

Outage Best Practices & Lessons Learned

**SRP-NGS Page, AZ
2003 / 2004 & 2005 Precipitator Rebuilds**

DELIVERING
Genuine Know-how

Navajo Generating Station



Project Overview

- *Customer – Salt River Project (SRP)*
- *Location – Page, AZ*
- *Site – Navajo Generating Station (NGS)*
- *3 – 750 MW with 96 Field Joy Western Precipitator*
- *Scope – 3 year Precipitator Rebuild Program, Boiler Outage and BOP*
- *Contract Type – Alliance Contract - Target Price w/fee @ risk*

Precipitator Details

16 Chambers

– 8 on 8

32 Hoppers

– 2 per Chamber

96 Fields

– 3 per Hopper

2,592 Collector Plates

– 27 per Field

9,984 RDE's

– 104 per Field



PERFORMANCE STATISTICS

2003 UNIT #3

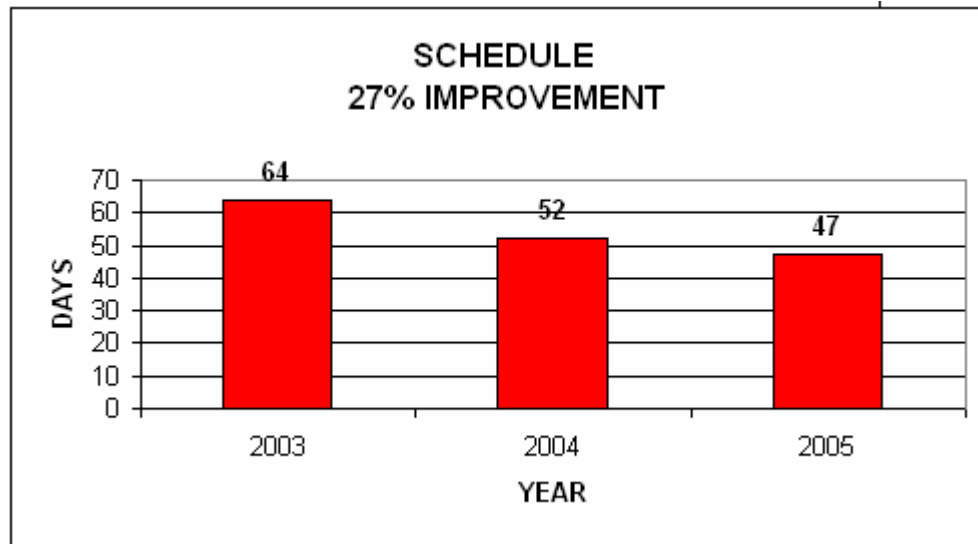
2004 UNIT #2

2005 UNIT #1

Statistics (2003 – 2005)

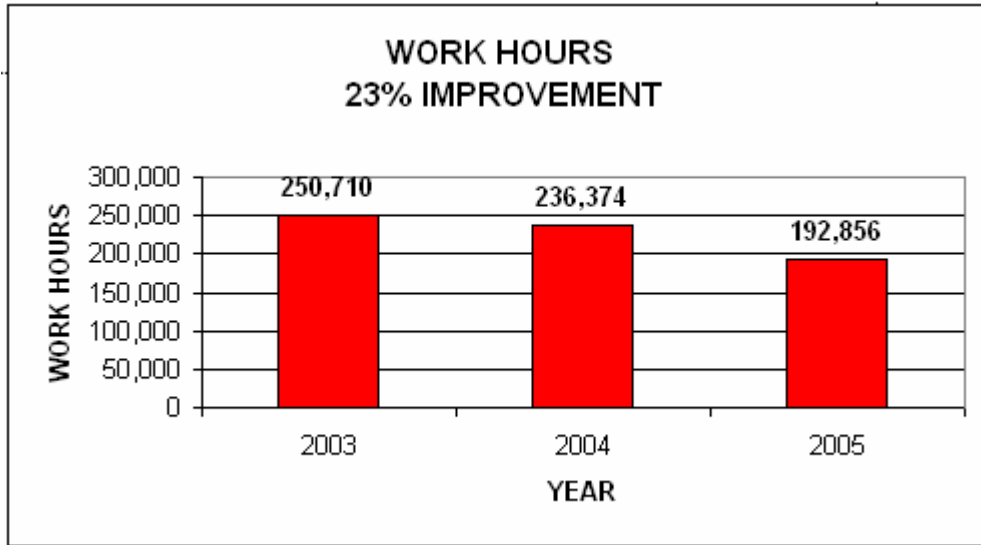


SAFETY
41% IMPROVEMENT

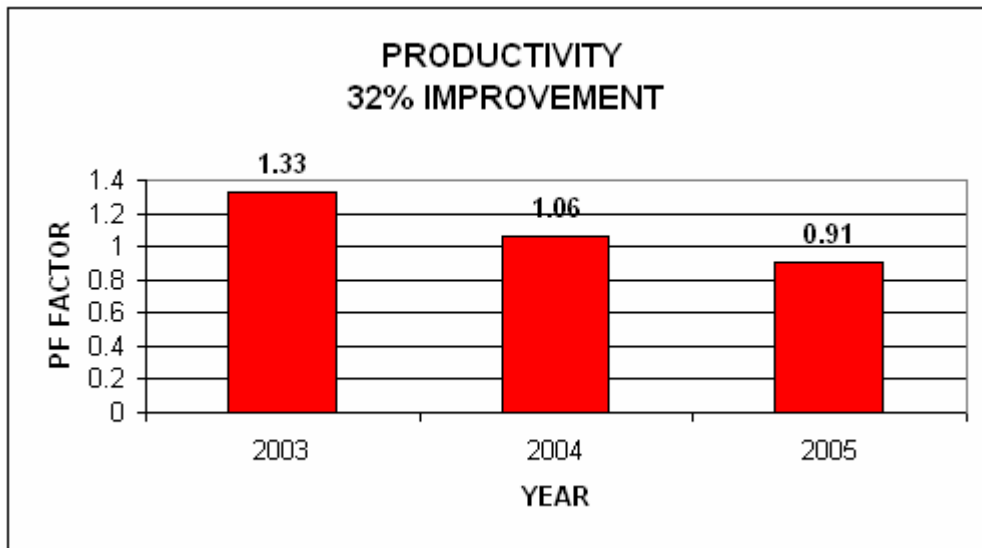


SCHEDULE
27% IMPROVEMENT

Statistics (2003 – 2005) cont.

