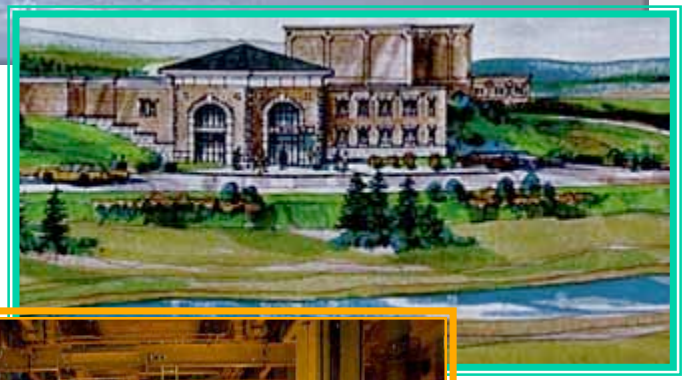
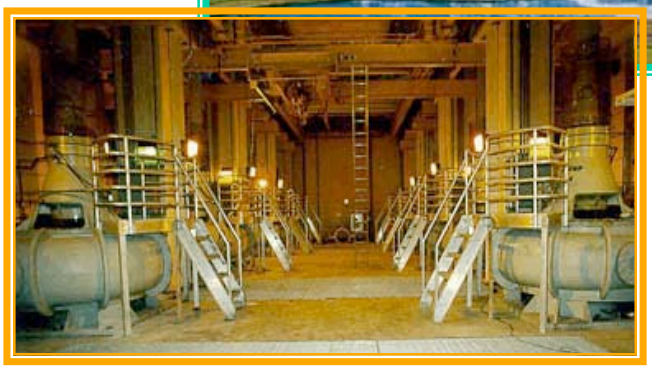
Facilities Asset Management Program

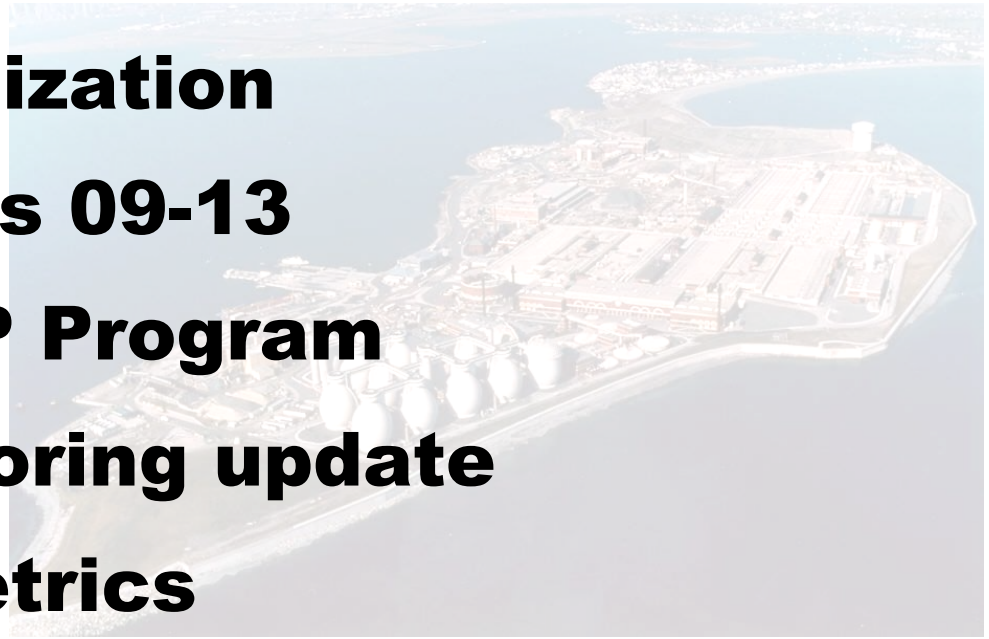




Wastewater Advisory Committee

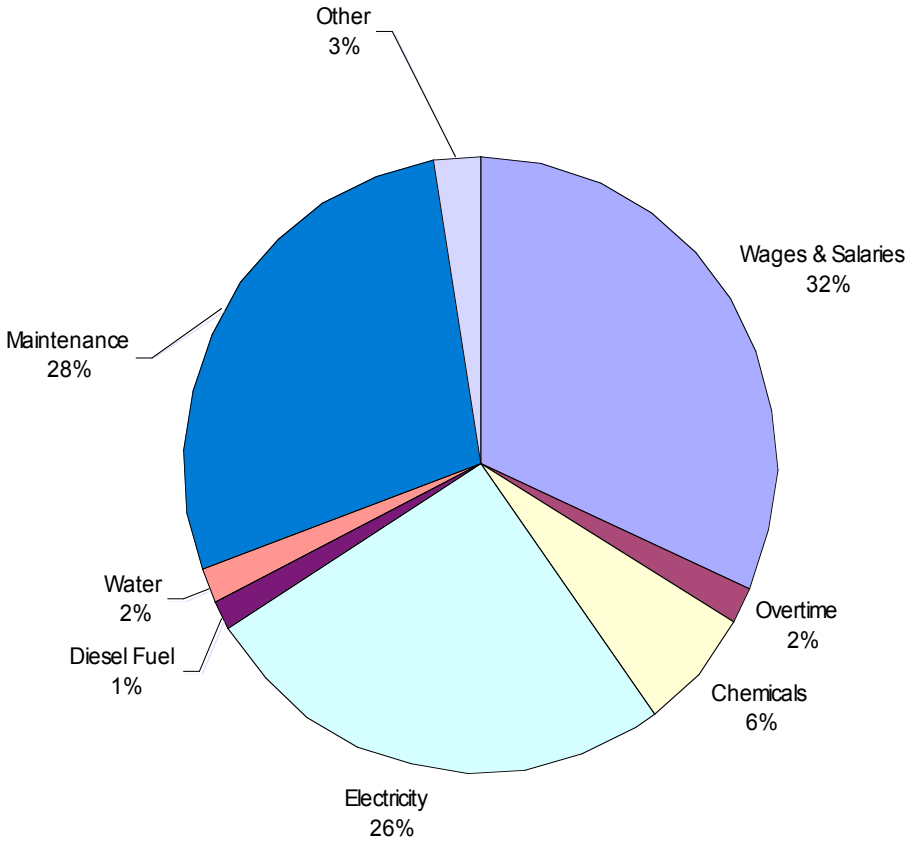
March 2009

Today's Agenda



- Change in organization
- Capital Programs 09-13
- Update on FAMP Program
- Condition Monitoring update
- Maintenance Metrics
- Service contracts

