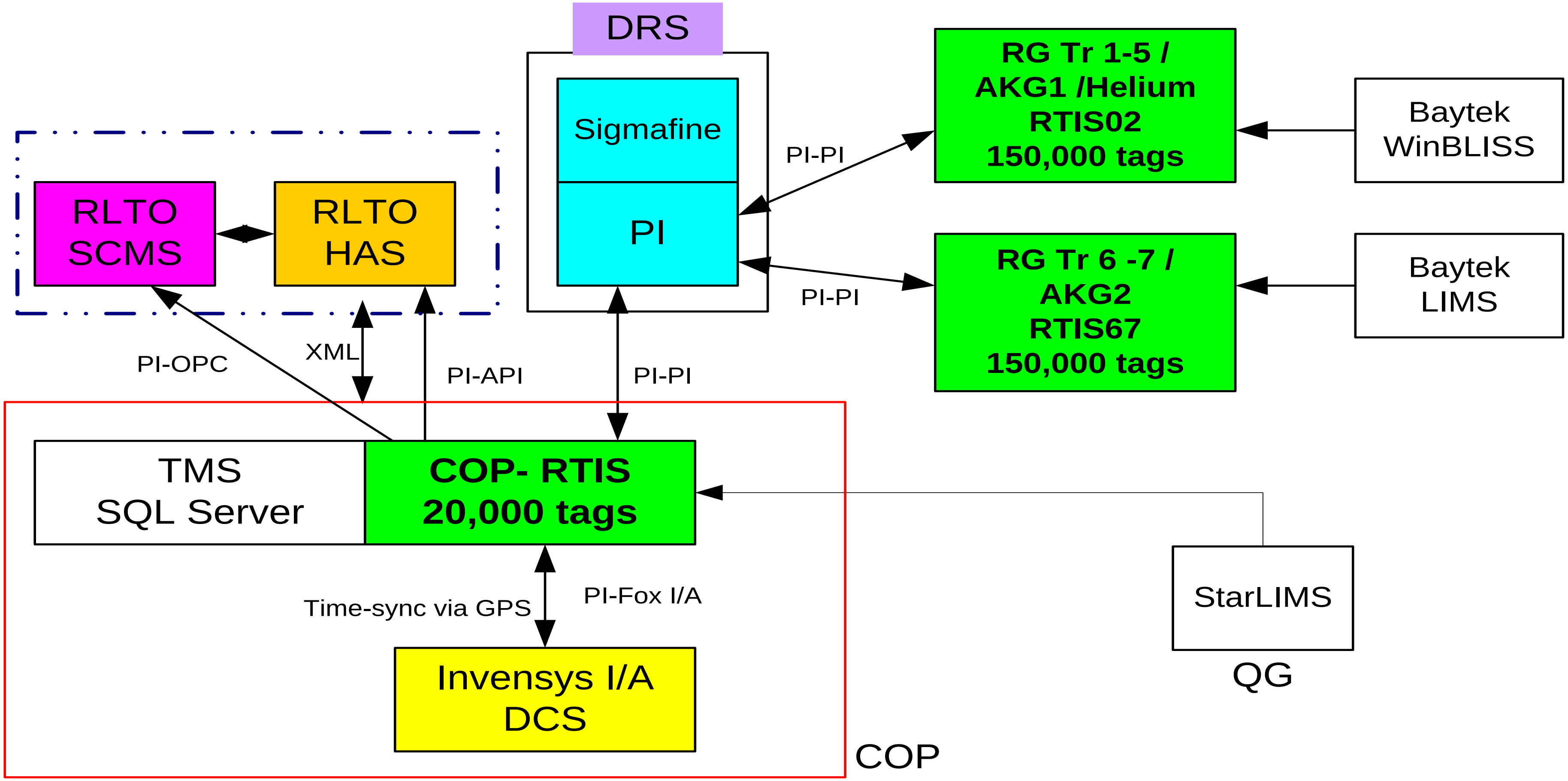
RasGas Reconciliation System

- Sigmafine is used to perform mass balance, components balance, energy balance and electrical power balance

- RasGas Model statistics:
  - 5 LNG and 1 Sales Gas Trains
  - 820 Flow meters
  - 23 Tanks
  - 66 Processes
  - 925 Flows


Raw Quantity
All Quantities are in ton
Reconciled quantity
All Quantities are in ton
The blocks below and the in/out streams are used to calculate the adjustment.
W1-1
60195
59186
W1-2
86848
84689
W1-3
66795
65557
W1-4
75662
74101
W1-5
71884
70417
WellHead # 1
361385
353948
W2-1
1
1
W2-2
52064
51288
W2-3
69913
68579
W2-4
81662
79873
W2-5
72352
70840
WellHead # 2
275992
270581
W3-1
52732
51964
W3-2
70378
69001
W3-3
60011
59029
W3-4
87550
85479
W3-5
55761
54887
WellHead # 3
326433
320361
Offshore Fuel
1996
1997
Offshore Process Facilities
5469
5472
Offshore Prcoess Water
955128
936204
1217
1217
Offshore Flare
947908
947907
1
939222
939221
1
Slug Catcher & Condensate Processing U-10
55
55
Flare
143317
141474
Field Condensate

RTIS Future Projects


DRS
Sigmafine
PI
RG Tr 1-5 / AKG1 /Helium RTIS02 150,000 tags
Baytek WinBLISS
PI-PI
RG Tr 6 -7 / AKG2 RTIS67 150,000 tags
Baytek LIMS
PI-PI
RLTO SCMS
RLTO HAS
PI-OPC
XML
PI-API
PI-PI
TMS SQL Server
COP- RTIS 20,000 tags
Time-sync via GPS
PI-Fox I/A
Invensys I/A DCS
StarLIMS
QG
COP

RTIS Applications

DEMO

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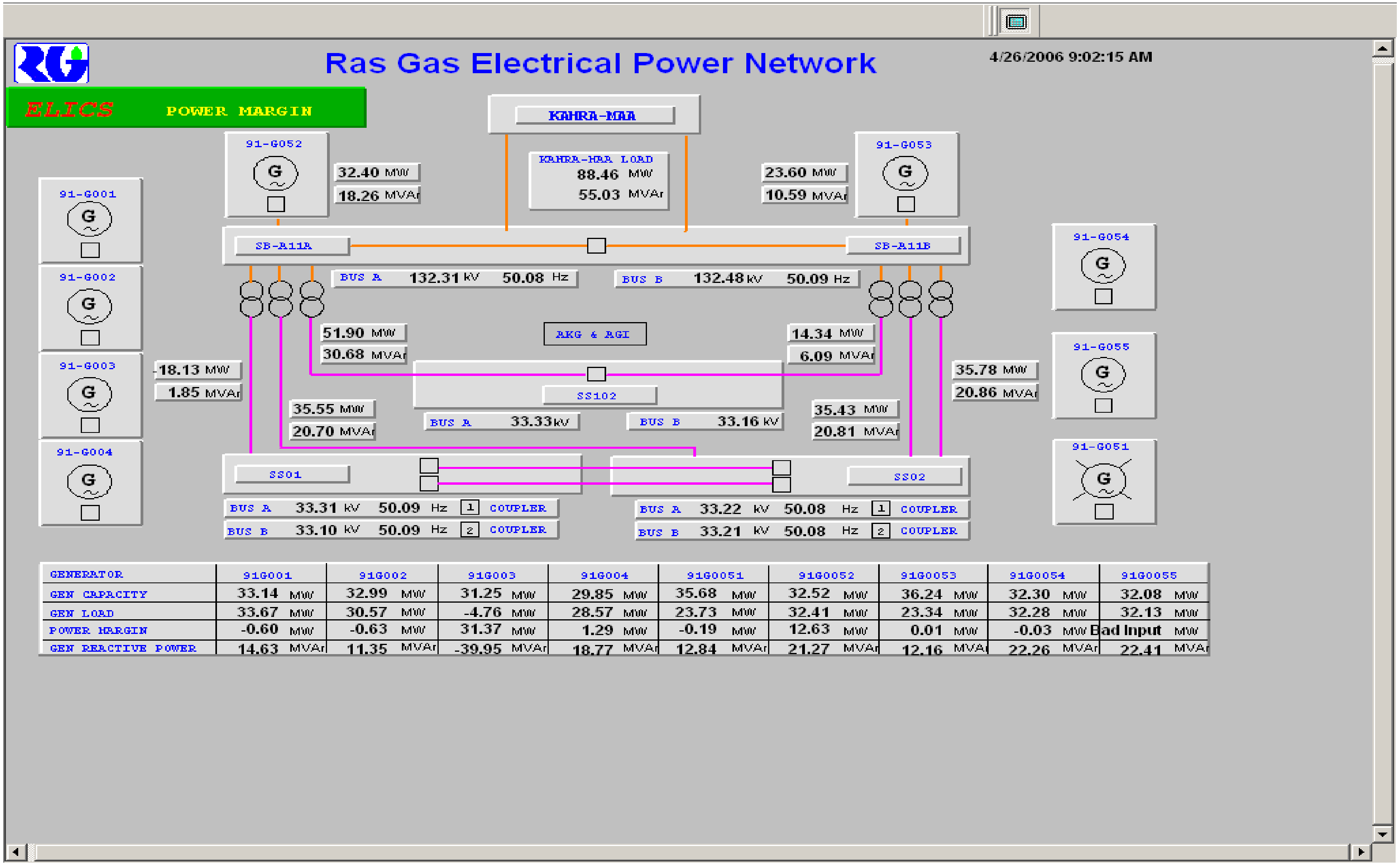
THANK YOU

Backup Slides

Applications & Systems

Utilities – Electrical Power



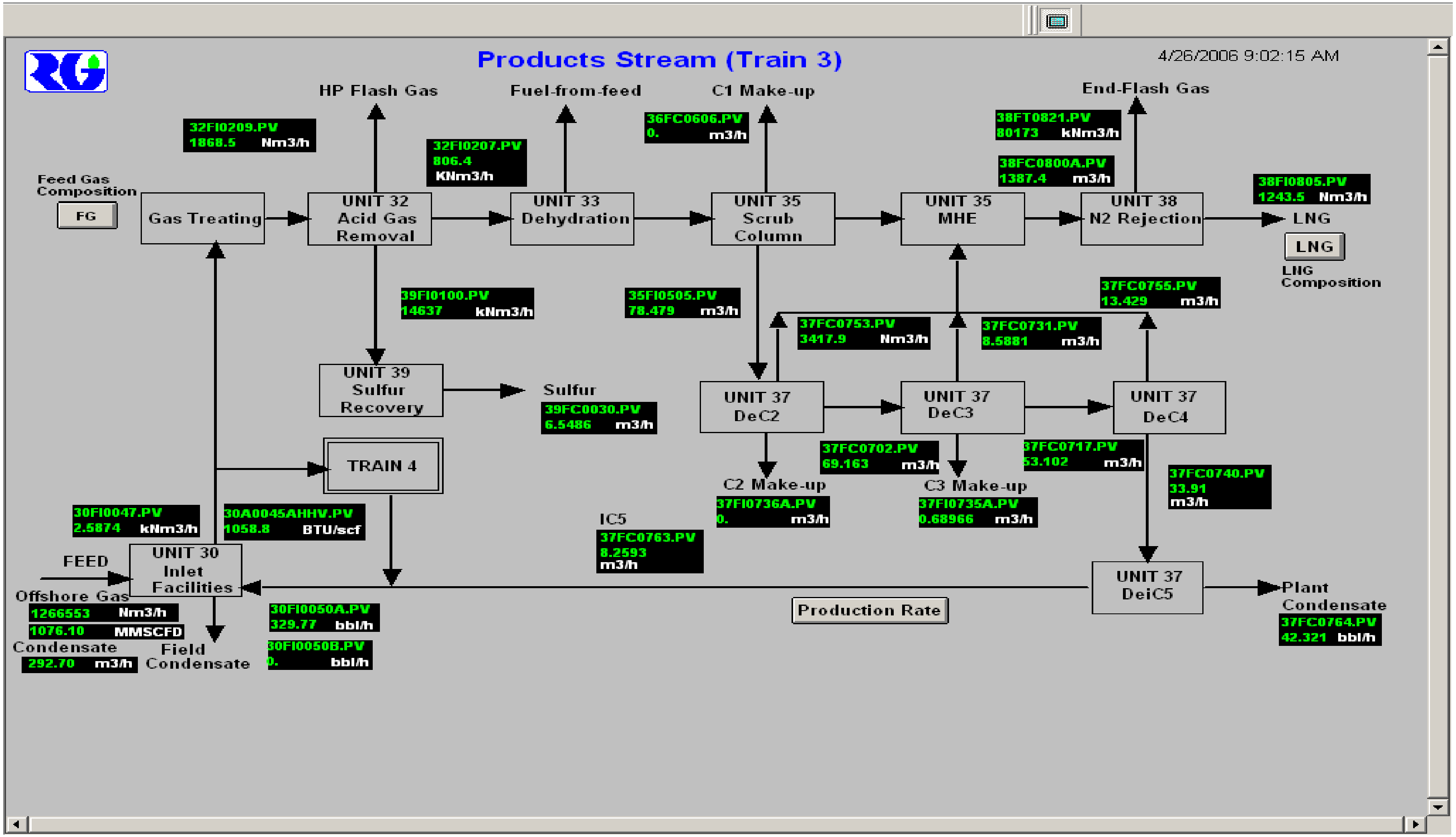
Ras Gas Electrical Power Network

4/26/2006 9:02:15 AM

ELICS
POWER MARGIN
KAHRA-MAA
KAHRA-MAA LOAD
88.46 MW
55.03 MVAr
91-G052
32.40 MW
18.26 MVAr
91-G053
23.60 MW
10.59 MVAr
91-G001
91-G002
91-G003
91-G004
91-G054
91-G055
91-G051
SB-A11A
SB-A11B
BUS A 132.31 kV 50.08 Hz
BUS B 132.48 kV 50.09 Hz
51.90 MW
30.68 MVAr
AKG & AGI
14.34 MW
6.09 MVAr
18.13 MW
1.85 MVAr
35.78 MW
20.86 MVAr
SS102
35.55 MW
20.70 MVAr
BUS A 33.33 kV
BUS B 33.16 kV
35.43 MW
20.81 MVAr
SS01
SS02
BUS A 33.31 kV 50.09 Hz 1 COUPLER
BUS B 33.10 kV 50.09 Hz 2 COUPLER
BUS A 33.22 kV 50.08 Hz 1 COUPLER
BUS B 33.21 kV 50.08 Hz 2 COUPLER