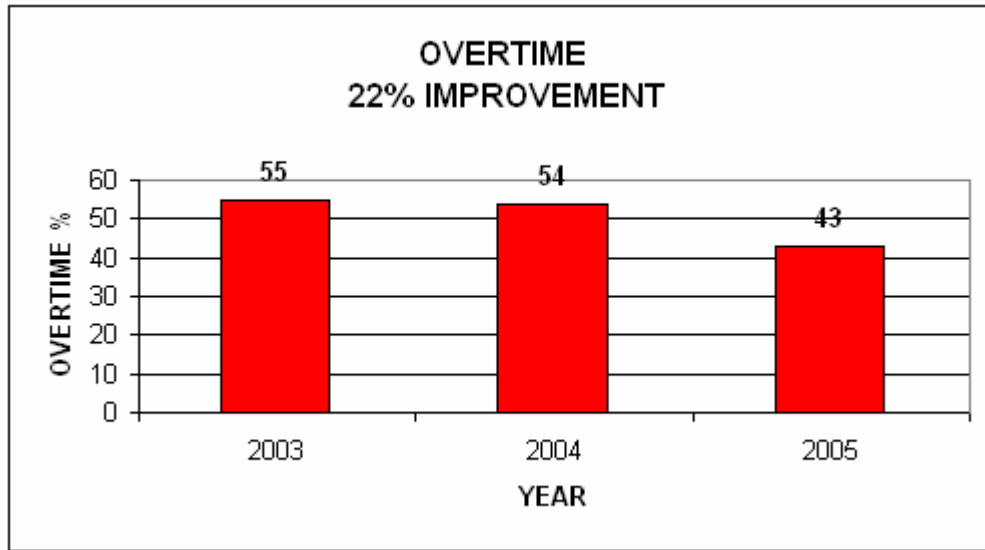


WORK HOURS
23% IMPROVEMENT

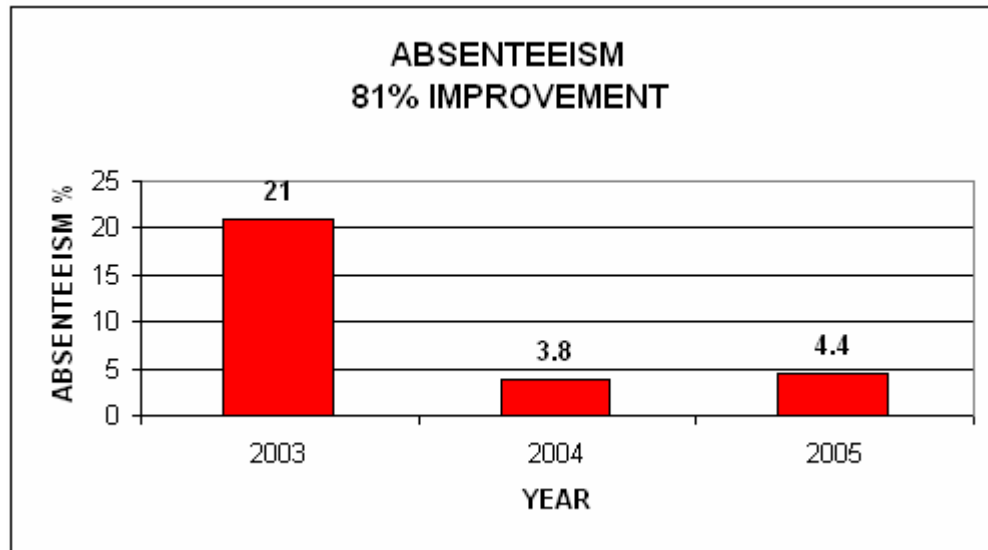


PRODUCTIVITY
32% IMPROVEMENT

Statistics (2003 – 2005) cont.

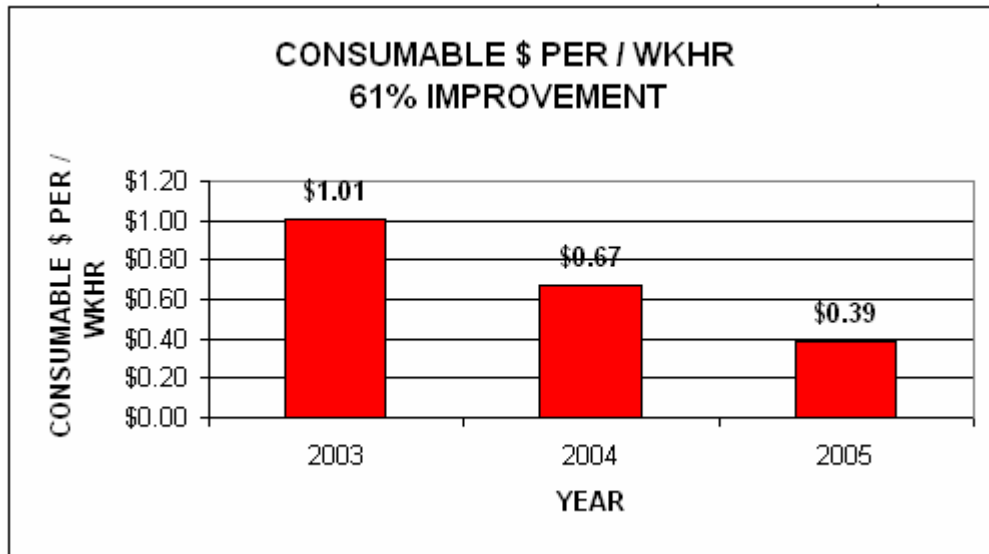


OVERTIME
22% IMPROVEMENT

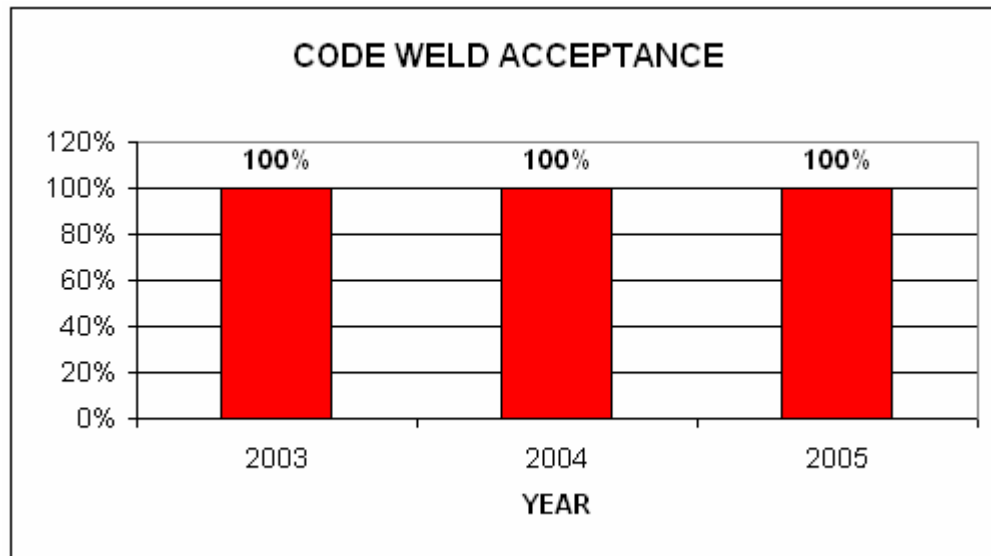


ABSENTEEISM
81% IMPROVEMENT

Statistics (2003 – 2005) cont.