Components of the Deer Island FY09 CEB



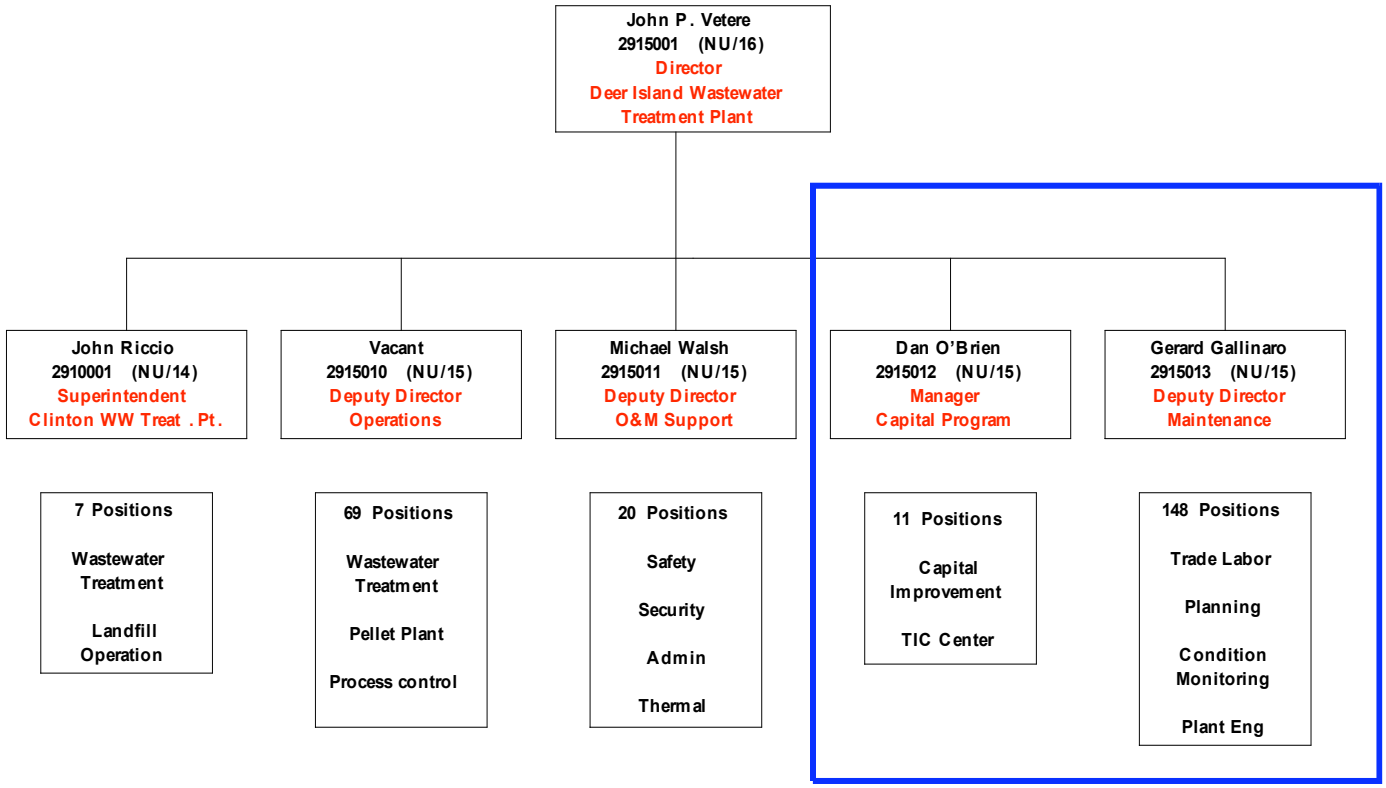
Deer Island's Amended Budget $52,222,816