GENERATOR	91G001	91G002	91G003	91G004	91G0051	91G0052	91G0053	91G0054	91G0055
GEN CAPACITY	33.14 MW	32.99 MW	31.25 MW	29.85 MW	35.68 MW	32.52 MW	36.24 MW	32.30 MW	32.08 MW
GEN LOAD	33.67 MW	30.57 MW	-4.76 MW	28.57 MW	23.73 MW	32.41 MW	23.34 MW	32.28 MW	32.13 MW
POWER MARGIN	-0.60 MW	-0.63 MW	31.37 MW	1.29 MW	-0.19 MW	12.63 MW	0.01 MW	-0.03 MW	Bad Input MW
GEN REACTIVE POWER	14.63 MVAr	11.35 MVAr	-39.95 MVAr	18.77 MVAr	12.84 MVAr	21.27 MVAr	12.16 MVAr	22.26 MVAr	22.41 MVAr

LNG Train 3 Products Stream


Products Stream (Train 3)
4/26/2006 9:02:15 AM
HP Flash Gas
Fuel-from-feed
C1 Make-up
End-Flash Gas
Feed Gas Composition
FG
Gas Treating
UNIT 32 Acid Gas Removal
UNIT 33 Dehydration
UNIT 35 Scrub Column
UNIT 35 MHE
UNIT 38 N2 Rejection
LNG
LNG
LNG Composition
UNIT 39 Sulfur Recovery
Sulfur
UNIT 37 DeC2
UNIT 37 DeC3
UNIT 37 DeC4
TRAIN 4
C2 Make-up
C3 Make-up
IC5
FEED
UNIT 30 Inlet Facilities
Offshore Gas
Condensate
Field Condensate
UNIT 37 DeiC5
Plant Condensate
Production Rate

32FI0209.PV 1868.5 Nm3/h

32FI0207.PV 806.4 KNm3/h

36FC0606.PV 0. m3/h

38FT0821.PV 80173 kNm3/h

38FC0800A.PV 1387.4 m3/h

38FI0805.PV 1243.5 Nm3/h

39FI0100.PV 14637 kNm3/h

35FI0505.PV 78.479 m3/h

37FC0755.PV 13.429 m3/h

37FC0753.PV 3417.9 Nm3/h

37FC0731.PV 8.5881 m3/h

39FC0030.PV 6.5486 m3/h

37FC0702.PV 69.163 m3/h

37FC0717.PV 53.102 m3/h

37FC0740.PV 33.91 m3/h

37FI0736A.PV 0. m3/h

37FI0735A.PV 0.68966 m3/h

30FI0047.PV 2.5874 kNm3/h

30A0045AHHV.PV 1058.8 BTU/scf

37FC0763.PV 8.2593 m3/h

Offshore Gas 1266553 Nm3/h

1076.10 MMSCFD

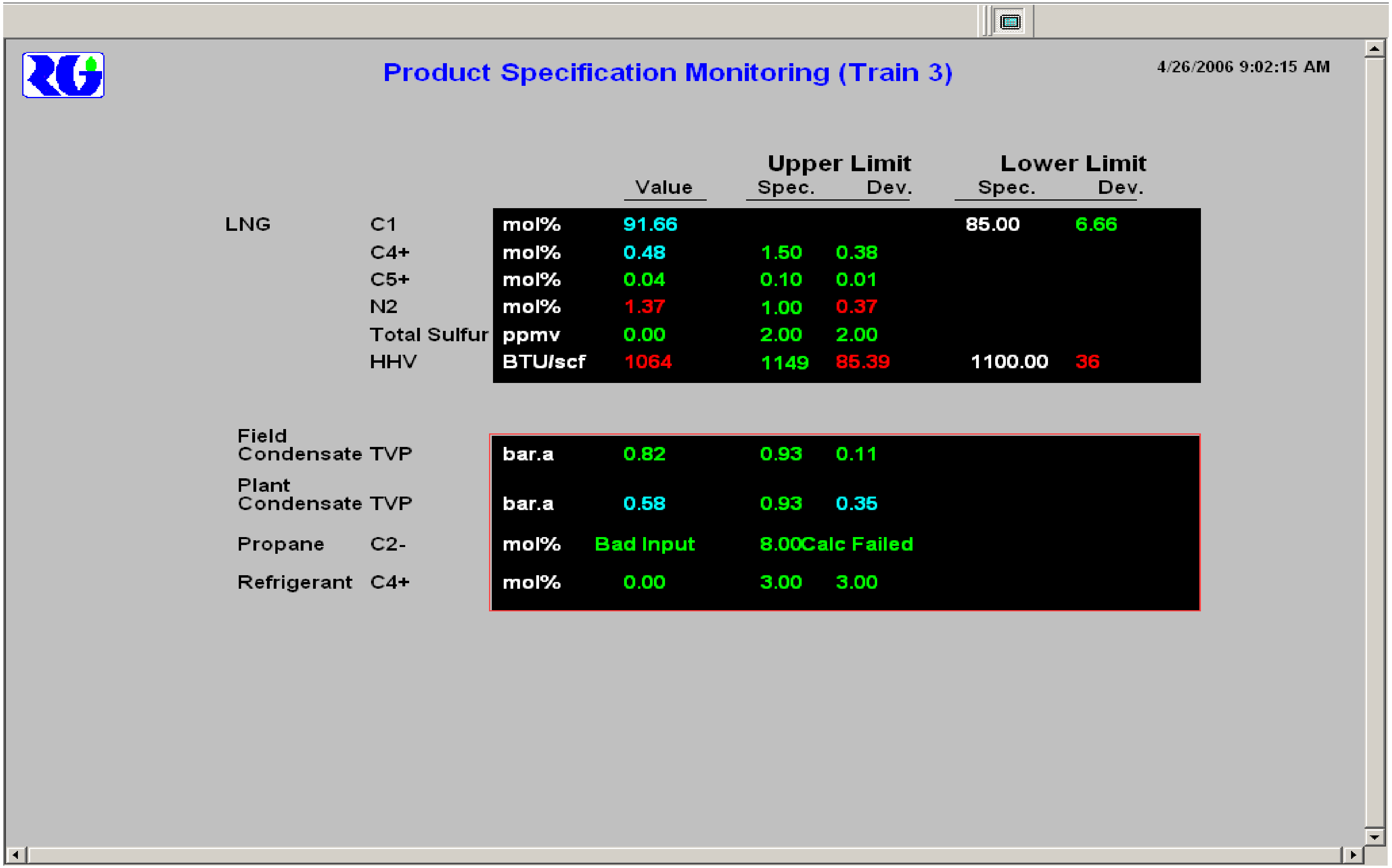
Condensate 292.70 m3/h

30FI0050A.PV 329.77 bbl/h

30FI0050B.PV 0. bbl/h

37FC0764.PV 42.321 bbl/h

Products Specification Monitoring

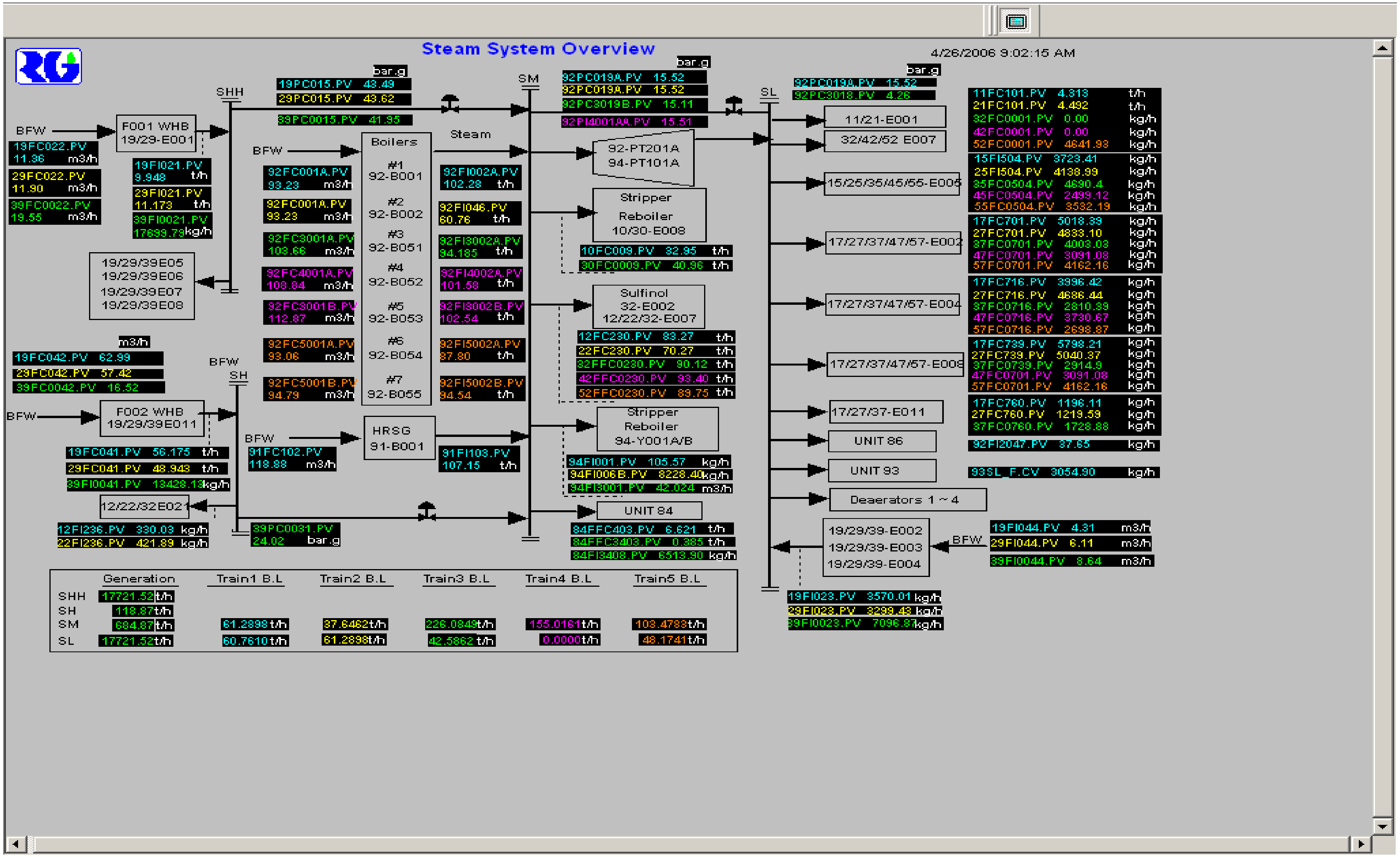


Product Specification Monitoring (Train 3)

4/26/2006 9:02:15 AM

			Value	Upper Limit Spec.	Upper Limit Dev.	Lower Limit Spec.	Lower Limit Dev.
LNG	C1	mol%	91.66			85.00	6.66
	C4+	mol%	0.48	1.50	0.38		
	C5+	mol%	0.04	0.10	0.01		
	N2	mol%	1.37	1.00	0.37		
	Total Sulfur	ppmv	0.00	2.00	2.00		
	HHV	BTU/scf	1064	1149	85.39	1100.00	36
Field Condensate	TVP	bar.a	0.82	0.93	0.11		
Plant Condensate	TVP	bar.a	0.58	0.93	0.35		
Propane	C2-	mol%	Bad Input	8.00	Calc Failed		
Refrigerant	C4+	mol%	0.00	3.00	3.00		