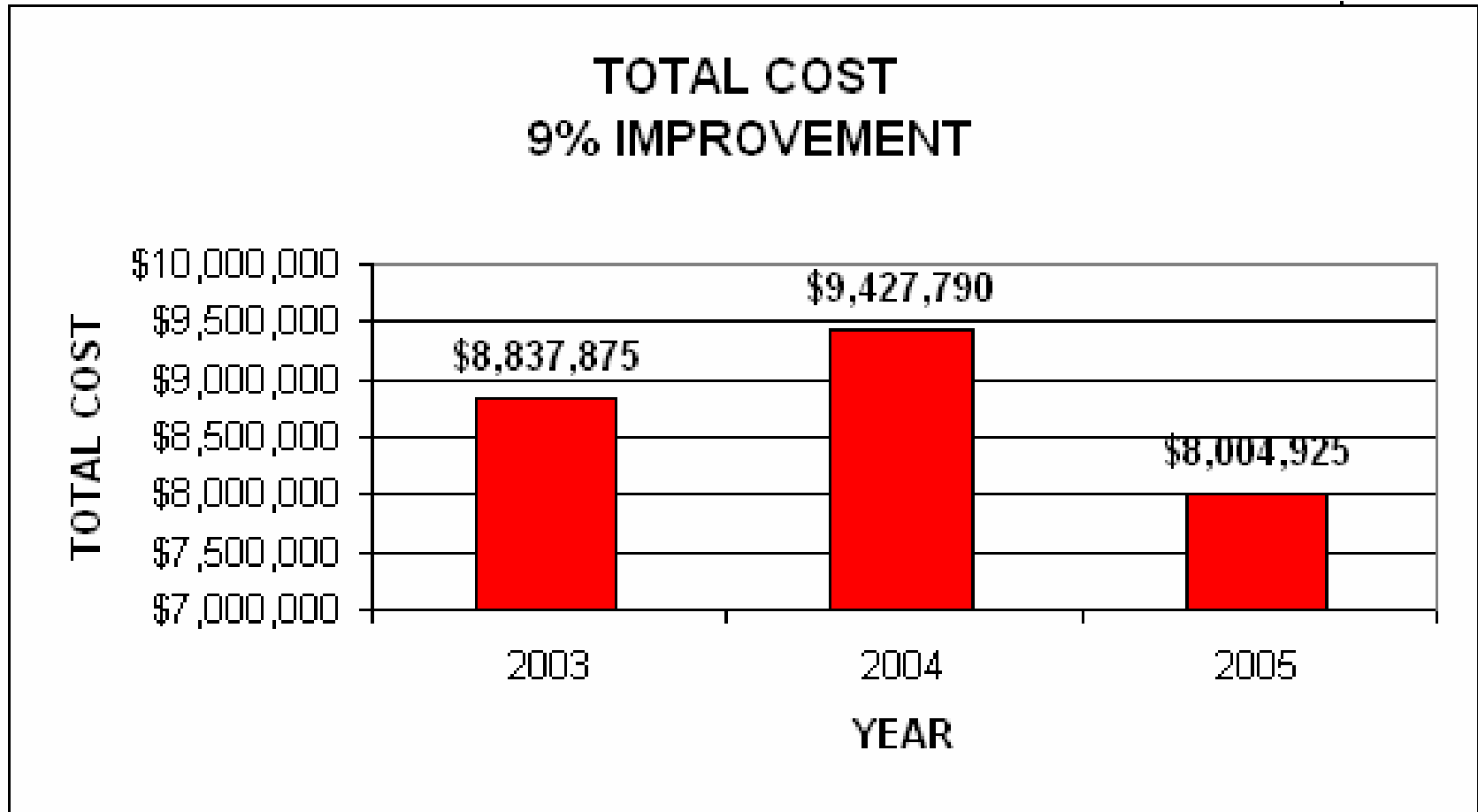


**CONSUMABLES
61% IMPROVEMENT**



**CODE WELD
ACCEPTANCE**

Statistics (2003 – 2005) cont.



HOW DID WE ACCOMPLISH THESE IMPROVEMENTS ?



Outage Excellence

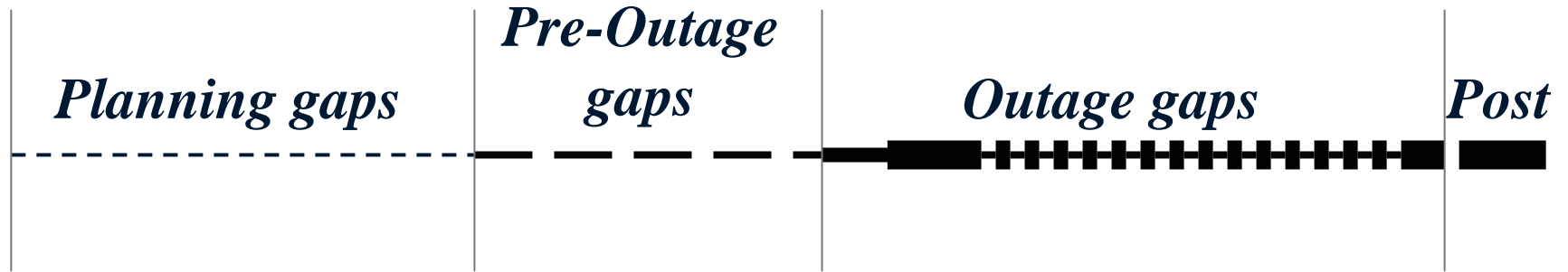
- *Enhanced work processes through capture of lessons learned to ensure continuous improvement in Safety, Schedule, Cost and Quality*
- *Consistent project controls and work process management tools to accomplish repeated success in outage performance*
- *Predictability ... Forecasting*
- *Integrated with SRP to better manage the outages as a team*
- *Meet business objectives*

Focus Areas

- ✓ *Relationships*
- ✓ *Communication / Teamwork*
- ✓ *All the Right parties involved:*
 - ✓ *Engineering, Operations, Inspections, Safety, Field Supervision, Procurement, Materials Management, Project Controls*
- ✓ *Buy-in – “The Teams Plan – The Teams Schedule”*
- ✓ *Project Controls*
- ✓ *Supervisor / Craft Training*
- ✓ *Execution – “Plan the Work – Work the Plan”*