Deer Island Wastewater Treatment Plant

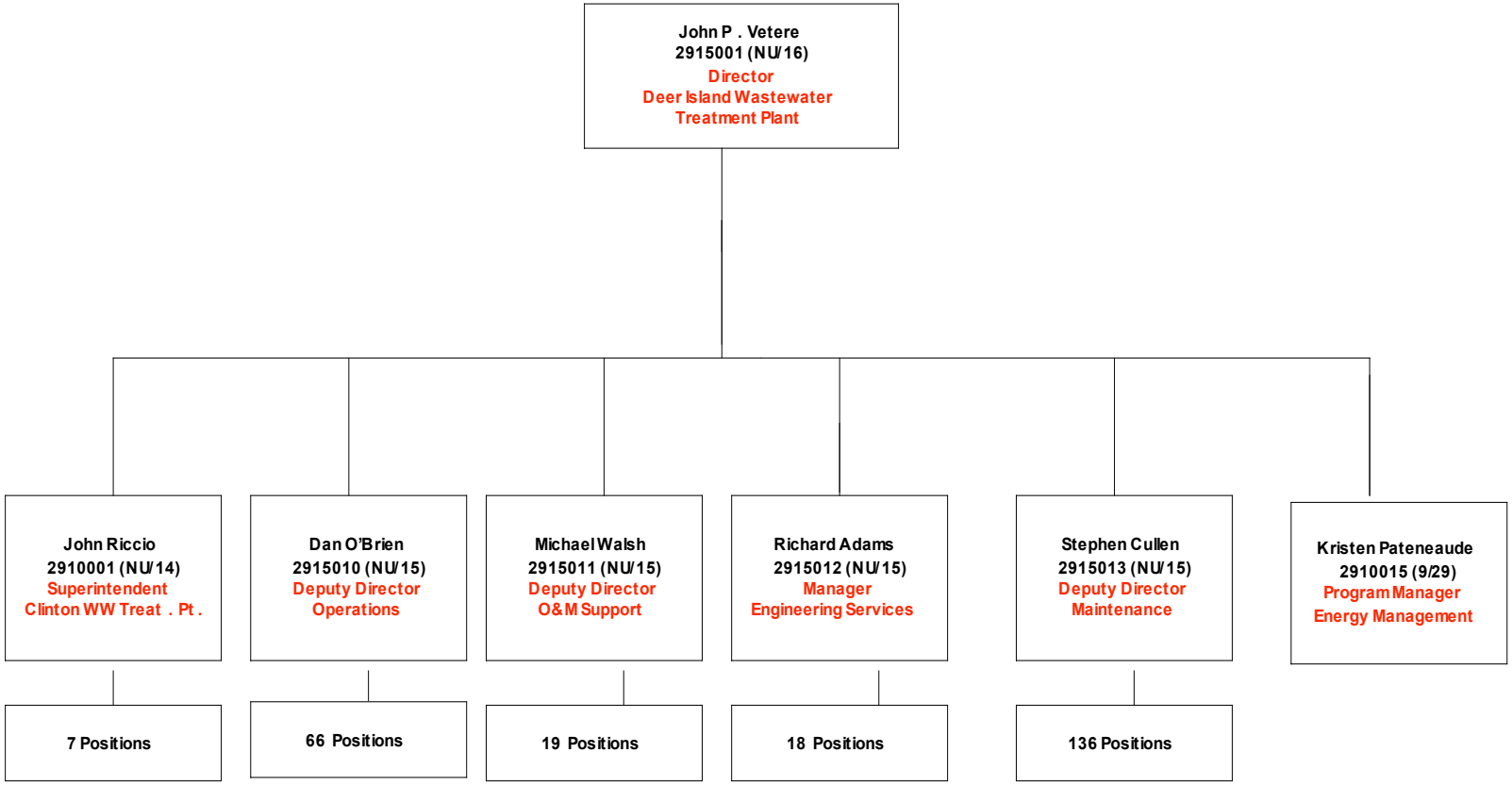
- **Result of $3.8 Billion Dollar Construction Project**
- **2nd Largest Wastewater Treatment Plant in the United States**
- **Built on 120 Acres**
- **Treatment Capacity:**
  - **Maximum**
    - **1.27 Billion Gal/Day**
  - **Average Daily Flow:**
    - **365 Million Gal/Day**