Utilities Monitoring – Steam



SHH
SM
SL
SH
BFW
Steam
F001 WHB
19/29-E001
19/29/39E05
19/29/39E06
19/29/39E07
19/29/39E08
F002 WHB
19/29/39E011
12/22/32E021
Boilers
#1
92-B001
#2
92-B002
#3
92-B051
#4
92-B052
#5
92-B053
#6
92-B054
#7
92-B055
HRSG
91-B001
92-PT201A
94-PT101A
Stripper
Reboiler
10/30-E008
Sulfinol
32-E002
12/22/32-E007
Stripper
Reboiler
94-Y001A/B
UNIT 84
11/21-E001
32/42/52 E007
15/25/35/45/55-E005
17/27/37/47/57-E002
17/27/37/47/57-E004
17/27/37/47/57-E008
17/27/37-E011
UNIT 86
UNIT 93
Deaerators 1 ~ 4
19/29/39-E002
19/29/39-E003
19/29/39-E004

Steam System Overview

4/26/2006 9:02:15 AM

bar.g
19PC015.PV 43.49
29PC015.PV 43.62
39PC0015.PV 41.95

bar.g
92PC019A.PV 15.52
92PC019A.PV 15.52
92PC3019B.PV 15.11
92PI4001AA.PV 15.51

bar.g
92PC019A.PV 15.52
92PC3018.PV 4.26

19FC022.PV 11.36 m3/h
29FC022.PV 11.90 m3/h
39FC0022.PV 19.55 m3/h

19FI021.PV 9.948 t/h
29FI021.PV 11.173 t/h
39FI0021.PV 17699.79 kg/h

92FC001A.PV 93.23 m3/h
92FC001A.PV 93.23 m3/h
92FC3001A.PV 103.66 m3/h
92FC4001A.PV 108.84 m3/h
92FC3001B.PV 112.87 m3/h
92FC5001A.PV 93.06 m3/h
92FC5001B.PV 94.79 m3/h

92FI002A.PV 102.28 t/h
92FI046.PV 60.76 t/h
92FI3002A.PV 94.185 t/h
92FI4002A.PV 101.58 t/h
92FI3002B.PV 102.54 t/h
92FI5002A.PV 87.80 t/h
92FI5002B.PV 94.54 t/h

m3/h
19FC042.PV 62.99
29FC042.PV 57.42
39FC0042.PV 16.52

19FC041.PV 56.175 t/h
29FC041.PV 48.943 t/h
39FI0041.PV 13428.13 kg/h

12FI236.PV 330.03 kg/h
22FI236.PV 421.89 kg/h

39PC0031.PV 24.02 bar.g

91FC102.PV 118.88 m3/h
91FI103.PV 107.15 t/h

10FC009.PV 32.95 t/h
30FC0009.PV 40.96 t/h

12FC230.PV 83.27 t/h
22FC230.PV 70.27 t/h
32FFC0230.PV 90.12 t/h
42FFC0230.PV 93.40 t/h
52FFC0230.PV 89.75 t/h

94FI001.PV 105.57 kg/h
94FI006B.PV 8228.40 kg/h
94FI3001.PV 42.024 m3/h

84FFC403.PV 6.621 t/h
84FFC3403.PV 0.385 t/h
84FI3408.PV 6513.90 kg/h

11FC101.PV 4.313 t/h
21FC101.PV 4.492 t/h
32FC0001.PV 0.00 kg/h
42FC0001.PV 0.00 kg/h
52FC0001.PV 4641.93 kg/h

15FI504.PV 3723.41 kg/h
25FI504.PV 4138.99 kg/h
35FC0504.PV 4690.4 kg/h
45FC0504.PV 2499.12 kg/h
55FC0504.PV 3532.19 kg/h

17FC701.PV 5018.39 kg/h
27FC701.PV 4833.10 kg/h
37FC0701.PV 4003.03 kg/h
47FC0701.PV 3091.08 kg/h
57FC0701.PV 4162.16 kg/h

17FC716.PV 3996.42 kg/h
27FC716.PV 4686.44 kg/h
37FC0716.PV 2810.39 kg/h
47FC0716.PV 3730.67 kg/h
57FC0716.PV 2698.87 kg/h

17FC739.PV 5798.21 kg/h
27FC739.PV 5040.37 kg/h
37FC0739.PV 2914.9 kg/h
47FC0701.PV 3091.08 kg/h
57FC0701.PV 4162.16 kg/h

17FC760.PV 1196.11 kg/h
27FC760.PV 1219.59 kg/h
37FC0760.PV 1728.88 kg/h

92FI2047.PV 37.65 kg/h

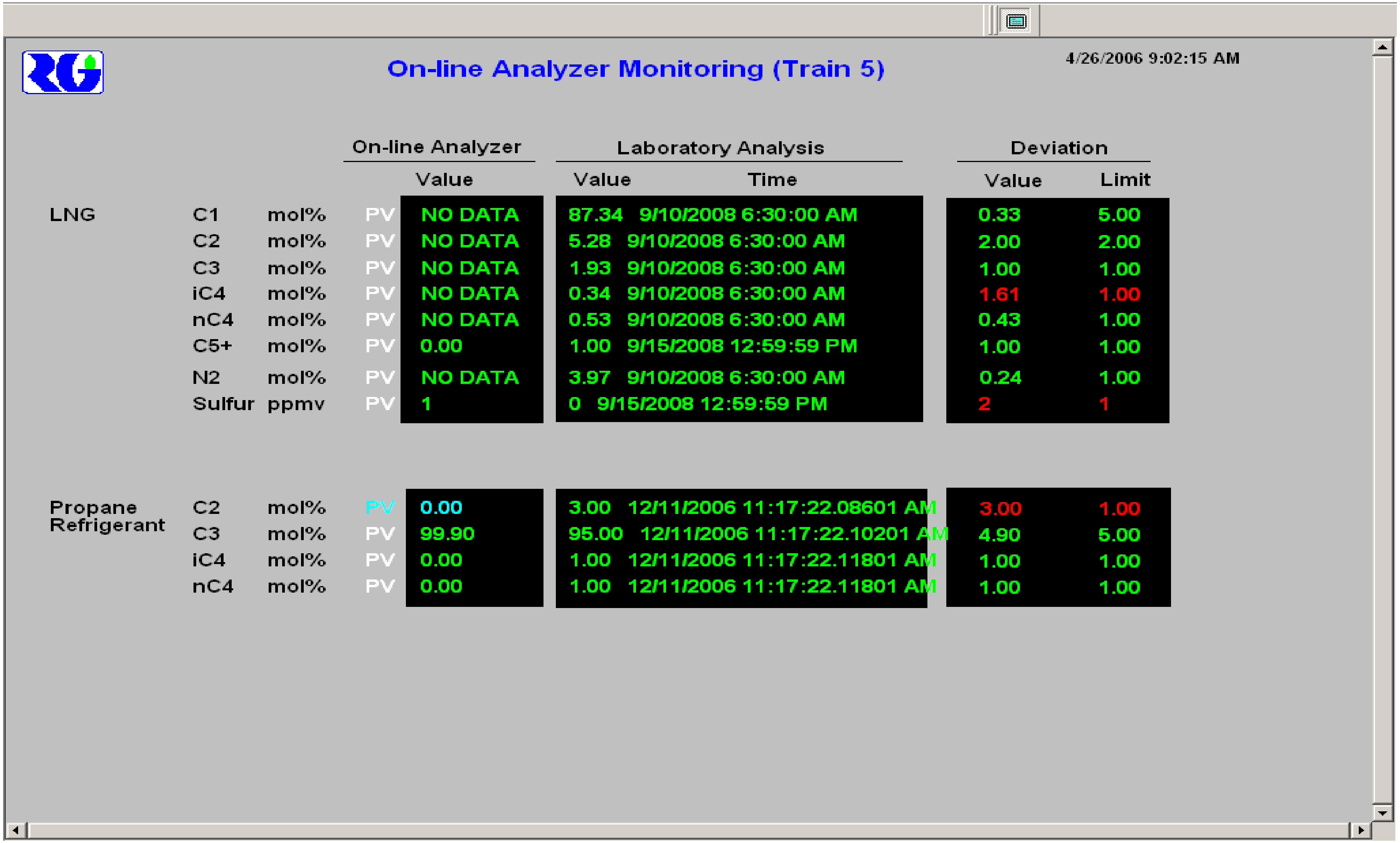
93SL_F.CV 3054.90 kg/h

19FI044.PV 4.31 m3/h
29FI044.PV 6.11 m3/h
39FI0044.PV 8.64 m3/h

19FI023.PV 3570.01 kg/h
29FI023.PV 3299.43 kg/h
39FI0023.PV 7096.87 kg/h

	Generation	Train1 B.L	Train2 B.L	Train3 B.L	Train4 B.L	Train5 B.L
SHH	17721.52 t/h					
SH	118.87 t/h					
SM	684.87 t/h	61.2898 t/h	37.6462 t/h	226.0849 t/h	155.0161 t/h	103.4783 t/h
SL	17721.52 t/h	60.7610 t/h	61.2898 t/h	42.5862 t/h	0.0000 t/h	48.1741 t/h

Analyzers Monitoring

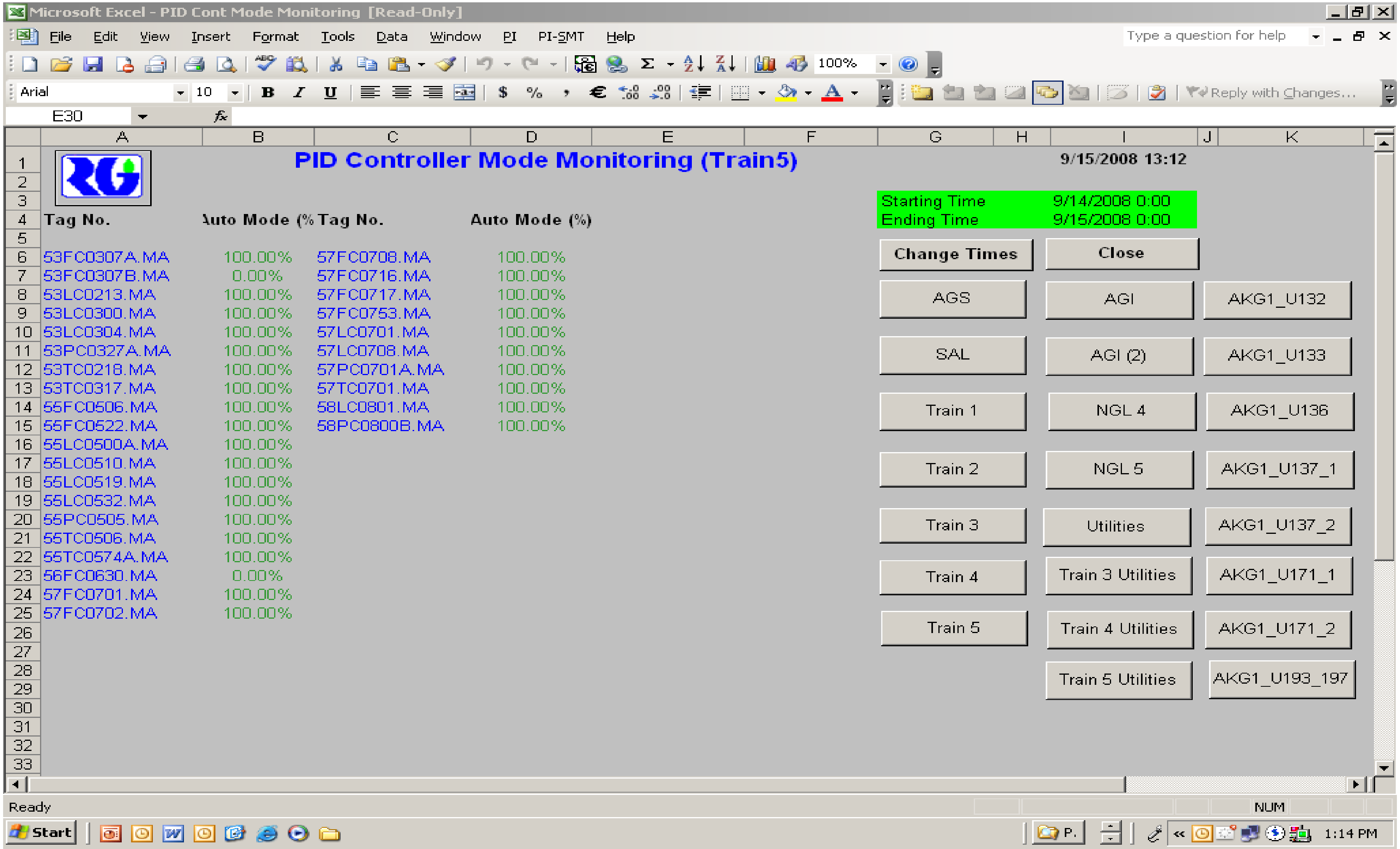


On-line Analyzer Monitoring (Train 5)