Relationships and Communication

2003 Outage

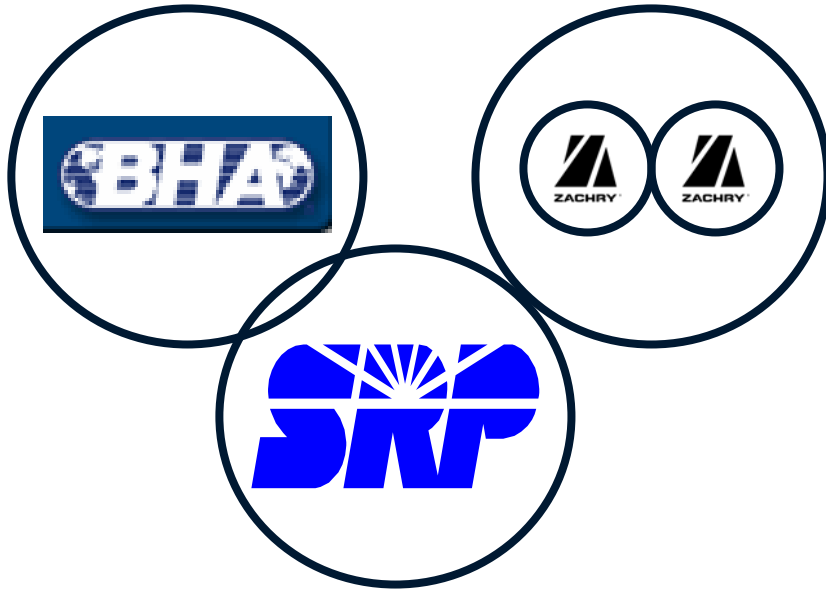


2004 & 2005 Outages

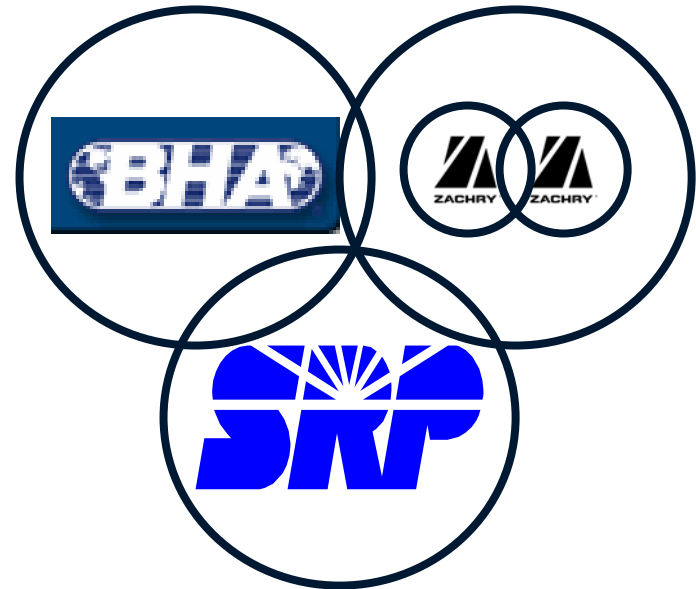


Communication / Teamwork

2003 Outage



2004 & 2005 Outages



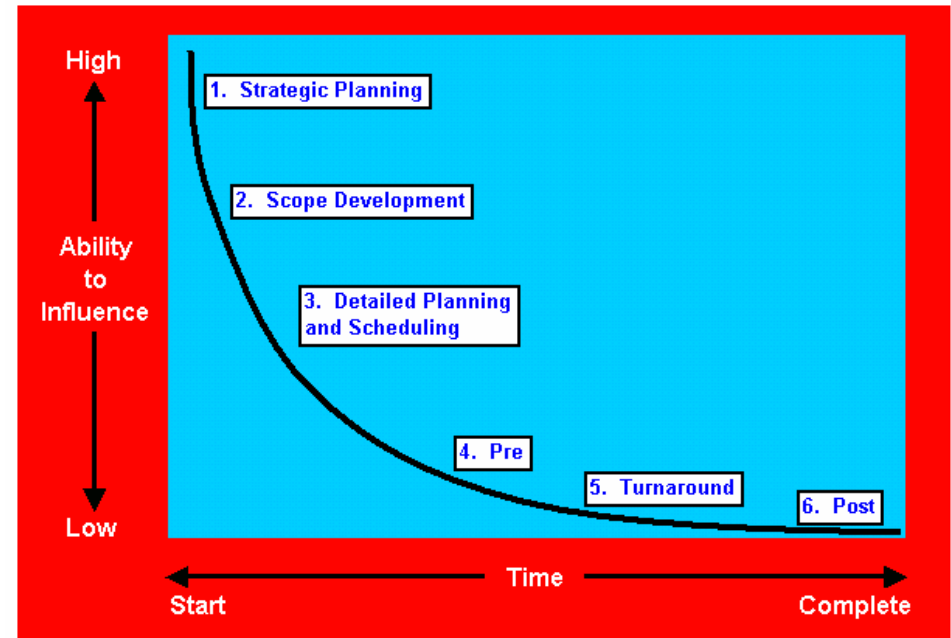
Safety

- ✓ *Planning for Safety*
- ✓ *Supervision Trained in all Safety Areas*
- ✓ *Employee Expectations*
- ✓ *Daily & Monthly Safety Meetings*
- ✓ *Safety Team involvement in all areas*



Project Controls Approach

- To effectively plan, estimate, schedule, monitor and control all phases of the Outages (Planning, Execution and Post)



“ What Gets Measured ... Gets Managed ”

Project Controls (Tools for Success)

✓ ***Schedule***

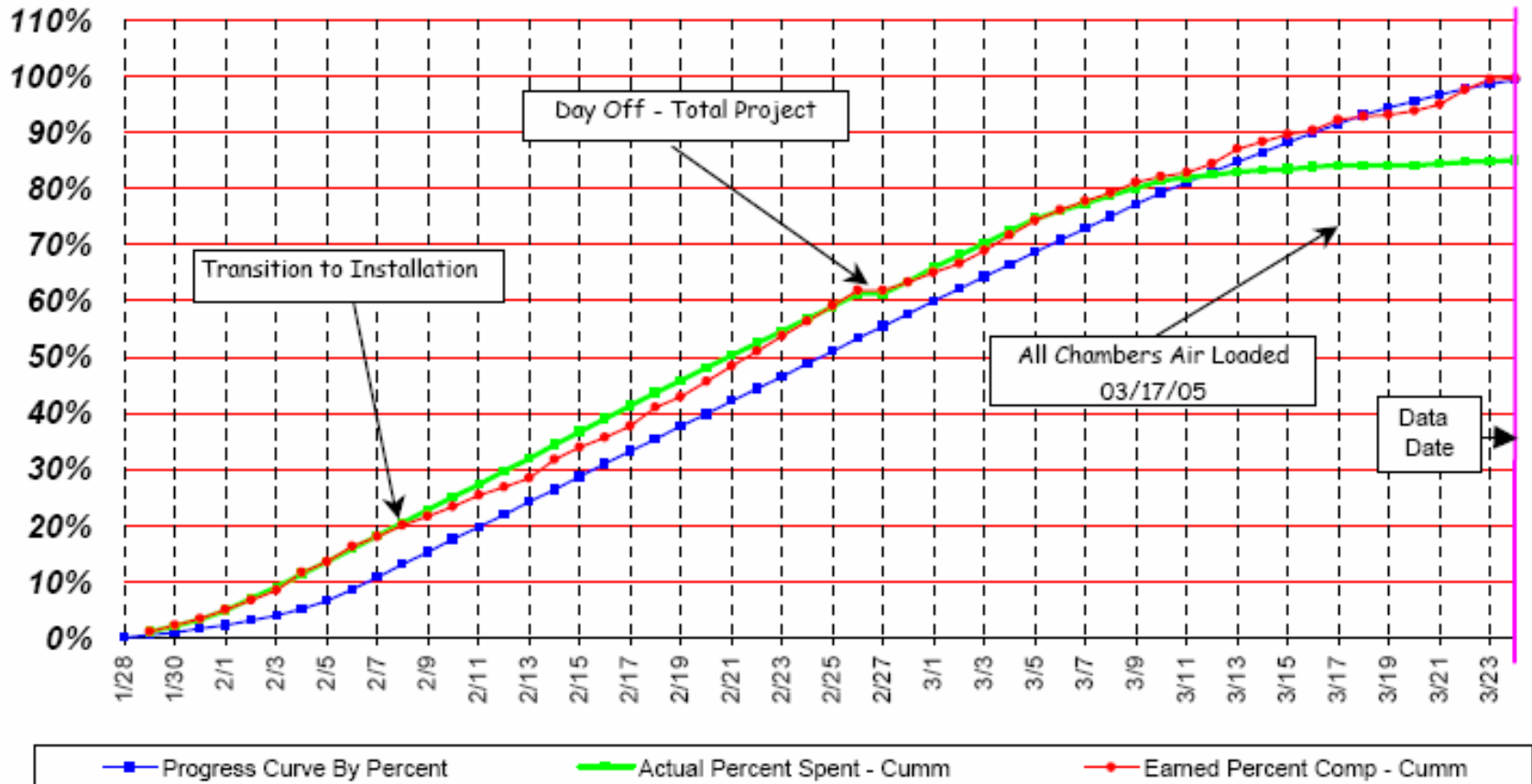
- ✓ Critical Path Analysis
- ✓ Updating & Reporting
- ✓ Timesheet Accuracy
- ✓ Progress Curves
- ✓ Productivity Curves
- ✓ Earned Work Hours
- ✓ Supervisor Schedules

✓ ***Cost Report***

- ✓ Format
- ✓ Input Items
- ✓ Issue Cycle
- ✓ Weekly
Reconciliation
- ✓ # Work Orders

Project Controls (Progress Curve)

Unit 1 Precipitator
Outage Only
Progress Curve By Percent



Project Controls (Tools for Success)