Operations Division – Deer Island Wastewater Treatment Plant

OFFICE OF THE DIRECTOR

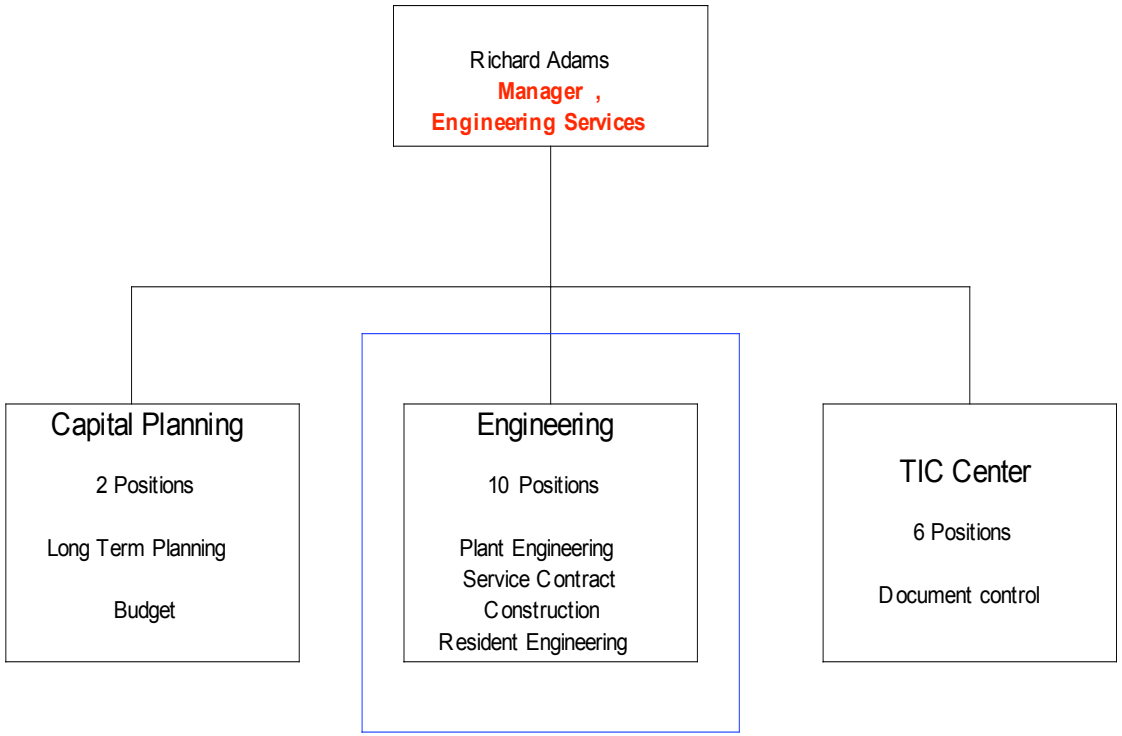


DEER ISLAND – OFFICE OF THE DIRECTOR
FY 09



DEER ISLAND ENGINEERING SERVICES

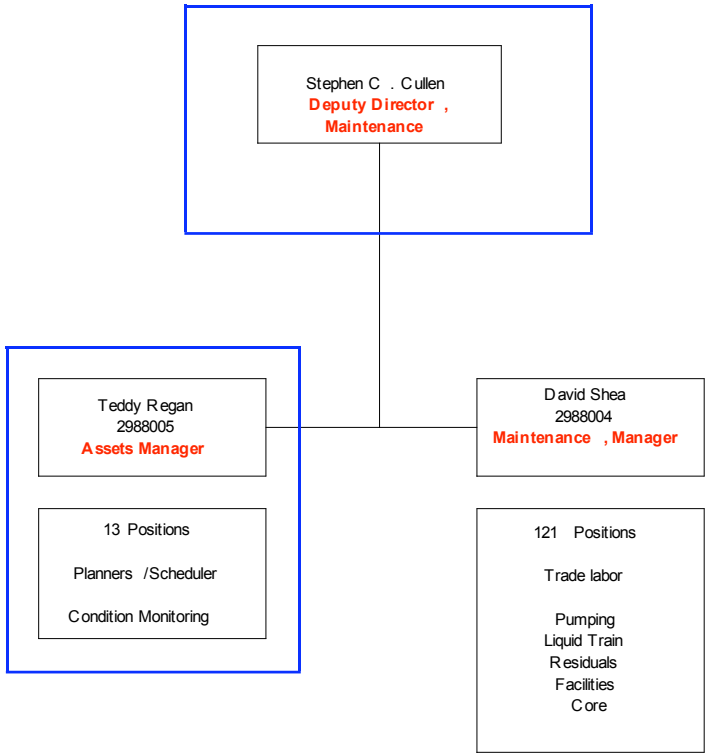
FY09



DEER ISLAND MAINTENANCE

DEPUTY DIRECTOR'S OFFICE

FY09



Today's Agenda

- Change in organization
- Capital Programs 09-13
- Update on FAMP Program
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- Maintenance Metrics
- Service contracts

Capital Project Spending

- FY 09 through FY12 Spending :$ 240M
- FY 09 Anticipated Awards $86.5M
- FY 10 Anticipated Awards $73.0M
- FY 11 Anticipated Awards $27.6M
- FY 12 Anticipated Awards $52.9M

Capital Projects

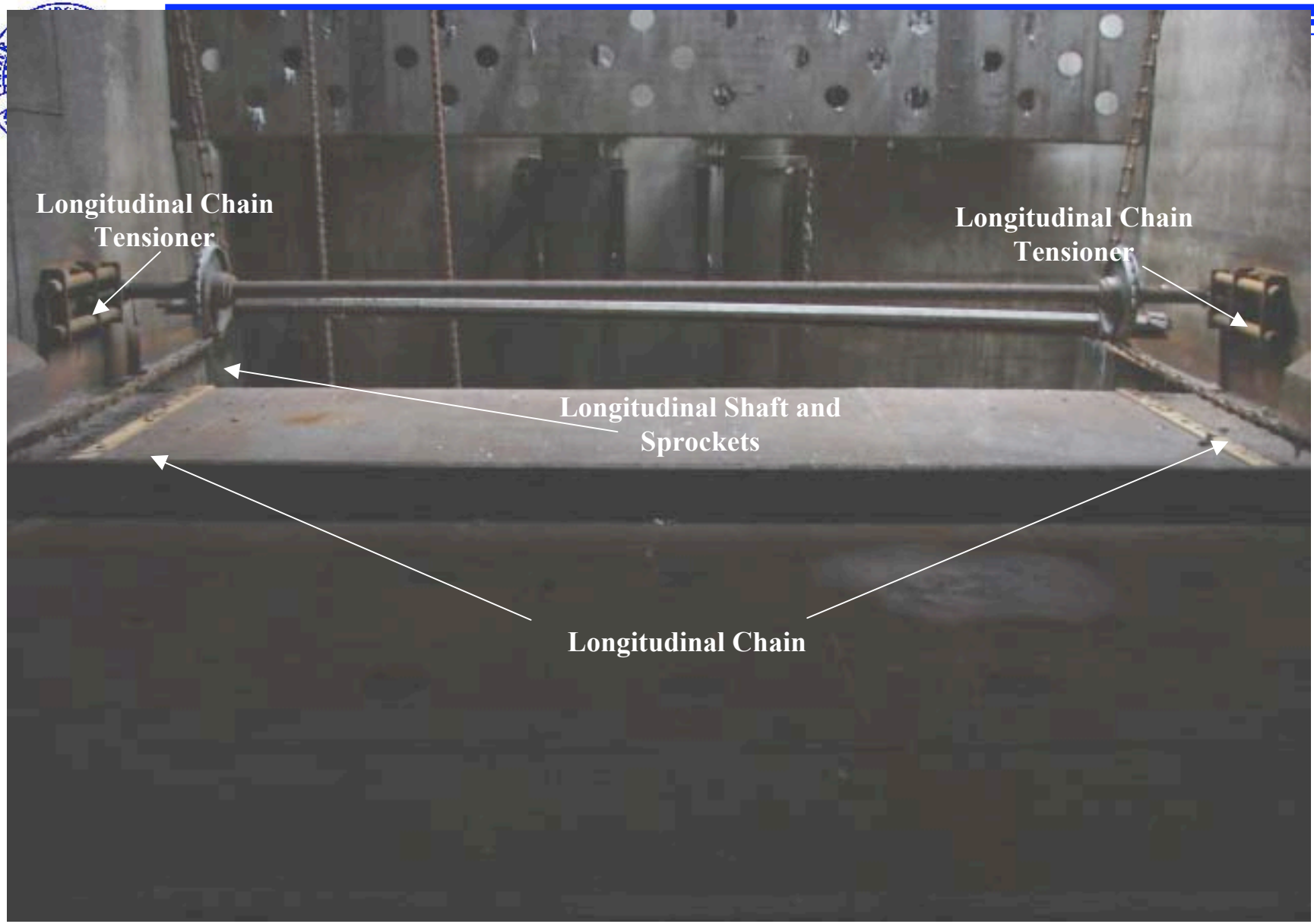
- FY09: 12 projects
- FY10: 22 projects
- FY11: 14 projects
- FY12: 12 projects
    - Residuals
- Equipment Assessment
- Sludge to energy technology
- Contract end date 2015