4/26/2006 9:02:15 AM

				On-line Analyzer	Laboratory Analysis		Deviation	
				Value	Value	Time	Value	Limit
LNG	C1	mol%	PV	NO DATA	87.34	9/10/2008 6:30:00 AM	0.33	5.00
	C2	mol%	PV	NO DATA	5.28	9/10/2008 6:30:00 AM	2.00	2.00
	C3	mol%	PV	NO DATA	1.93	9/10/2008 6:30:00 AM	1.00	1.00
	iC4	mol%	PV	NO DATA	0.34	9/10/2008 6:30:00 AM	1.61	1.00
	nC4	mol%	PV	NO DATA	0.53	9/10/2008 6:30:00 AM	0.43	1.00
	C5+	mol%	PV	0.00	1.00	9/15/2008 12:59:59 PM	1.00	1.00
	N2	mol%	PV	NO DATA	3.97	9/10/2008 6:30:00 AM	0.24	1.00
	Sulfur	ppmv	PV	1	0	9/15/2008 12:59:59 PM	2	1
Propane Refrigerant	C2	mol%	PV	0.00	3.00	12/11/2006 11:17:22.08601 AM	3.00	1.00
	C3	mol%	PV	99.90	95.00	12/11/2006 11:17:22.10201 AM	4.90	5.00
	iC4	mol%	PV	0.00	1.00	12/11/2006 11:17:22.11801 AM	1.00	1.00
	nC4	mol%	PV	0.00	1.00	12/11/2006 11:17:22.11801 AM	1.00	1.00

Plant Performance


Microsoft Excel - PID Cont Mode Monitoring [Read-Only]
File
Edit
View
Insert
Format
Tools
Data
Window
PI
PI-SMT
Help
Type a question for help
100%
Arial
10
Reply with Changes...
E30
Change Times
Close
AGS
AGI
AKG1_U132
SAL
AGI (2)
AKG1_U133
Train 1
NGL 4
AKG1_U136
Train 2
NGL 5
AKG1_U137_1
Train 3
Utilities
AKG1_U137_2
Train 4
Train 3 Utilities
AKG1_U171_1
Train 5
Train 4 Utilities
AKG1_U171_2
Train 5 Utilities
AKG1_U193_197
Ready
NUM
Start
1:14 PM

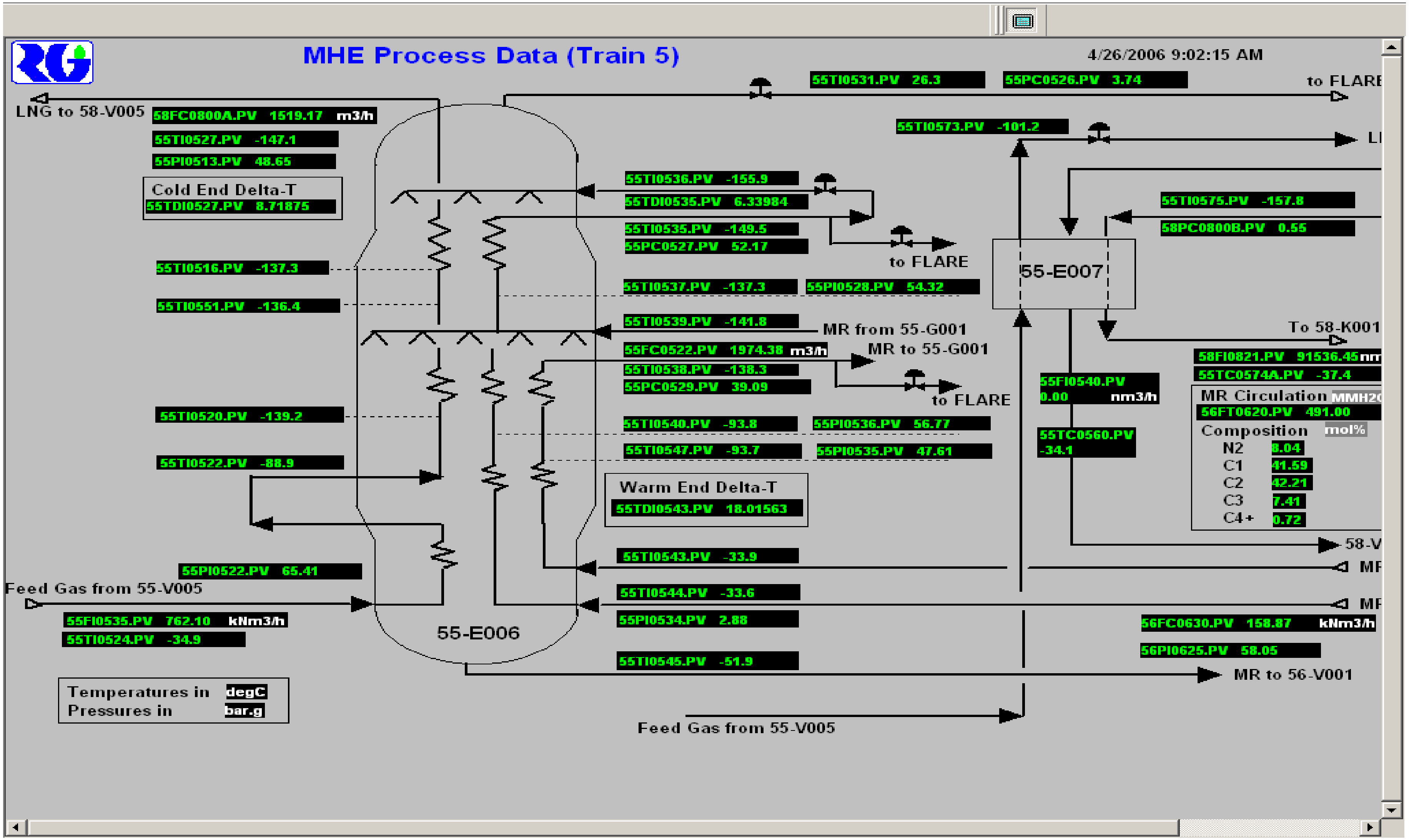
PID Controller Mode Monitoring (Train5)

9/15/2008 13:12

Starting Time 9/14/2008 0:00
Ending Time 9/15/2008 0:00

Tag No.	Auto Mode (%	Tag No.	Auto Mode (%)
53FC0307A.MA	100.00%	57FC0708.MA	100.00%
53FC0307B.MA	0.00%	57FC0716.MA	100.00%
53LC0213.MA	100.00%	57FC0717.MA	100.00%
53LC0300.MA	100.00%	57FC0753.MA	100.00%
53LC0304.MA	100.00%	57LC0701.MA	100.00%
53PC0327A.MA	100.00%	57LC0708.MA	100.00%
53TC0218.MA	100.00%	57PC0701A.MA	100.00%
53TC0317.MA	100.00%	57TC0701.MA	100.00%
55FC0506.MA	100.00%	58LC0801.MA	100.00%
55FC0522.MA	100.00%	58PC0800B.MA	100.00%
55LC0500A.MA	100.00%		
55LC0510.MA	100.00%		
55LC0519.MA	100.00%		
55LC0532.MA	100.00%		
55PC0505.MA	100.00%		
55TC0506.MA	100.00%		
55TC0574A.MA	100.00%		
56FC0630.MA	0.00%		
57FC0701.MA	100.00%		
57FC0702.MA	100.00%		

Process Data Monitoring



MHE Process Data (Train 5)

4/26/2006 9:02:15 AM

55TI0531.PV 26.3

55PC0526.PV 3.74

58FC0800A.PV 1519.17 m3/h

55TI0527.PV -147.1

55PI0513.PV 48.65

55TI0573.PV -101.2

Cold End Delta-T
55TDI0527.PV 8.71875

55TI0536.PV -155.9

55TDI0535.PV 6.33984

55TI0575.PV -157.8

58PC0800B.PV 0.55

55TI0535.PV -149.5

55PC0527.PV 52.17

55TI0516.PV -137.3

55TI0537.PV -137.3

55PI0528.PV 54.32

55TI0551.PV -136.4

55TI0539.PV -141.8

55FC0522.PV 1974.38 m3/h

55TI0538.PV -138.3

55PC0529.PV 39.09

58FI0821.PV 91536.45 nm

55TC0574A.PV -37.4

55FI0540.PV
0.00 nm3/h

MR Circulation MMH2
56FT0620.PV 491.00

55TI0520.PV -139.2

55TI0540.PV -93.8

55PI0536.PV 56.77

55TC0560.PV
-34.1

Composition mol%

N2	8.04
C1	41.59
C2	42.21
C3	7.41
C4+	0.72

55TI0522.PV -88.9

55TI0547.PV -93.7

55PI0535.PV 47.61

Warm End Delta-T
55TDI0543.PV 18.01563

55TI0543.PV -33.9

55PI0522.PV 65.41

55TI0544.PV -33.6

55PI0534.PV 2.88

56FC0630.PV 158.87 kNm3/h

55FI0535.PV 762.10 kNm3/h

55TI0524.PV -34.9

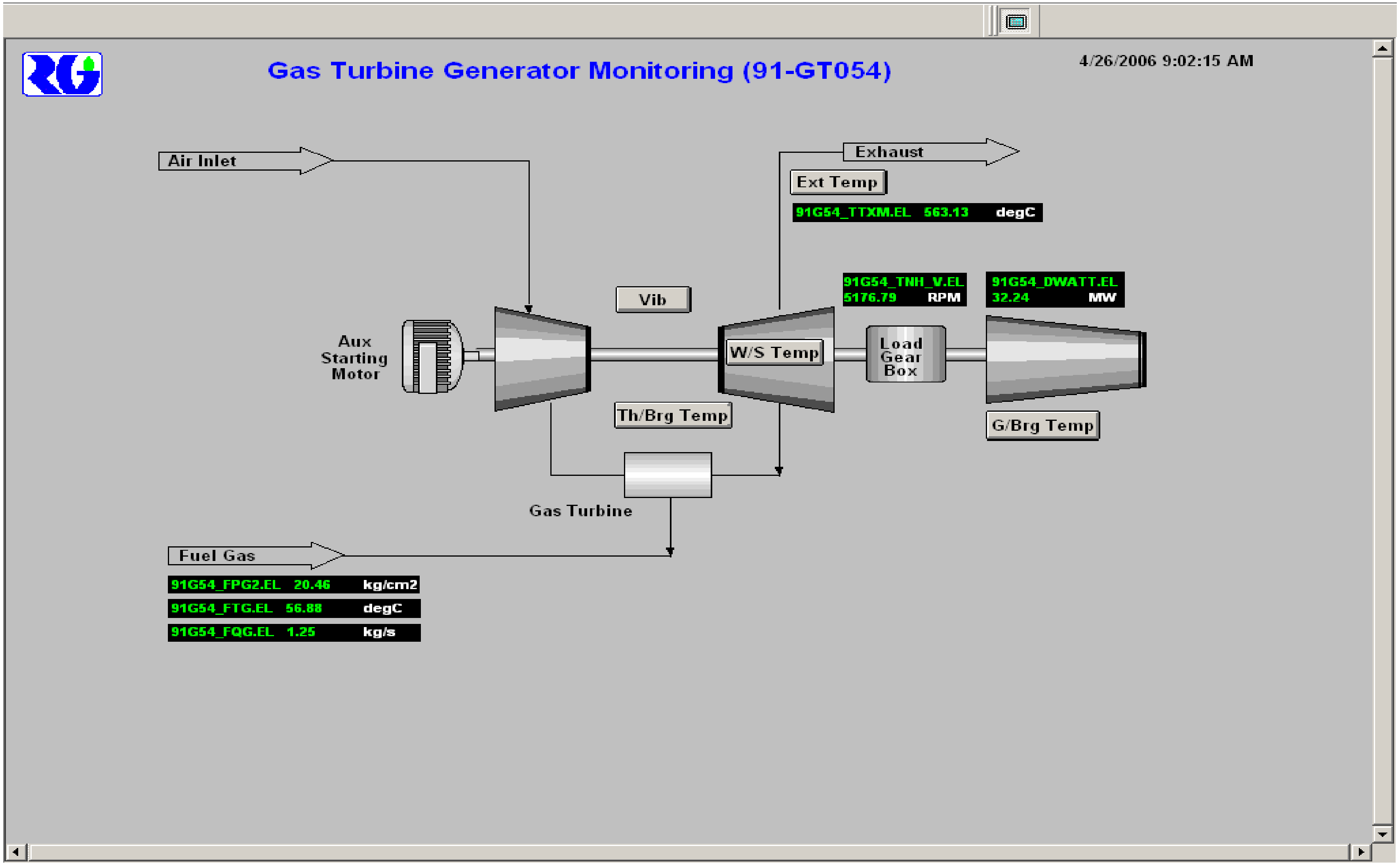
56PI0625.PV 58.05

55TI0545.PV -51.9

Temperatures in degC
Pressures in bar.g

to FLARE
LNG to 58-V005
LI
to FLARE
55-E007
MR from 55-G001
MR to 55-G001
To 58-K001
to FLARE
58-V
MF
Feed Gas from 55-V005
MF
55-E006
MR to 56-V001
Feed Gas from 55-V005