✓ ***Cost Projections***

- ✓ Daily Cost Tracking
- ✓ Budget Compliance
- ✓ Analyzing Variances
- ✓ Cost to Complete
- ✓ Cost at Completion

✓ ***Earned Value***

✓ ***Resource Management***

- ✓ Staffing Plan
Development
- ✓ Resource Histograms
 - ✓ Original plan, Current Plan
 - ✓ Actual and Forecasted
 - ✓ Plan the Work ... Work the Plan !
- ✓ Overtime / Absenteeism

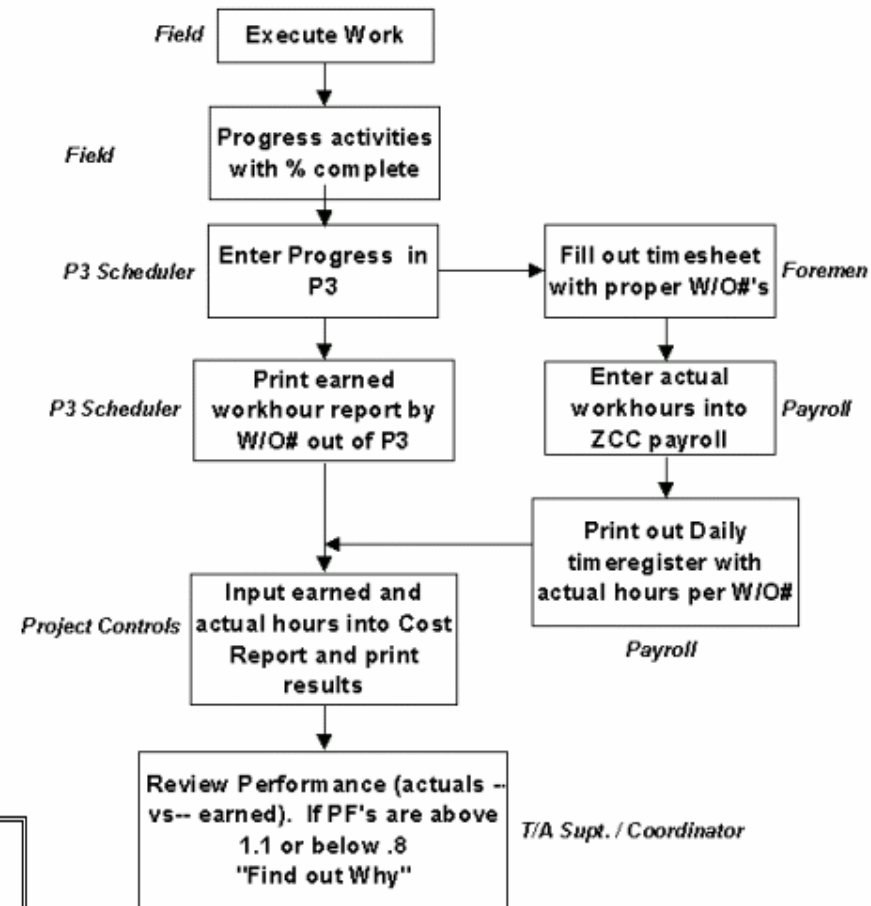
Project Controls (Earned Value)

- ✓ *Earned value information is an input to our scheduling and cost control processes, establishing auditable progress levels in the schedule and cost codes.*

Project Controls (Earned Value Process)

Based on activity progress (i.e., percent completes) and actual expenditures (hours on timesheets) provided by the field, our earned value process allows this information to then be used to forecast schedule and cost at completion. Our Operations teams manage our Outage by these forecasts.

Earned Value flow process

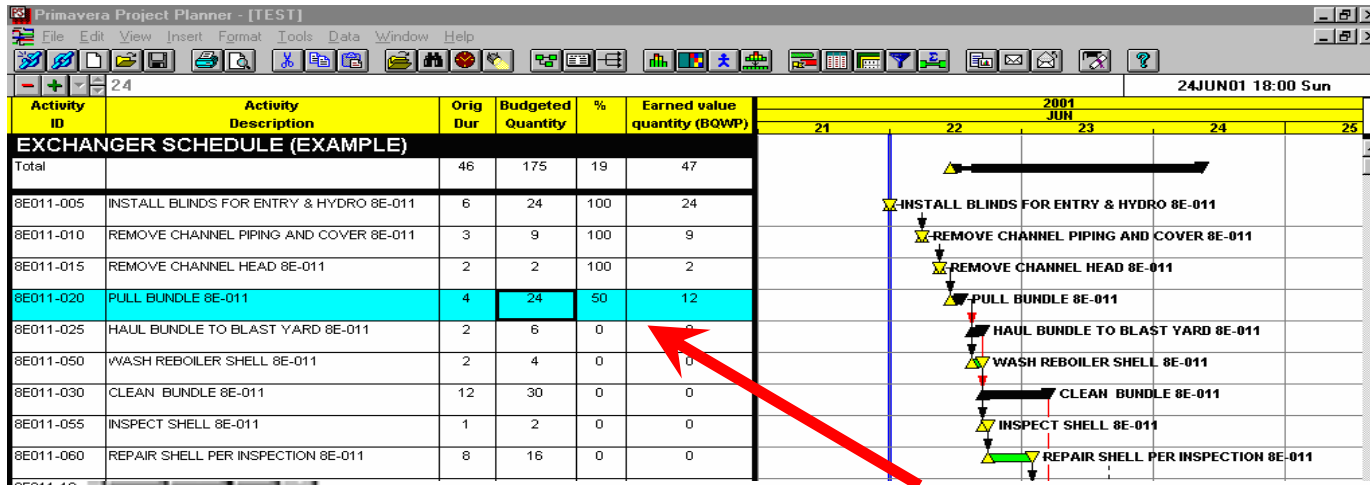


DESCRIPTION	WORK HOUR BUDGET		ACTUAL HOURS	EARNED HOURS	% COMP	PF
	ORIGINAL	CURRENT				
EXCHANGER WORK	5000	6000	428	500	8%	0.86

Project Controls (Earned Value Details)

- ✓ *Measures actual versus planned (earned)*
 - **Earned Hours = 47 (see example)**
 - **Actual Timesheet Hours = 39**
 - **Productivity Factor (PF) = .82 (this is good)**
 - **ZCC standard = below 1.0 is good**
- ✓ *Provides early signal of problem areas*
- ✓ *Provides a tool for trending performance*
- ✓ *Promotes Ownership at Craft / Discipline Level*

Project Controls (Earned Value Details)