CEB Projects

- Responsible for the development of bid documents
- Responsible for Project management
- Service contract examples: Elect Maint., Boiler Maint, CTG Maint, STG Maint, Landscaping, Roofing, Coating, etc.)
- 23 Contracts Totaling $15.8M

PRIMARY AND SECONDARY CLARIFIER REHABILITATION PROJECT

Interior of Primary Clarifier-Battery A



Interior of Primary Clarifier-Battery B

Clarifier Chain Failures

(Top) Side View of failed Clarifier Chain in service 11 years (type 403)

(Middle and Bottom) Side and Top View of New Section of Clarifier Chain (Type 403)

Significant Corrosion on Primary Chain (Typical)

RESIDUALS PIPE REPLACEMENT PROJECT

(Left) Residuals Pipe Gallery

(Right) Section of Pipe Removed for Inspection

DIGESTED SLUDGE PUMP PROJECT


CAUTION
11/10/2008

NMPS VFD/MOTOR REPLACEMENT


MOTOR
4
MOTOR
6
12/10/2007


8
12/10/2007

H1S/H1R PIPELINE FAILURES

H1S/H1R Piping Failure

WIND TURBINES

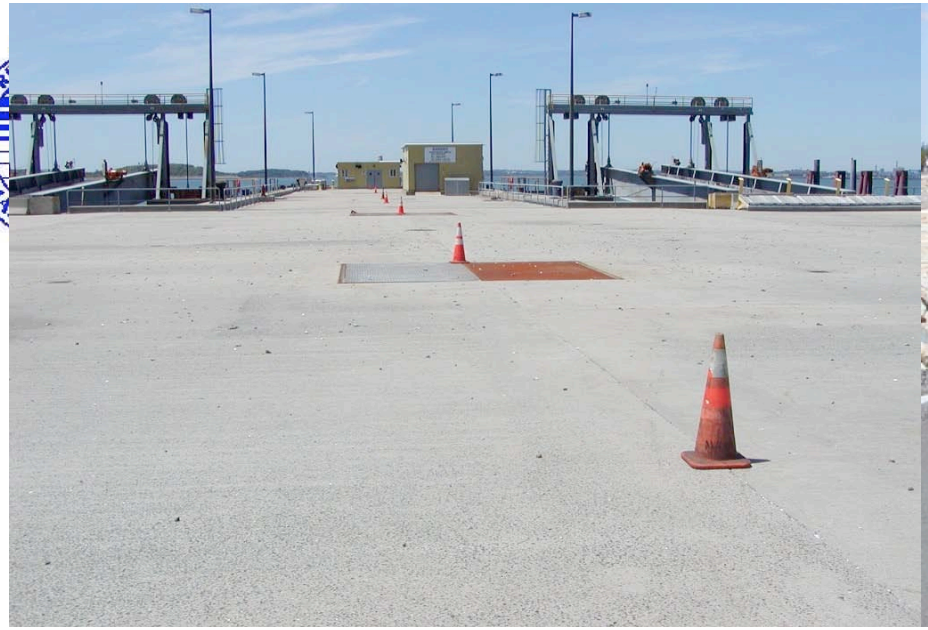
CSB Demo


10/21/2008

Diesel Removal


JACKET WATER
09/05/2008

FUEL OIL LINE REPLACEMENT



ELECTRICAL UPGRADE 3


6'-4"
C-9


6'-4"
A-5

Back Pressure Turbine Generator


11/14/2008

Today's Agenda

- Change in organization
- Capital Programs 09-13
- **Update on FAMP Program**
- Condition Monitoring update
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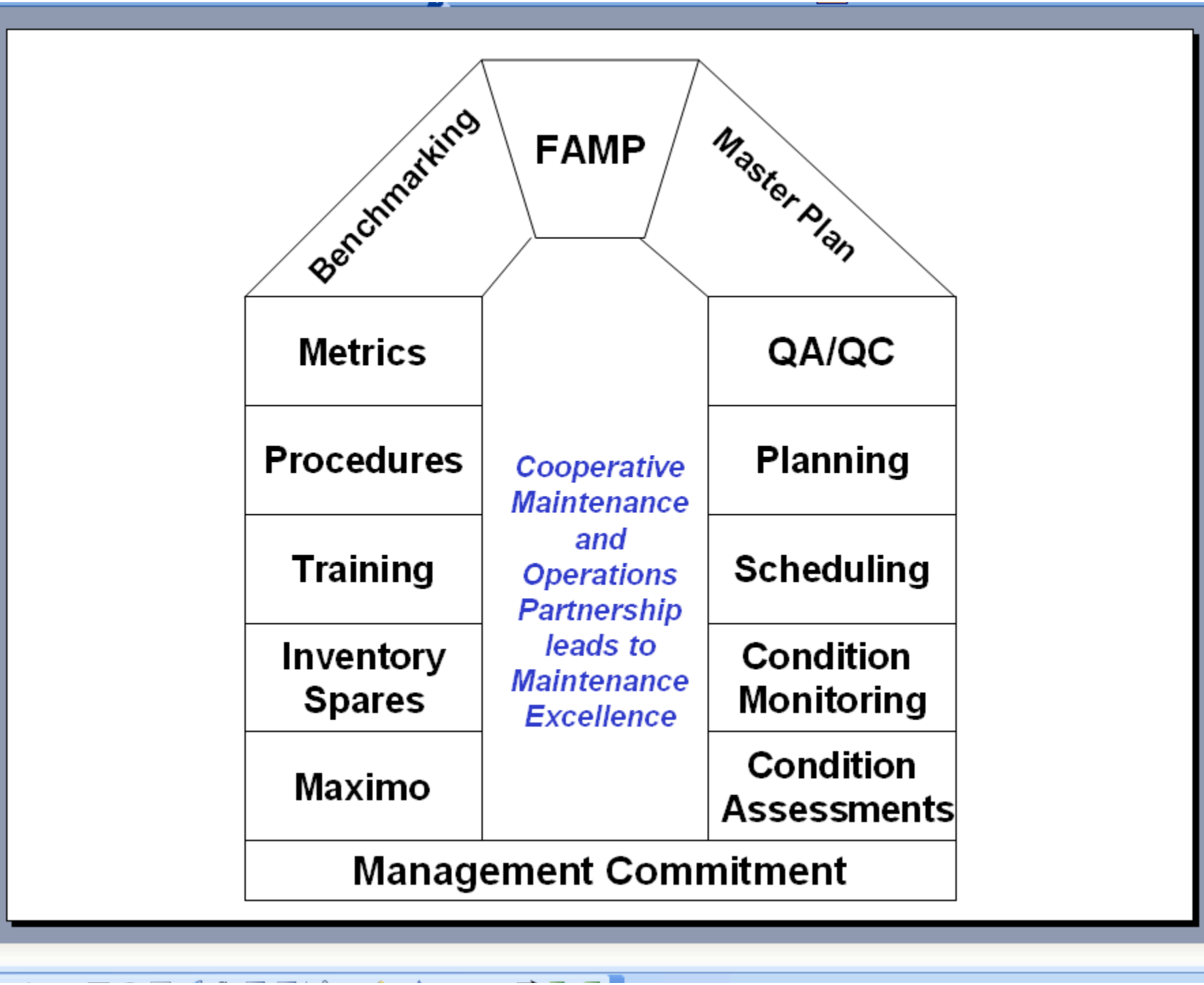
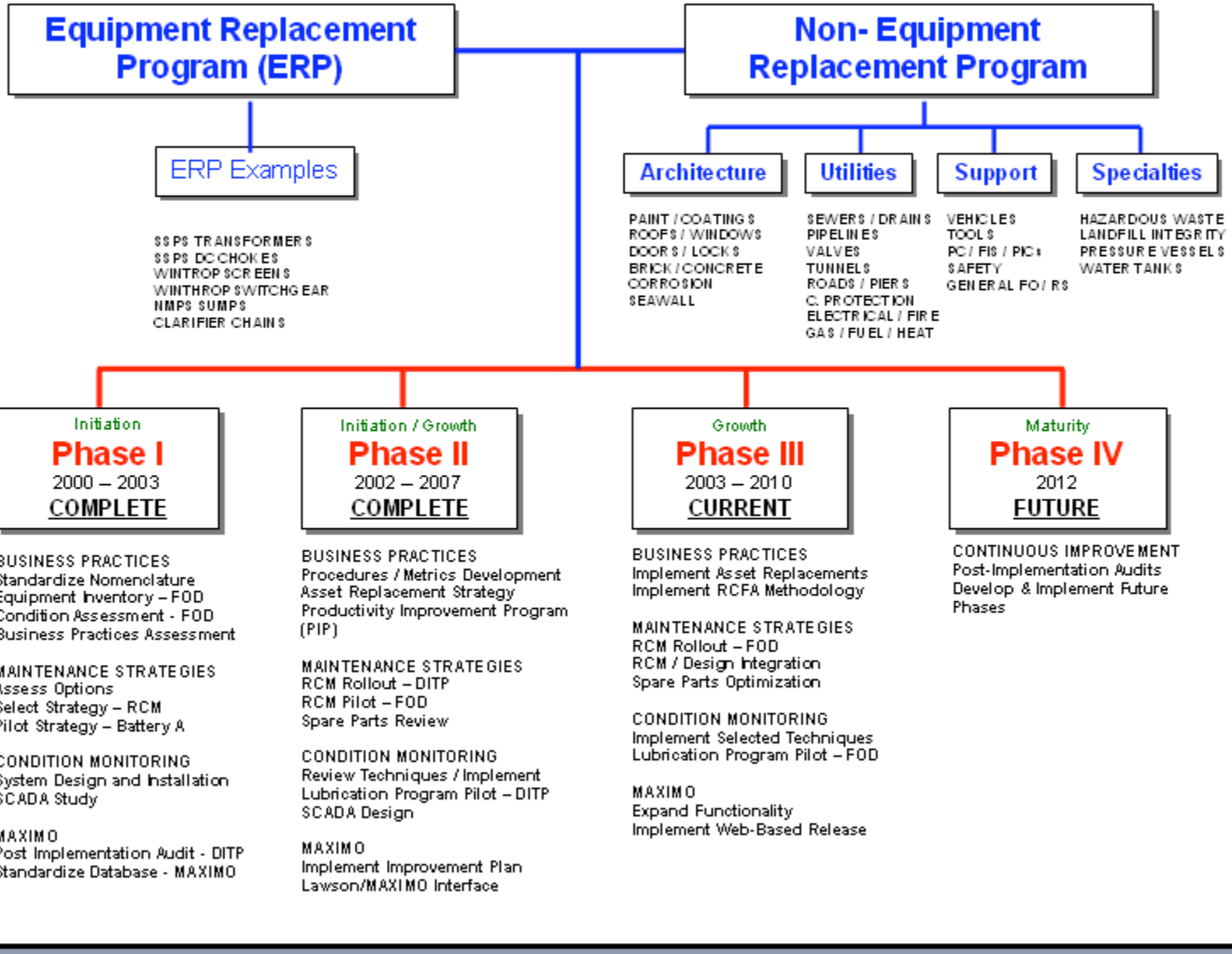
Asset Management Program