Gas Turbine Generator Monitoring

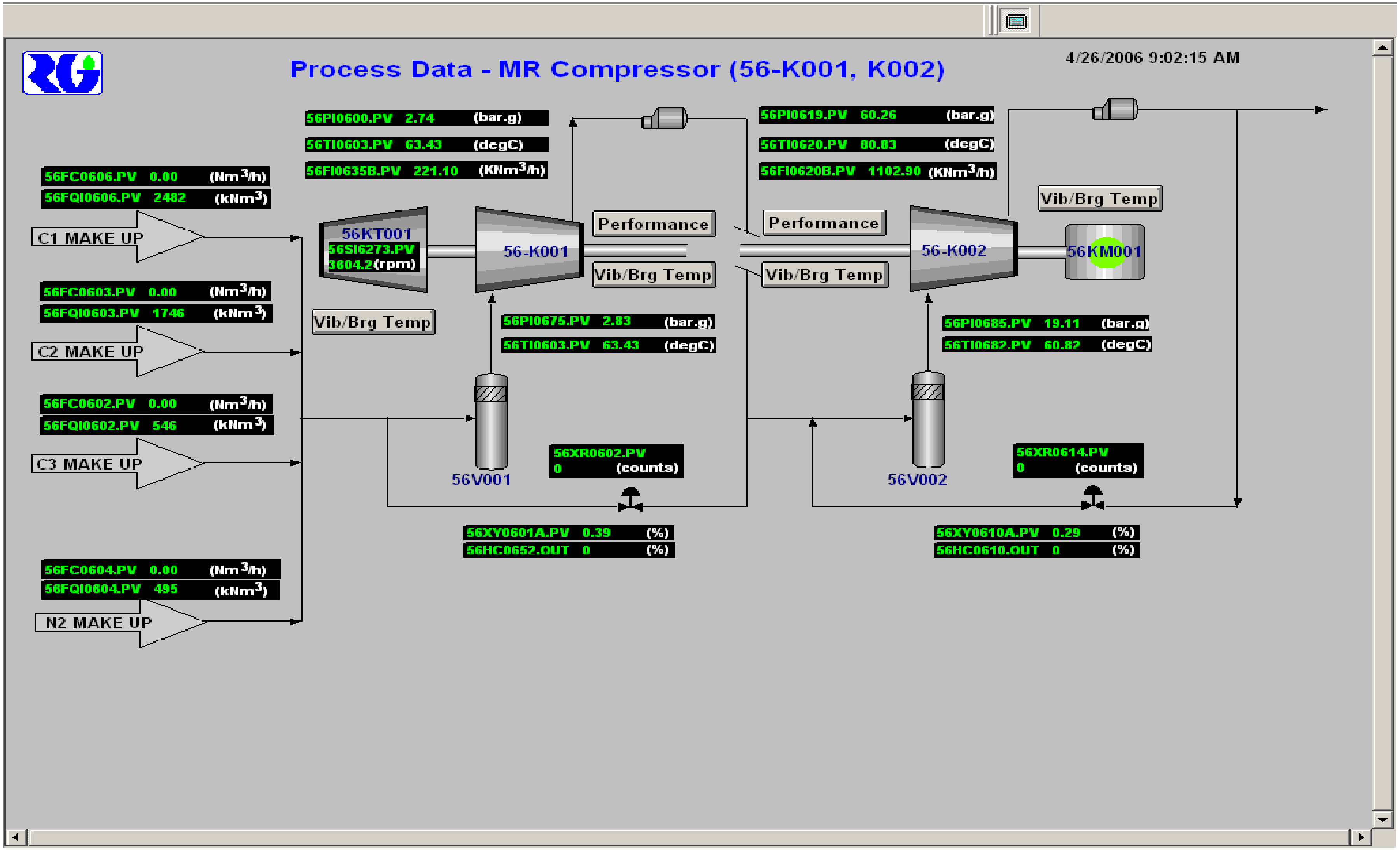

Air Inlet
Exhaust
Ext Temp
Vib
Aux Starting Motor
W/S Temp
Load Gear Box
Th/Brg Temp
G/Brg Temp
Gas Turbine
Fuel Gas

Gas Turbine Generator Monitoring (91-GT054)

4/26/2006 9:02:15 AM

91G54_TTXM.EL	563.13	degC
91G54_TNH_V.EL	5176.79	RPM
91G54_DWATT.EL	32.24	MW
91G54_FPG2.EL	20.46	kg/cm2
91G54_FTG.EL	56.88	degC
91G54_FQG.EL	1.25	kg/s

Compressor Monitoring



Process Data - MR Compressor (56-K001, K002)

4/26/2006 9:02:15 AM

56FC0606.PV 0.00 (Nm^3/h)
56FQI0606.PV 2482 (kNm^3)

56FC0603.PV 0.00 (Nm^3/h)
56FQI0603.PV 1746 (kNm^3)

56FC0602.PV 0.00 (Nm^3/h)
56FQI0602.PV 546 (kNm^3)

56FC0604.PV 0.00 (Nm^3/h)
56FQI0604.PV 495 (kNm^3)

56PI0600.PV 2.74 (bar.g)
56TI0603.PV 63.43 (degC)
56FI0635B.PV 221.10 (KNm^3/h)

56SI6273.PV
3604.2 (rpm)

56PI0675.PV 2.83 (bar.g)
56TI0603.PV 63.43 (degC)

56XR0602.PV
0 (counts)

56XY0601A.PV 0.39 (%)
56HC0652.OUT 0 (%)

56PI0619.PV 60.26 (bar.g)
56TI0620.PV 80.83 (degC)
56FI0620B.PV 1102.90 (KNm^3/h)

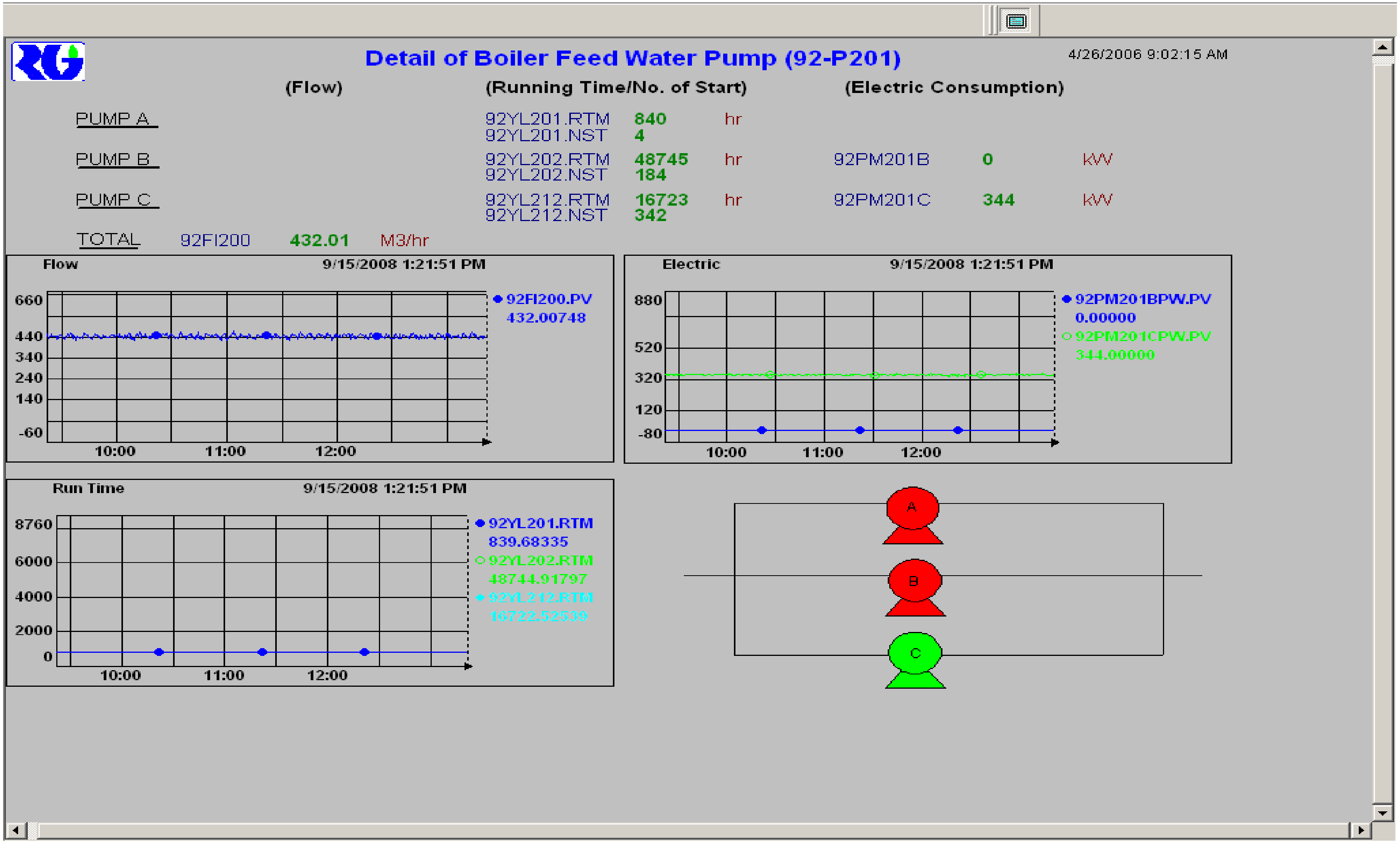
56PI0685.PV 19.11 (bar.g)
56TI0682.PV 60.82 (degC)

56XR0614.PV
0 (counts)

56XY0610A.PV 0.29 (%)
56HC0610.OUT 0 (%)

C1 MAKE UP
C2 MAKE UP
C3 MAKE UP
N2 MAKE UP
56KT001
56-K001
Performance
Vib/Brg Temp
Vib/Brg Temp
56V001
Performance
Vib/Brg Temp
56-K002
Vib/Brg Temp
56KM001
56V002

Pump Monitoring



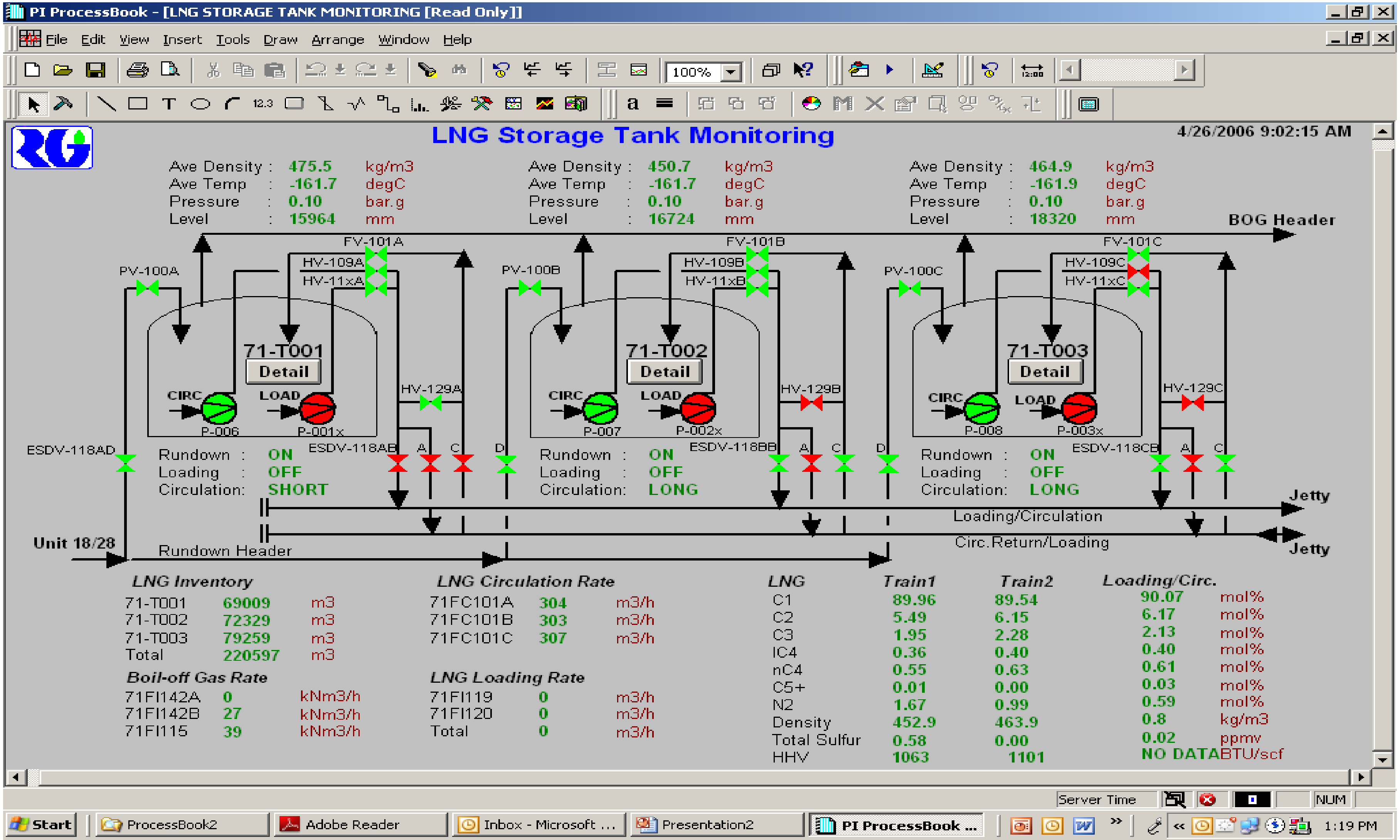
Detail of Boiler Feed Water Pump (92-P201)