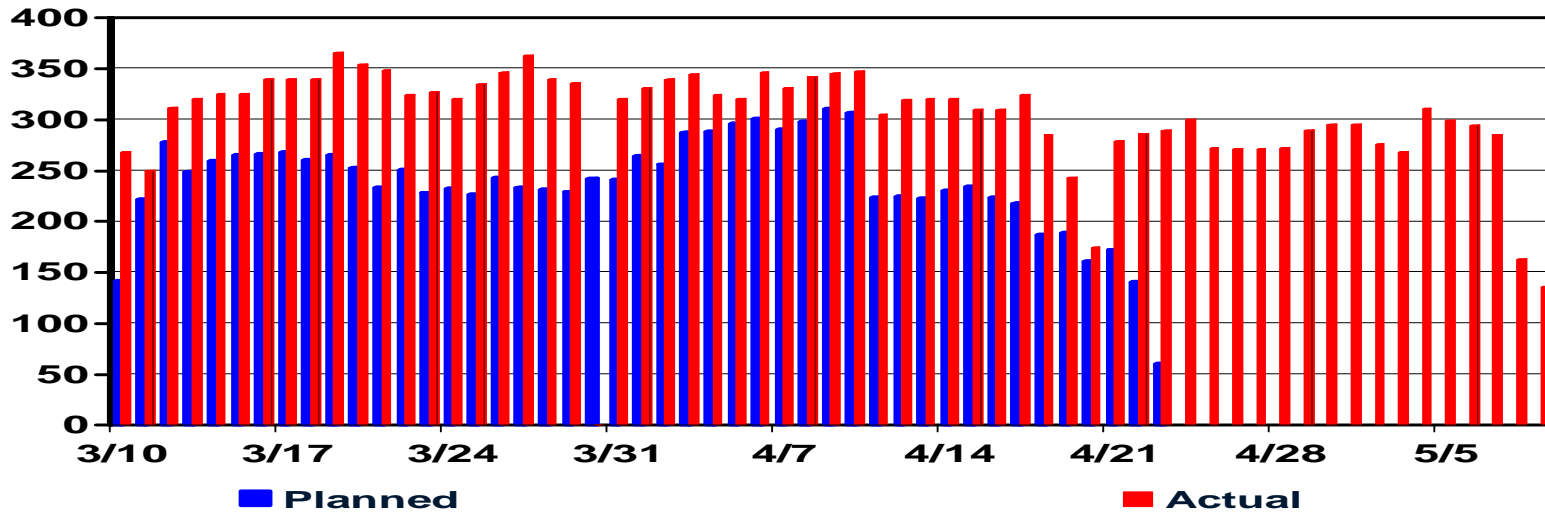
Progress from Field

Activity ID	Activity Description	Orig Dur	Budgeted Quantity	%	Earned value quantity (BQWP)
EXCHANGER SCHEDULE (EXAMPLE)					
Total		46	175	19	47
8E011-005	INSTALL BLINDS FOR ENTRY & HYDRO 8E-011	6	24	100	24
8E011-010	REMOVE CHANNEL PIPING AND COVER 8E-011	3	9	100	9
8E011-015	REMOVE CHANNEL HEAD 8E-011	2	2	100	2
8E011-020	PULL BUNDLE 8E-011	4	24	50	12

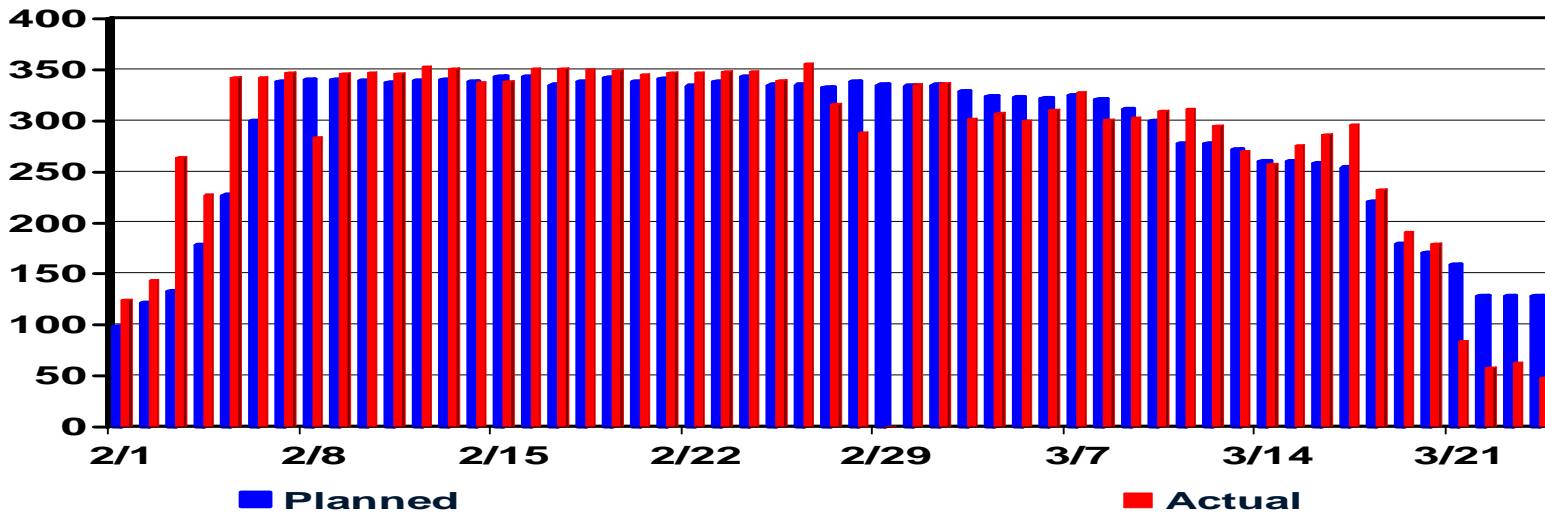
Project Controls (Milestone Schedule)

Start Date		29JUL02 06:00	Early Bar			PROJECT: O303		Date			Revision			Checked			Approved		
Finish Date		13MAY03 15:59	Progress Bar			UNIT 03, 2003 MAJOR OVERHAUL													
Data Date		03DEC02 06:00	Critical Activity			MILE STONE && HAMMOCKS LAYOUT jc CHK FF													
Run Date		02FEB03 13:48				ALL MILESTONES FOR SIGN OFF													
						Sheet 1 of 2													
Activity ID	Activity Description	Act Type	Orig Dur	Rem Dur	%	Early Start	Early Finish	Gantt Chart (MAR, APR, MAY)											
V9ZCC100	Start Pre-Outage	Start milestone	0	0	0	11FEB03 07:00*													
V9ZCC2999	Finish Pre-Outage	Finish milestone	0	0	0		19FEB03 16:59												
V7CM011111	CM0 Start Zachry Work	Start milestone	0	0	0	10MAR03 06:00													
V9ZCC10000	Outage begins	Start milestone	0	0	0	10MAR03 07:00*													
V7CM33333	CM3 Complete Demo Upper Weights & Wires (1-8)	Finish milestone	0	0	0		13MAR03 11:59												
V7CM22222	CM2 Complete Demo Lower Weight & Wires (9-16)	Finish milestone	0	0	0		14MAR03 19:59												
V7C011245	C01 Remaining Demo Complete	Finish milestone	0	0	0		16MAR03 19:59												
V7C021245	C02 Remaining Demo Complete	Finish milestone	0	0	0		16MAR03 23:59												
V7C031245	C03 Remaining Demo Complete	Finish milestone	0	0	0		17MAR03 03:59												
V7C041245	C04 Remaining Demo Complete	Finish milestone	0	0	0		17MAR03 07:59												
V7C051245	C05 Remaining Demo Complete	Finish milestone	0	0	0		17MAR03 11:59												
V7C061245	C06 Remaining Demo Complete	Finish milestone	0	0	0		17MAR03 15:59												
V7C071245	C07 Remaining Demo Complete	Finish milestone	0	0	0		17MAR03 19:59												
V7C081245	C08 Remaining Demo Complete	Finish milestone	0	0	0		17MAR03 23:59												
V7C091245	C09 Remaining Demo Complete	Finish milestone	0	0	0		18MAR03 03:59												
V7C101245	C10 Remaining Demo Complete	Finish milestone	0	0	0		18MAR03 07:59												
V7C111245	C11 Remaining Demo Complete	Finish milestone	0	0	0		18MAR03 11:59												
V7C121245	C12 Remaining Demo Complete	Finish milestone	0	0	0		18MAR03 15:59												
V7C131245	C13 Remaining Demo Complete	Finish milestone	0	0	0		18MAR03 19:59												
V7C141245	C14 Remaining Demo Complete	Finish milestone	0	0	0		18MAR03 23:59												
V7C151245	C15 Remaining Demo Complete	Finish milestone	0	0	0		19MAR03 03:59												