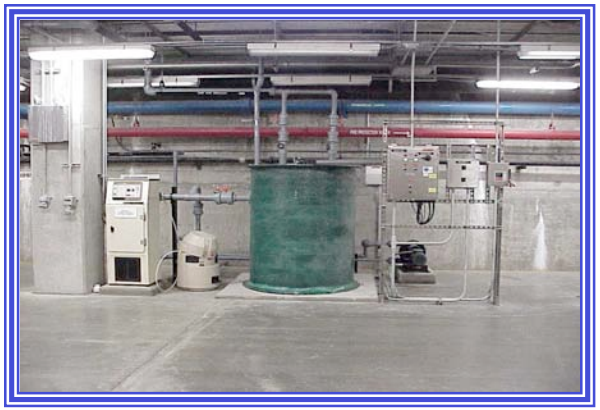
- Drivers
  - Business Strategy #21: develop and implement an agency-wide multi-year maintenance plan
- Goals
  - Protect Ratepayer Investment
  - Prolong Asset Life
  - Preserve the Environment


Benchmarking
FAMP
Master Plan
Metrics
Procedures
Training
Inventory Spares
Maximo
Cooperative Maintenance and Operations Partnership leads to Maintenance Excellence
QA/QC
Planning
Scheduling
Condition Monitoring
Condition Assessments
Management Commitment

Facilities Asset Management Program Model (FAMP)

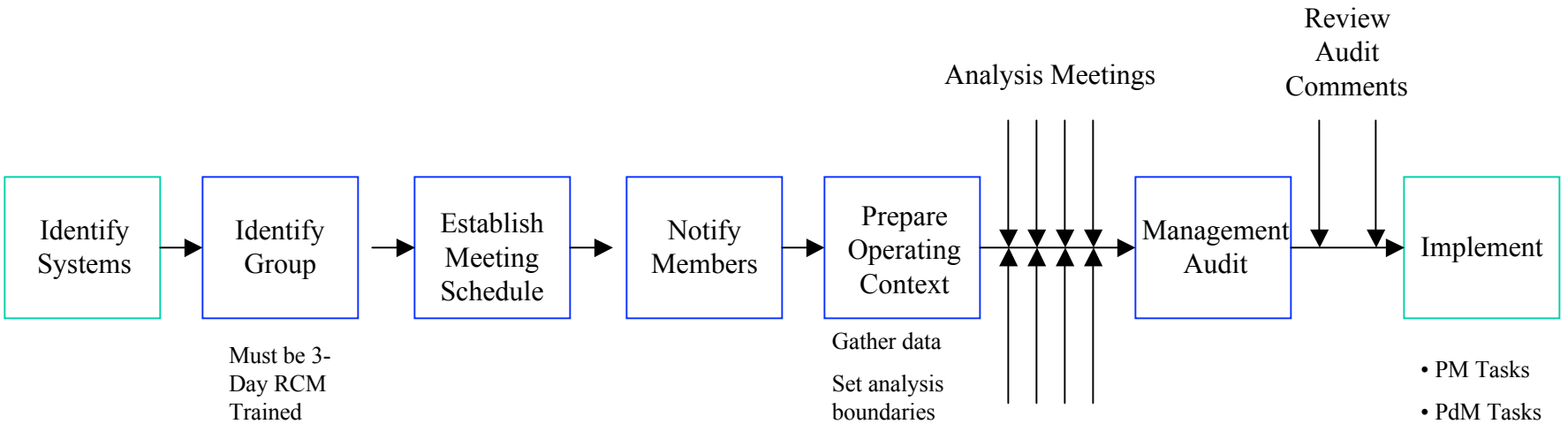


Reliability Centered Maintenance (RCM)



- RCM is a structured process where the system experts (operations and maintenance staff) jointly analyze system components and recommend the most appropriate maintenance requirements (including tasks, frequencies and trades) of physical assets as they are operated
- Concept developed over a period of thirty years by the aviation industry

RCM - Approach



RCM as of 3-1-09

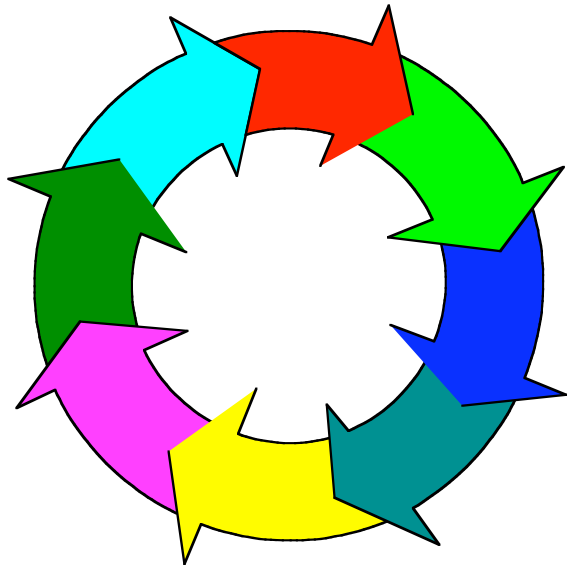
- DITP status
  - 83 RCM analyses completed
  - 72 currently implemented
- DITP results
  - Overall 24% reduction in PM cost
- DITP future
  - 110 total systems to complete
  - Annual reviews to stay current