4/26/2006 9:02:15 AM

	(Flow)			(Running Time/No. of Start)			(Electric Consumption)		
PUMP A				92YL201.RTM 92YL201.NST	840 4	hr			
PUMP B				92YL202.RTM 92YL202.NST	48745 184	hr	92PM201B	0	kW
PUMP C				92YL212.RTM 92YL212.NST	16723 342	hr	92PM201C	344	kW
TOTAL	92FI200	432.01	M3/hr						

Flow
9/15/2008 1:21:51 PM
660
440
340
240
140
-60
10:00
11:00
12:00
● 92FI200.PV
432.00748
Electric
9/15/2008 1:21:51 PM
880
520
320
120
-80
10:00
11:00
12:00
● 92PM201BPW.PV
0.00000
○ 92PM201CPW.PV
344.00000
Run Time
9/15/2008 1:21:51 PM
8760
6000
4000
2000
0
10:00
11:00
12:00
● 92YL201.RTM
839.68335
○ 92YL202.RTM
48744.91797
◆ 92YL212.RTM
16722.52539
A
B
C

LNG Storage Tank Monitoring


File
Edit
View
Insert
Tools
Draw
Arrange
Window
Help
100%
PV-100A
FV-101A
HV-109A
HV-11xA
71-T001
Detail
CIRC
LOAD
P-006
P-001x
HV-129A
ESDV-118AD
ESDV-118AB
A
C
D
PV-100B
FV-101B
HV-109B
HV-11xB
71-T002
Detail
CIRC
LOAD
P-007
P-002x
HV-129B
ESDV-118BB
A
C
D
PV-100C
FV-101C
HV-109C
HV-11xC
71-T003
Detail
CIRC
LOAD
P-008
P-003x
HV-129C
ESDV-118CB
A
C
BOG Header
Jetty
Loading/Circulation
Circ.Return/Loading
Jetty
Unit 18/28
Rundown Header
Server Time
NUM
Start
ProcessBook2
Adobe Reader
Inbox - Microsoft ...
Presentation2
PI ProcessBook ...
1:19 PM

PI ProcessBook - [LNG STORAGE TANK MONITORING [Read Only]]

LNG Storage Tank Monitoring

4/26/2006 9:02:15 AM

Ave Density : 475.5 kg/m3
Ave Temp : -161.7 degC
Pressure : 0.10 bar.g
Level : 15964 mm

Ave Density : 450.7 kg/m3
Ave Temp : -161.7 degC
Pressure : 0.10 bar.g
Level : 16724 mm

Ave Density : 464.9 kg/m3
Ave Temp : -161.9 degC
Pressure : 0.10 bar.g
Level : 18320 mm

Rundown : ON
Loading : OFF
Circulation: SHORT

Rundown : ON
Loading : OFF
Circulation: LONG

Rundown : ON
Loading : OFF
Circulation: LONG

LNG Inventory

71-T001	69009	m3
71-T002	72329	m3
71-T003	79259	m3
Total	220597	m3

Boil-off Gas Rate

71FI142A	0	kNm3/h
71FI142B	27	kNm3/h
71FI115	39	kNm3/h

LNG Circulation Rate

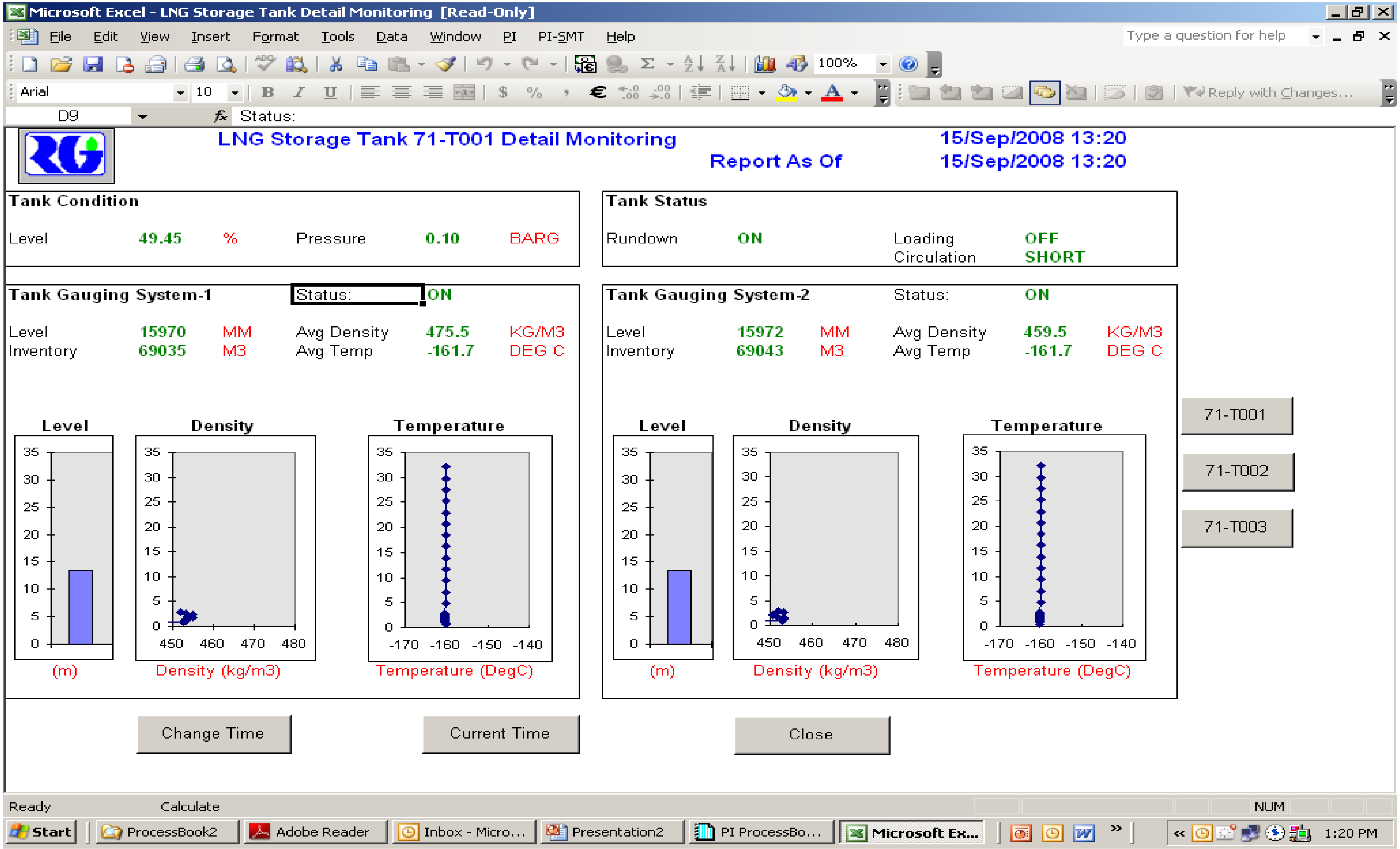
71FC101A	304	m3/h
71FC101B	303	m3/h
71FC101C	307	m3/h

LNG Loading Rate

71FI119	0	m3/h
71FI120	0	m3/h
Total	0	m3/h

LNG	*Train1*	*Train2*	*Loading/Circ.*	
C1	89.96	89.54	90.07	mol%
C2	5.49	6.15	6.17	mol%
C3	1.95	2.28	2.13	mol%
IC4	0.36	0.40	0.40	mol%
nC4	0.55	0.63	0.61	mol%
C5+	0.01	0.00	0.03	mol%
N2	1.67	0.99	0.59	mol%
Density	452.9	463.9	0.8	kg/m3
Total Sulfur	0.58	0.00	0.02	ppmv
HHV	1063	1101	NO DATA	BTU/scf

LNG Storage Tank – Detail Monitoring



Microsoft Excel - LNG Storage Tank Detail Monitoring [Read-Only]

D9 Status:

LNG Storage Tank 71-T001 Detail Monitoring 15/Sep/2008 13:20

Report As Of 15/Sep/2008 13:20

Tank Condition

Level 49.45 %

Pressure 0.10 BARG

Tank Status

Rundown ON

Loading OFF

Circulation SHORT

Tank Gauging System-1 Status: ON

Level 15970 MM

Inventory 69035 M3

Avg Density 475.5 KG/M3

Avg Temp -161.7 DEG C

Tank Gauging System-2 Status: ON

Level 15972 MM

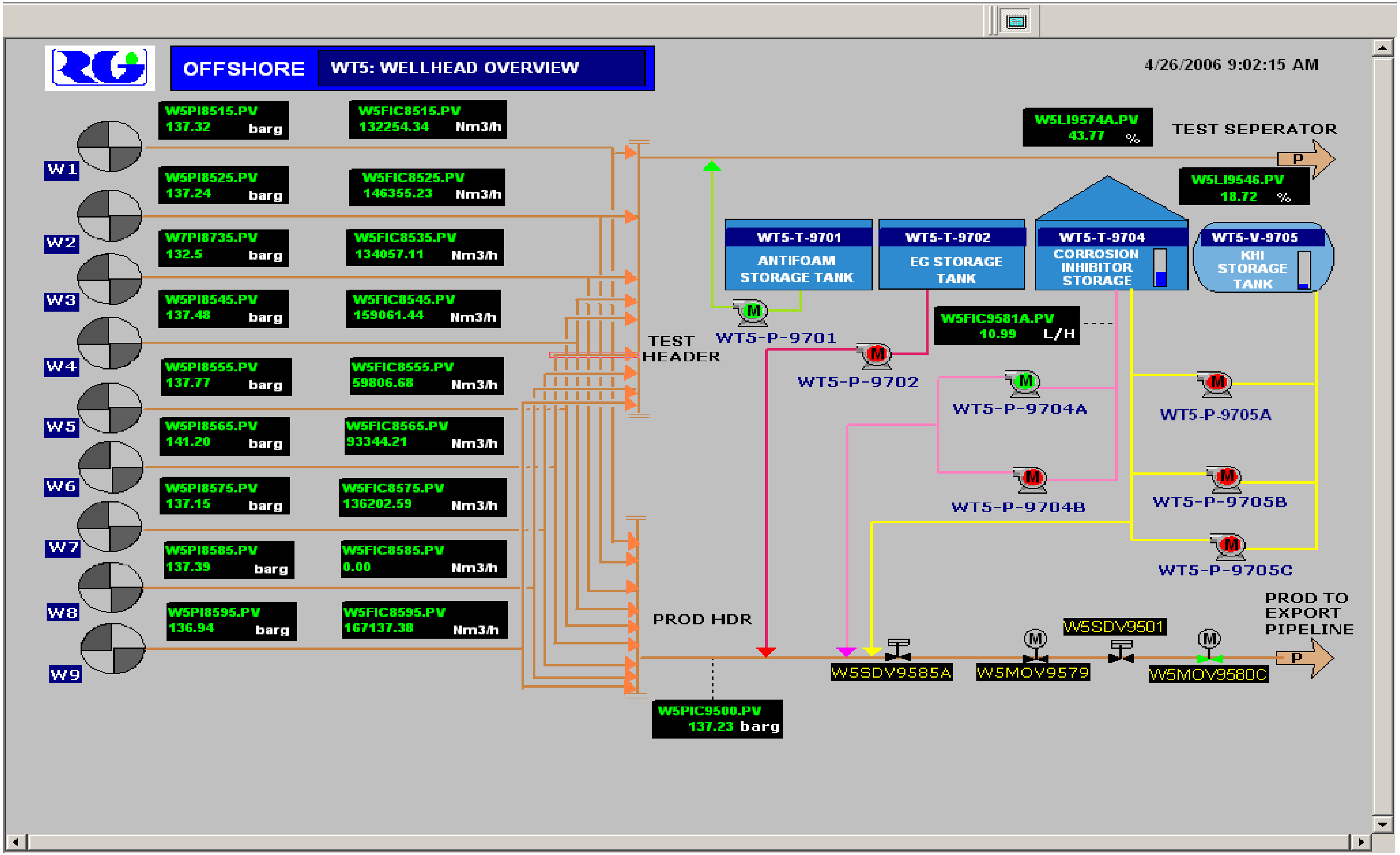
Inventory 69043 M3

Avg Density 459.5 KG/M3

Avg Temp -161.7 DEG C

File
Edit
View
Insert
Format
Tools
Data
Window
PI
PI-SMT
Help
Type a question for help
100%
Arial
10
Reply with Changes...
Level
Density
Temperature
35
30
25
20
15
10
5
0
450
460
470
480
-170
-160
-150
-140
(m)
Density (kg/m3)
Temperature (DegC)
71-T001
71-T002
71-T003
Change Time
Current Time
Close
Ready
Calculate
NUM
Start
ProcessBook2
Adobe Reader
Inbox - Micro...
Presentation2
PI ProcessBo...
Microsoft Ex...
1:20 PM