Resource Management



Unit 3



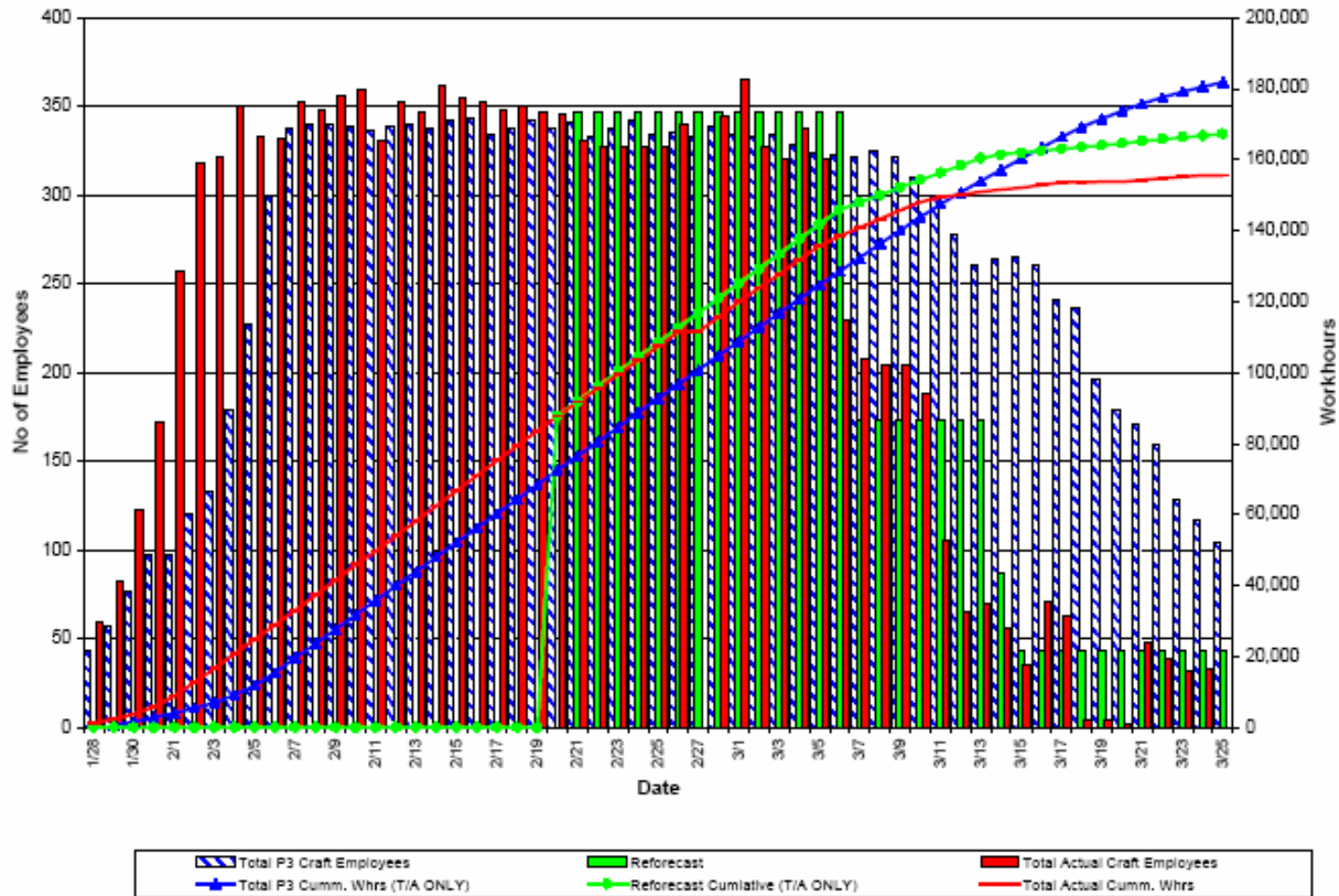
Unit 2

Resource Management (cont.)

Zachry Construction Corporation
 SRP/NGS UNIT 1 Job #5632
 Total Direct Resource Plan with Actuals
 Total Turnaround Timeframe

Precip Work

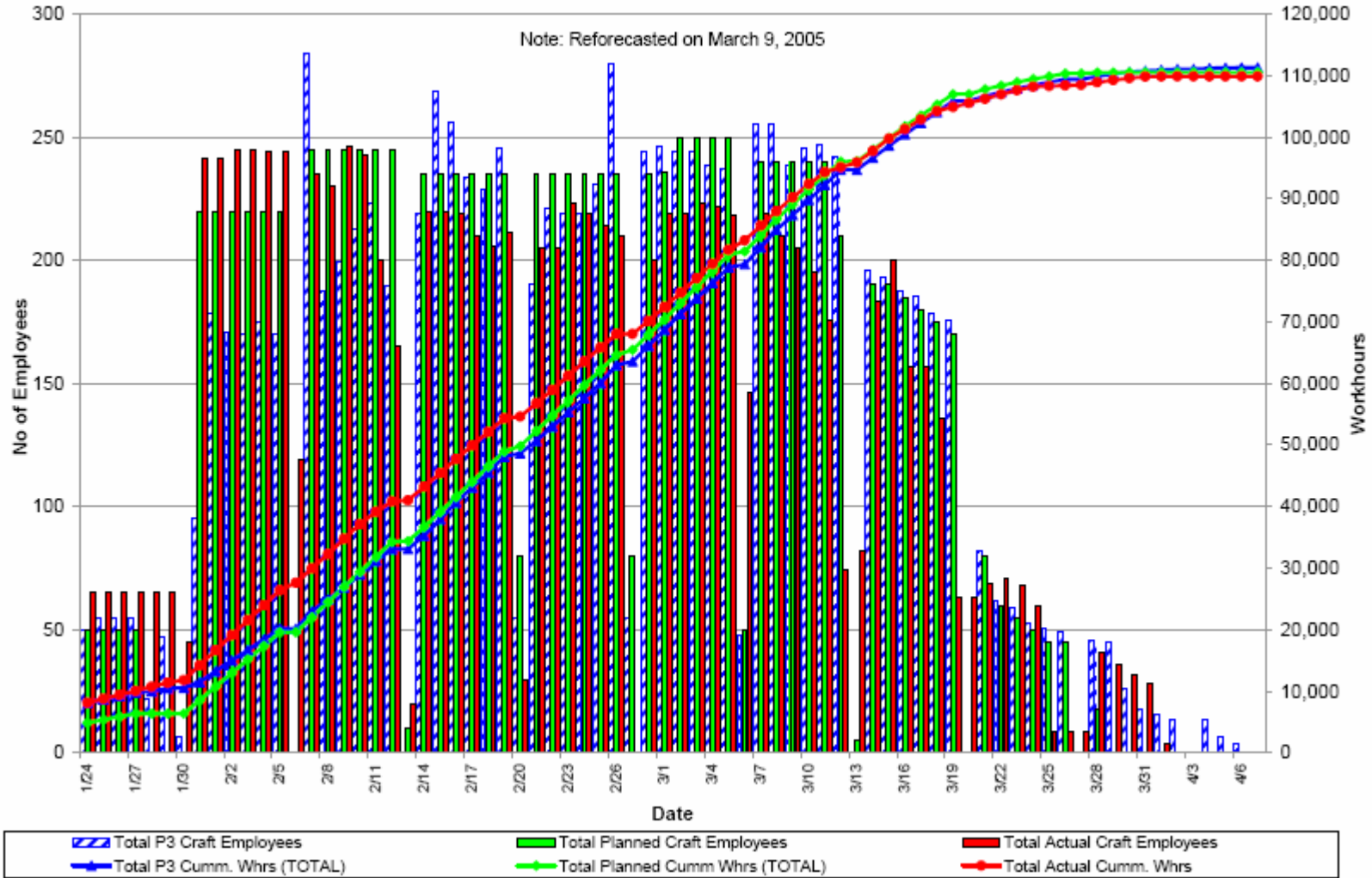
Unit 1



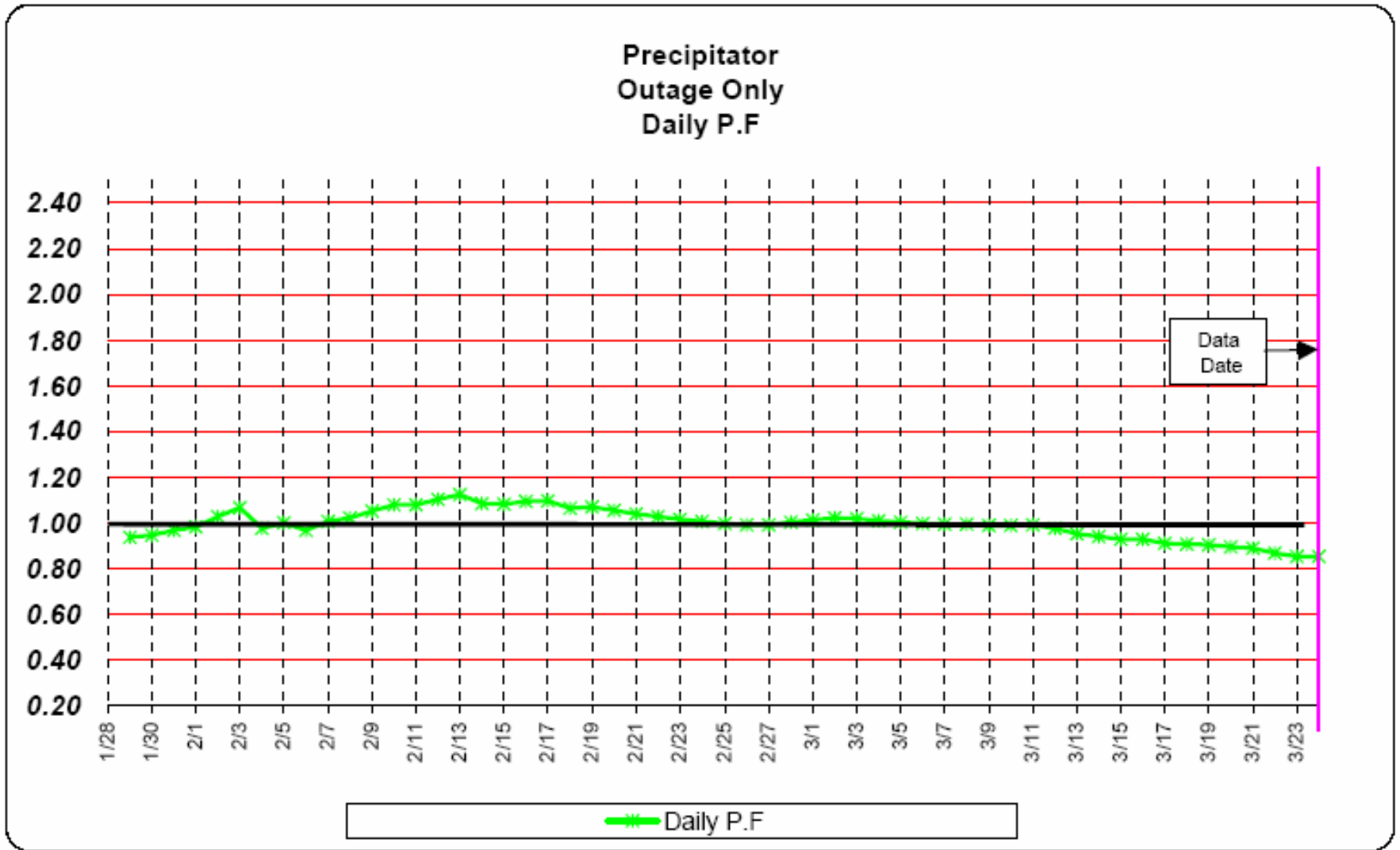
Resource Management (cont.)

Zachry Construction Corporation
 SRP/NGS UNIT 1 Job #5632
 Total Resource Plan with Actuals

Boiler Work
 04/03/05



Project Controls (Productivity)



Project Controls (Tools for Success)

- ✓ *Outage Readiness Assessment Process*
- ✓ *Early Mobilization of Key Personnel*
- ✓ *Early Project Planning*
- ✓ *Supervisor Process Training*
- ✓ *Timesheets Color Coded*
- ✓ *Use of CRA (Cost Report Analyzer)*
- ✓ *Change Order Process*
- ✓ *Material Management Support Personnel and Process*

Project Controls (Tools for Success)

✓ *Early Issue of Overhaul*

Purchase Orders:

- ✓ Allowed ZCC to Setup Cost Codes (Work Orders) in advance of Overhaul
- ✓ Budgets were balanced between P3, CMIS and Maximo

✓ *ZCC Access to SRP Cost System*

✓ *Electronic Interface w/SRP & ZCC Programs*

Field Operations

- ✓ *Lead Man Process*
- ✓ *Supervisor Training*
- ✓ *Precipitator Scale Model*
- ✓ *Previous ZCC*
- ✓ *Communications*
- ✓ *Experienced Liaisons*
- ✓ *Material Movement Planning*

Employees



- ✓ *Efficient*
- ✓ *Safe*
- ✓ *Innovative*

Field Operations (cont.)

- ✓ *General Foremen hire Foremen*
- ✓ *Foremen hire craftsmen and crew*
- ✓ *Daily Reports from Project Controls*
- ✓ *Timesheet Identification / Color Coded by day*
- ✓ *Safety Department Involvement*



Supervisor Training



Site Orientation

33 modules for all new hire employees including:

- ✓ Employee Expectation Cards
- ✓ Drug & Alcohol Policy
- ✓ PPE training
- ✓ STA training
- ✓ Housekeeping requirements
- ✓ Barricade & Scaffold Tagging
- ✓ Evacuation Procedure
- ✓ Vehicle Safety
- ✓ Hand Safety

Supervisor Training (Project Controls)

- ✓ *Training Plan & Schedule*
- ✓ *Work Hour Budgets*
- ✓ *Timesheets*
- ✓ *Cost Reports*
- ✓ *Schedule Update Process*
- ✓ *Cost Projections*
- ✓ *Productivity Factor (Earned vs Actuals)*
- ✓ *Change Order Process*

Supervisor Training (CBT)

- ✓ *Computer Based Training*
 - ✓ Z Learning Center (ZLC)



Precipitator Model

- ✓ *Innovative*
- ✓ *Proactive*
- ✓ *On-Site Training*



Precipitator Model (cont.)



Recap

- *Alliance Relationships facilitate joint Ownership, Collaborative Teamwork, Capture of Lessons Learned, Continuous Improvement and Balanced Risk Allocation*
- *Critical Success Factors include Implementation of Outage Best Practices, Communication and Training*
- *Joint Commitment to Front End work processes reduce project schedule and costs*

Q & A