Offshore Wellhead Overview



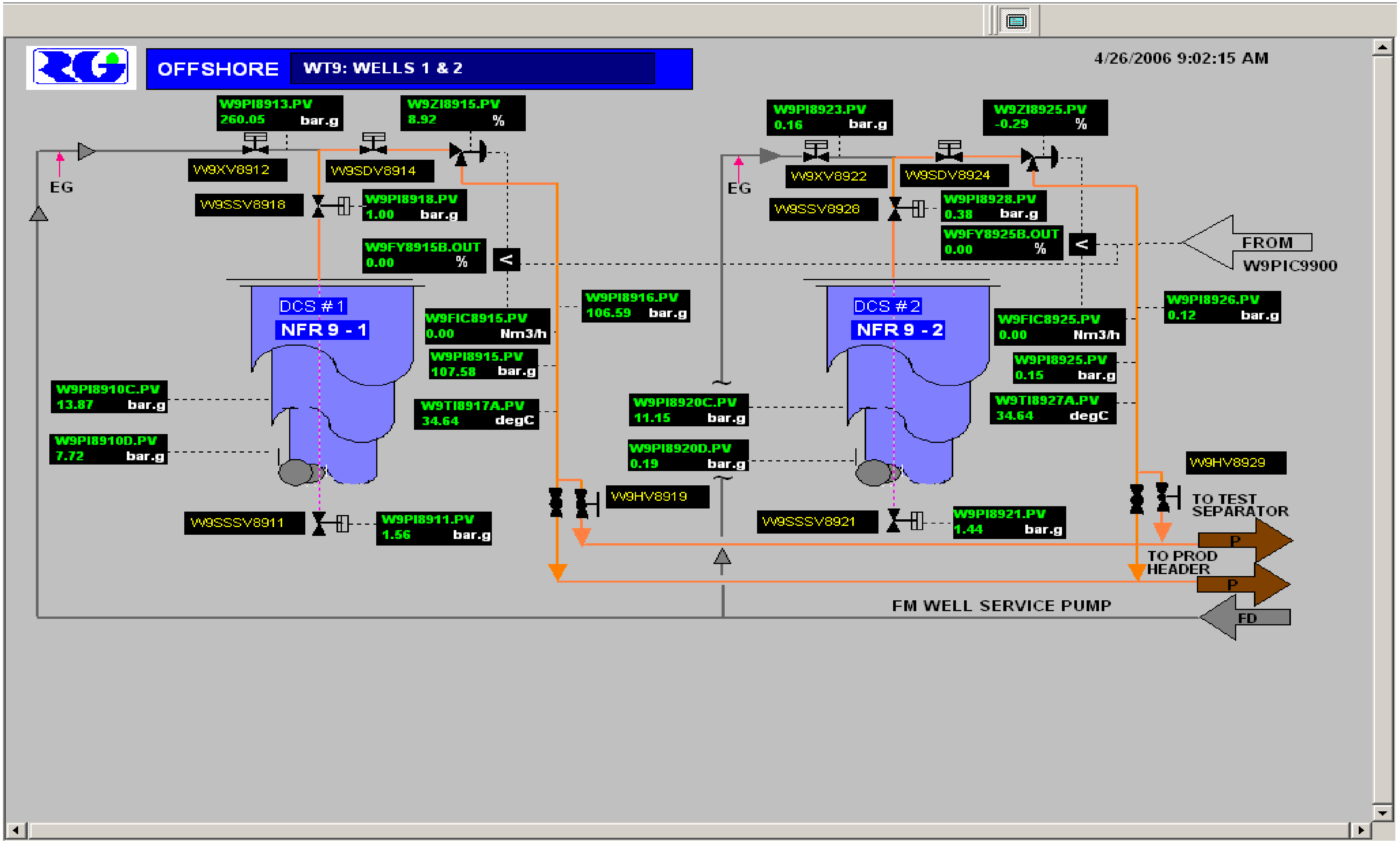
OFFSHORE WT5: WELLHEAD OVERVIEW

4/26/2006 9:02:15 AM

W5PI8515.PV 137.32 barg
W5FIC8515.PV 132254.34 Nm3/h
W5PI8525.PV 137.24 barg
W5FIC8525.PV 146355.23 Nm3/h
W7PI8735.PV 132.5 barg
W5FIC8535.PV 134057.11 Nm3/h
W5PI8545.PV 137.48 barg
W5FIC8545.PV 159061.44 Nm3/h
W5PI8555.PV 137.77 barg
W5FIC8555.PV 59806.68 Nm3/h
W5PI8565.PV 141.20 barg
W5FIC8565.PV 93344.21 Nm3/h
W5PI8575.PV 137.15 barg
W5FIC8575.PV 136202.59 Nm3/h
W5PI8585.PV 137.39 barg
W5FIC8585.PV 0.00 Nm3/h
W5PI8595.PV 136.94 barg
W5FIC8595.PV 167137.38 Nm3/h
W5LI9574A.PV 43.77 %
W5LI9546.PV 18.72 %
W5FIC9581A.PV 10.99 L/H
W5PIC9500.PV 137.23 barg

W1
W2
W3
W4
W5
W6
W7
W8
W9
TEST SEPERATOR
P
TEST HEADER
WT5-T-9701 ANTIFOAM STORAGE TANK
WT5-T-9702 EG STORAGE TANK
WT5-T-9704 CORROSION INHIBITOR STORAGE
WT5-V-9705 KHI STORAGE TANK
M
WT5-P-9701
WT5-P-9702
WT5-P-9704A
WT5-P-9704B
WT5-P-9705A
WT5-P-9705B
WT5-P-9705C
PROD HDR
W5SDV9585A
W5MOV9579
W5SDV9501
W5MOV9580C
PROD TO EXPORT PIPELINE
P

Offshore Wells Overview



OFFSHORE WT9: WELLS 1 & 2

4/26/2006 9:02:15 AM

W9PI8913.PV 260.05 bar.g

W9ZI8915.PV 8.92 %

W9PI8923.PV 0.16 bar.g

W9ZI8925.PV -0.29 %

W9PI8918.PV 1.00 bar.g

W9PI8928.PV 0.38 bar.g

W9FY8915B.OUT 0.00 %

W9FY8925B.OUT 0.00 %

W9PI8916.PV 106.59 bar.g

W9PI8926.PV 0.12 bar.g

W9FIC8915.PV 0.00 Nm3/h

W9FIC8925.PV 0.00 Nm3/h

W9PI8915.PV 107.58 bar.g

W9PI8925.PV 0.15 bar.g

W9PI8910C.PV 13.87 bar.g

W9TI8917A.PV 34.64 degC

W9PI8920C.PV 11.15 bar.g

W9TI8927A.PV 34.64 degC

W9PI8910D.PV 7.72 bar.g

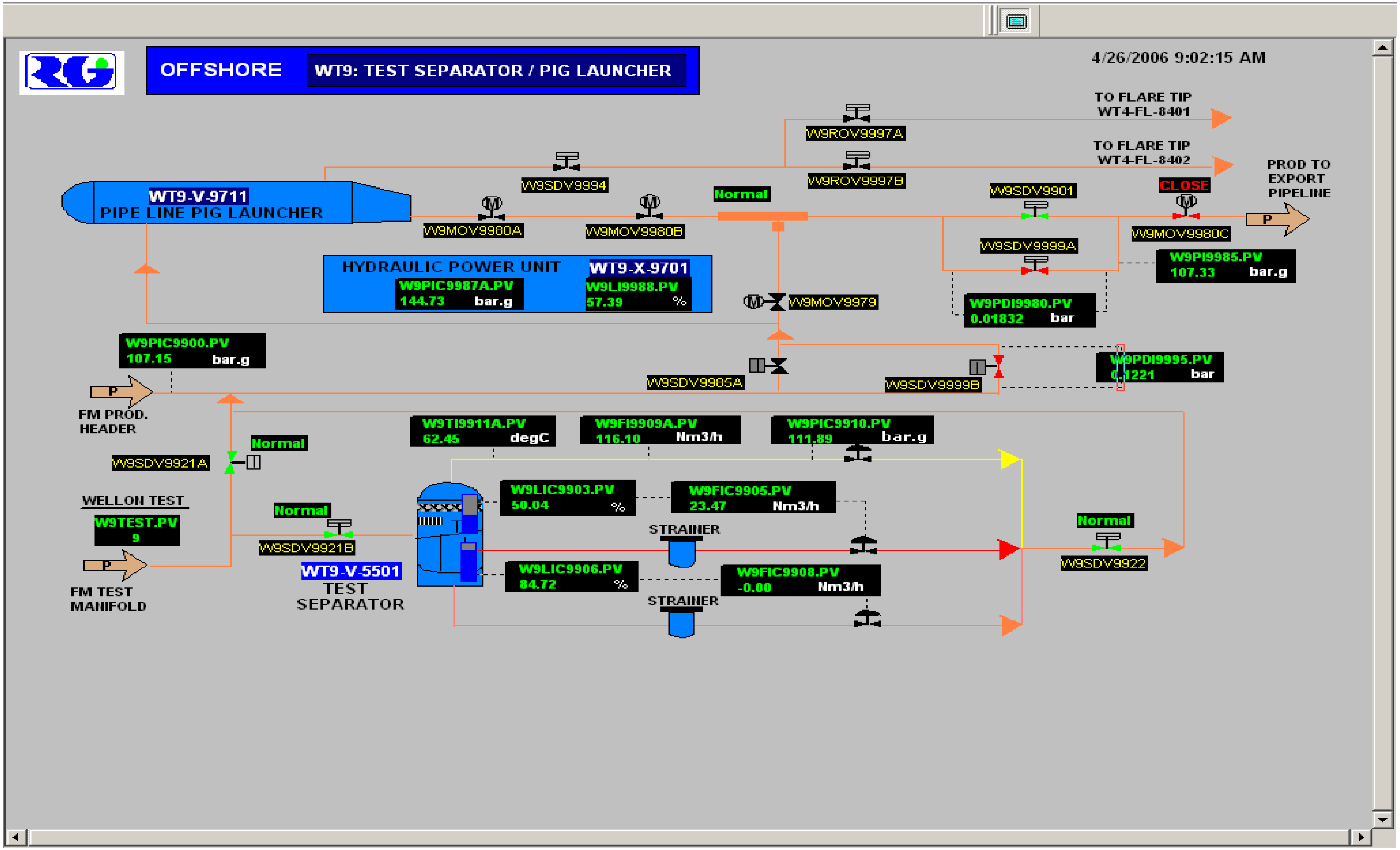
W9PI8920D.PV 0.19 bar.g

W9PI8911.PV 1.56 bar.g

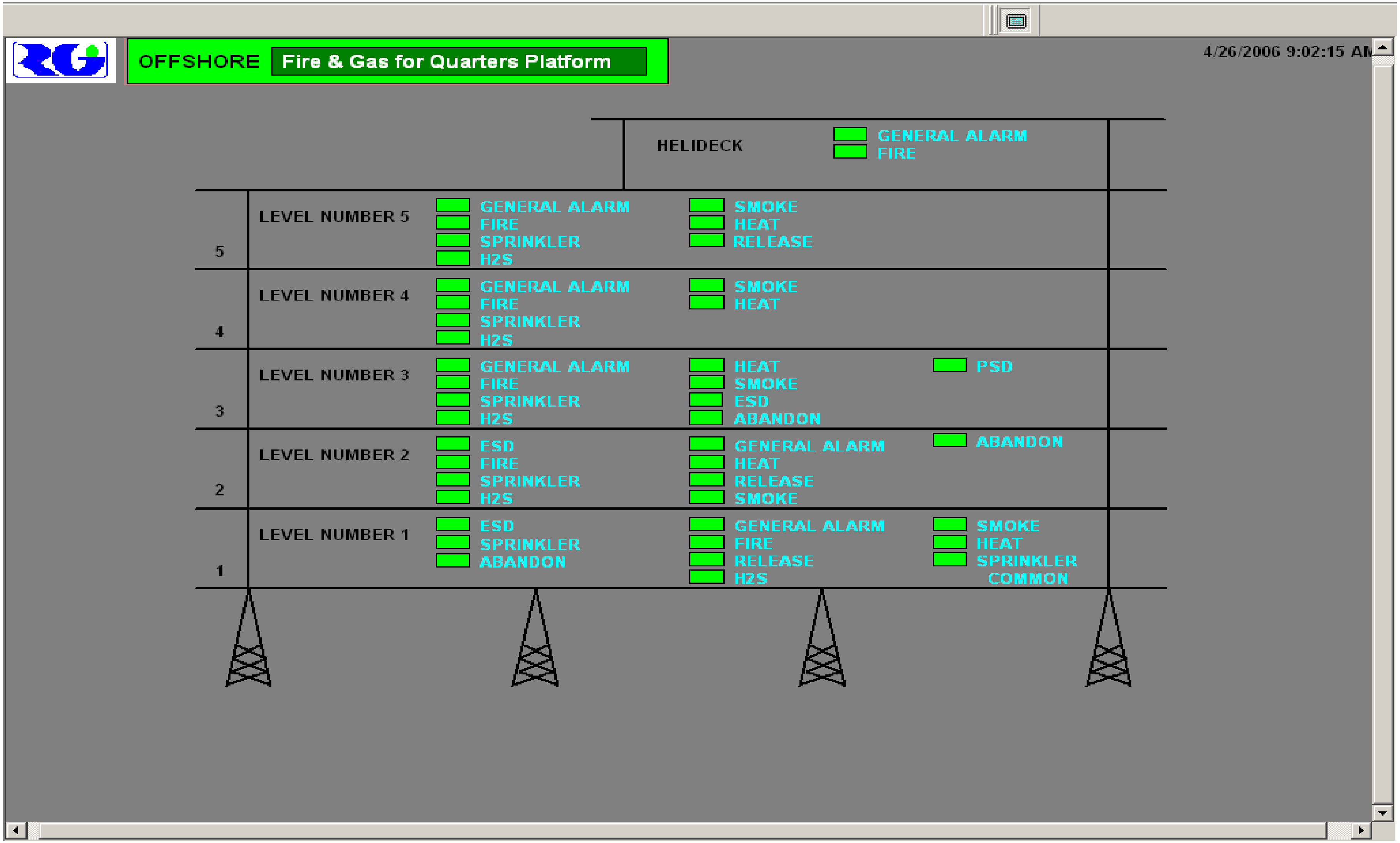
W9PI8921.PV 1.44 bar.g

W9XV8912
W9SDV8914
W9XV8922
W9SDV8924
EG
EG
W9SSV8918
W9SSV8928
<
<
FROM
W9PIC9900
DCS # 1
NFR 9 - 1
DCS # 2
NFR 9 - 2
W9HV8929
W9HV8919
TO TEST SEPARATOR
W9SSSV8911
W9SSSV8921
P
TO PROD HEADER
P
FM WELL SERVICE PUMP
FD

Offshore Test Separator / Pig Launcher


OFFSHORE
WT9: TEST SEPARATOR / PIG LAUNCHER
4/26/2006 9:02:15 AM
TO FLARE TIP
WT4-FL-8401
TO FLARE TIP
WT4-FL-8402
PROD TO
EXPORT
PIPELINE
W9ROV9997A
W9ROV9997B
W9SDV9994
Normal
W9SDV9901
CLOSE
WT9-V-9711
PIPE LINE PIG LAUNCHER
W9MOV9980A
W9MOV9980B
W9MOV9980C
W9SDV9999A
HYDRAULIC POWER UNIT
WT9-X-9701
W9PIC9987A.PV
144.73 bar.g
W9LI9988.PV
57.39 %
W9PI9985.PV
107.33 bar.g
W9MOV9979
W9PDI9980.PV
0.01832 bar
W9PIC9900.PV
107.15 bar.g
W9PDI9995.PV
0.1221 bar
W9SDV9985A
W9SDV9999B
P
FM PROD.
HEADER
W9TI9911A.PV
62.45 degC
W9FI9909A.PV
116.10 Nm3/h
W9PIC9910.PV
111.89 bar.g
Normal
W9SDV9921A
WELLON TEST
W9TEST.PV
9
Normal
W9SDV9921B
W9LIC9903.PV
50.04 %
W9FIC9905.PV
23.47 Nm3/h
STRAINER
Normal
W9SDV9922
P
WT9-V-5501
TEST
SEPARATOR
FM TEST
MANIFOLD
W9LIC9906.PV
84.72 %
W9FIC9908.PV
-0.00 Nm3/h
STRAINER

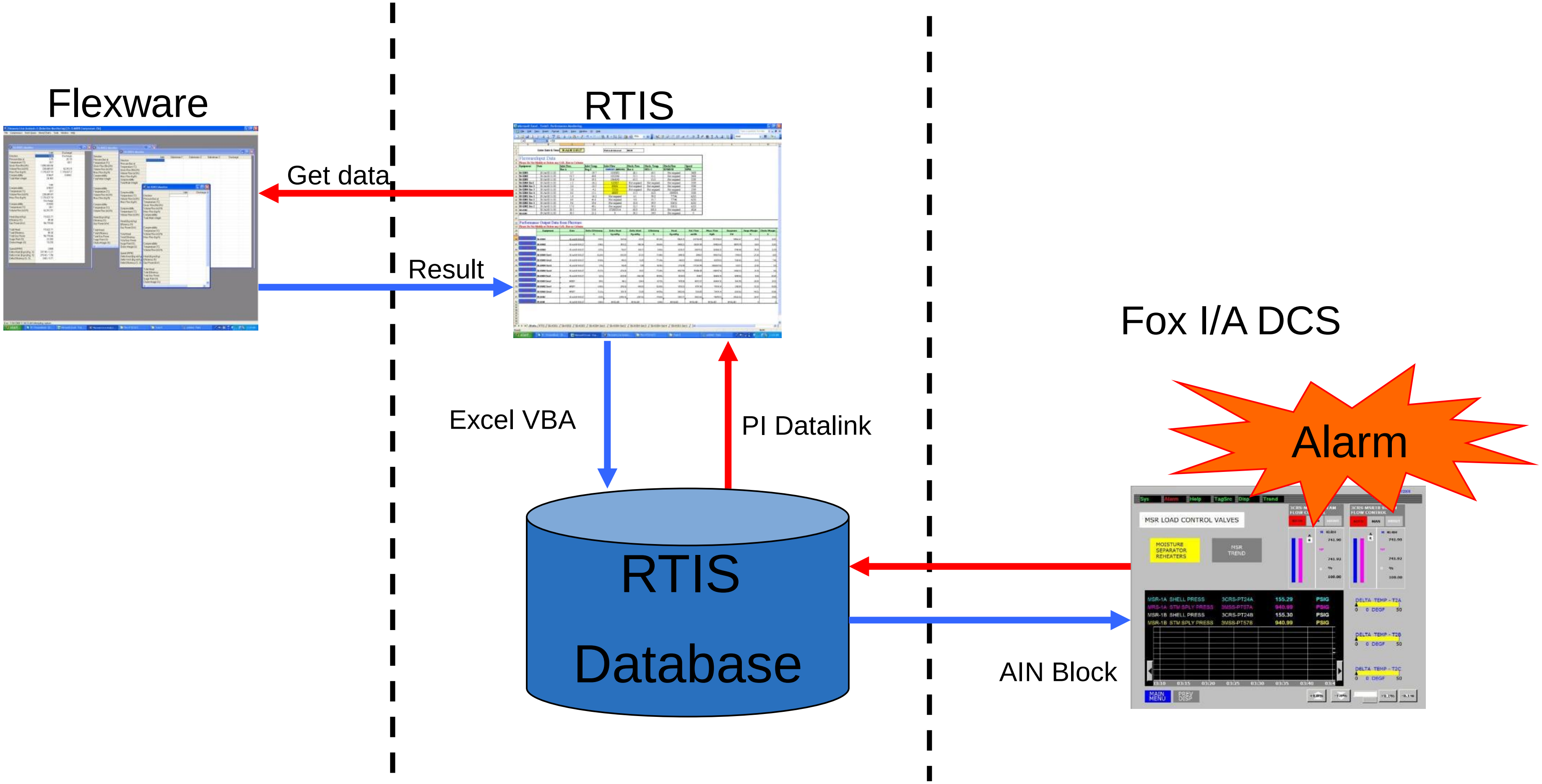
Offshore Fire & Gas Alarms


OFFSHORE
Fire & Gas for Quarters Platform
4/26/2006 9:02:15 AM
HELIDECK
GENERAL ALARM
FIRE
LEVEL NUMBER 5
5
GENERAL ALARM
FIRE
SPRINKLER
H2S
SMOKE
HEAT
RELEASE
LEVEL NUMBER 4
4
GENERAL ALARM
FIRE
SPRINKLER
H2S
SMOKE
HEAT
LEVEL NUMBER 3
3
GENERAL ALARM
FIRE
SPRINKLER
H2S
HEAT
SMOKE
ESD
ABANDON
PSD
LEVEL NUMBER 2
2
ESD
FIRE
SPRINKLER
H2S
GENERAL ALARM
HEAT
RELEASE
SMOKE
ABANDON
LEVEL NUMBER 1
1
ESD
SPRINKLER
ABANDON
GENERAL ALARM
FIRE
RELEASE
H2S
SMOKE
HEAT
SPRINKLER
COMMON

Flexware – RTIS – DCS Integration

- Compressors are required to be monitored and operated away from stonewall region
- Flexware is used to monitor compressor operation and report the performance
- Flexware calculation was automated with real time data
- RTIS provides: Stonewall alarm at DCS to alert panel operator whenever stonewall value deviate from limit, historical data and real time trends to monitor the compressors

Flexware – RTIS – DCS Integration



Flexware

RTIS

Get data

Result

Excel VBA

PI Datalink

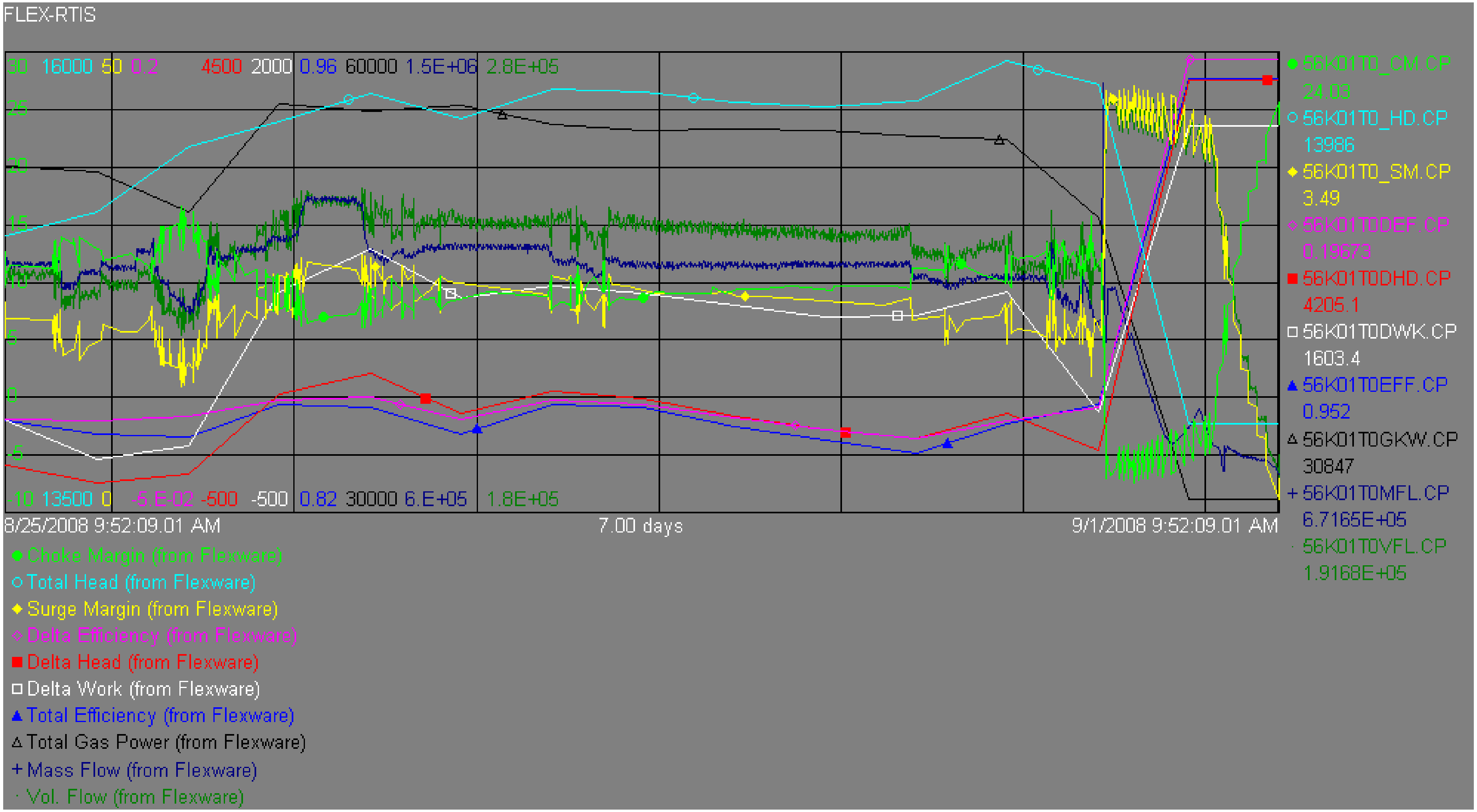
RTIS Database

Fox I/A DCS

Alarm

AIN Block

Flexware: Online Monitoring


FLEX-RTIS
30 16000 50 0.2 4500 2000 0.96 60000 1.5E+06 2.8E+05
25
20
15
10
5
0
-5
-10 13500 0 -5.E-02 -500 -500 0.82 30000 6.E+05 1.8E+05
8/25/2008 9:52:09.01 AM
7.00 days
9/1/2008 9:52:09.01 AM
● 56K01T0_CM.CP
24.03
○ 56K01T0_HD.CP
13986
◆ 56K01T0_SM.CP
3.49
◇ 56K01T0DEF.CP
0.19673
■ 56K01T0DHD.CP
4205.1
□ 56K01T0DWK.CP
1603.4
▲ 56K01T0EFF.CP
0.952
△ 56K01T0GKW.CP
30847
+ 56K01T0MFL.CP
6.7165E+05
· 56K01T0VFL.CP
1.9168E+05
● Choke Margin (from Flexware)
○ Total Head (from Flexware)
◆ Surge Margin (from Flexware)
◇ Delta Efficiency (from Flexware)
■ Delta Head (from Flexware)
□ Delta Work (from Flexware)
▲ Total Efficiency (from Flexware)
△ Total Gas Power (from Flexware)
+ Mass Flow (from Flexware)
· Vol. Flow (from Flexware)