Maximo Highlights

- 72,710 Pieces of equipment in Maximo
- 99.1% Equipment availability
- 32,435 Work Orders per year
- 1800 Preventive Maintenance/month
- 100% Preventive Maintenance completed
- 12 % Predictive Maintenance
- < 1% Emergency Maintenance

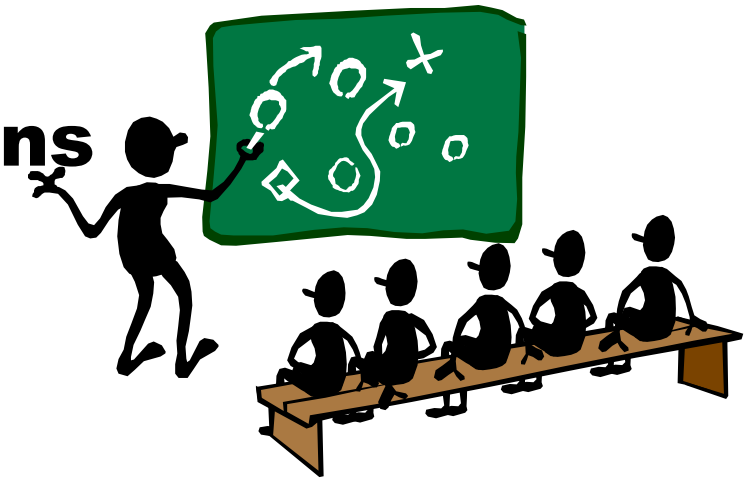
Software Utilization

- **Maximo 5.2**
- **Lawson/Maximo interface**
- **Increase Functionality**
  - Link documents
  - Data-base roll-up
  - Performance reporting
  - Required fields
  - PICS Maximo Interface
  - Enhanced Queries



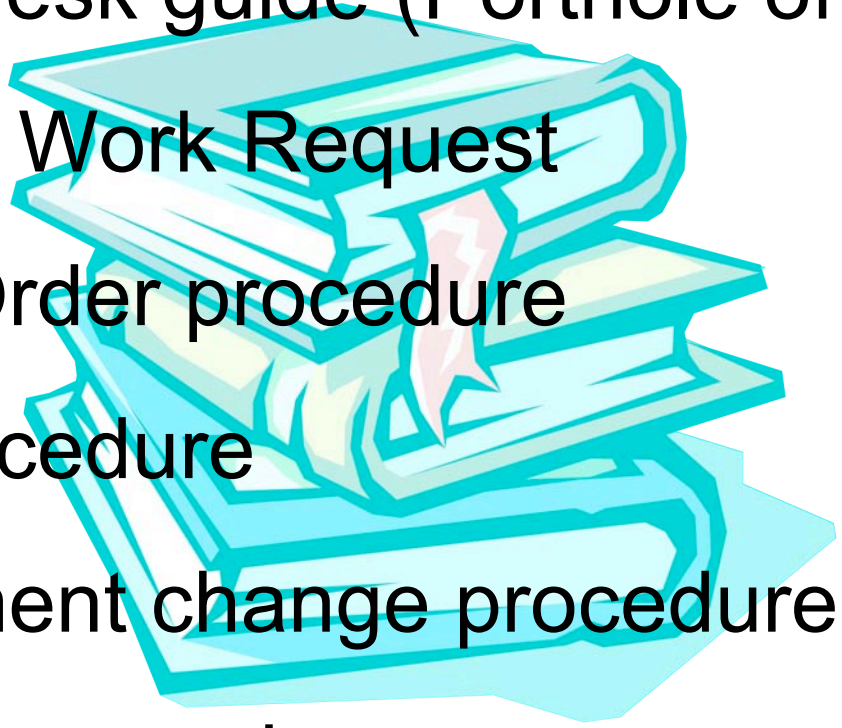
Training

- Alignment Training
- Maximo Training
- RCM Training
- Arc flash training
- Vendor Presentations
- New Procedures



Procedures

- Maximo desk guide (Porthole of Knowledge)
  - Enter a Work Request
  - Work Order procedure
  - PM procedure
  - Equipment change procedure
  - QA/QC procedure



Benchmarking

- **Site Visits and Meetings conducted with Fortune 500 companies and others to expand MWRA program**
  - **Dofasco Steel, Canada**
  - **Broward County, Florida**
  - **Coors Brewing and Ball Industries**
  - **Society for Maintenance & Reliability Professionals (www.SMRP.org)**

MWRA Shares Best Practices

- City of Detroit, Water & Sewerage
- King County, Seattle, Wastewater Division
- Gillette Worldwide

- MIT
- Boston Public Library
- Mass General

Today's Agenda

- Change in organization
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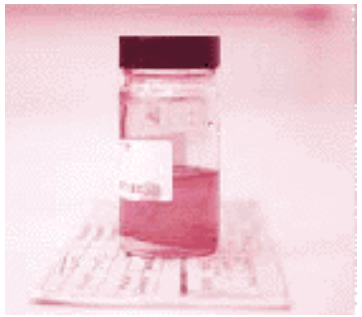
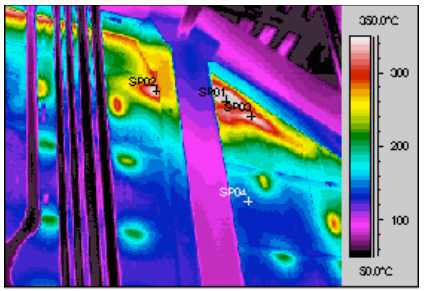
Condition Monitoring

- Non-intrusive maintenance techniques
- Monitor health of high cost, critical assets
- Alert staff well in advance of pending failure

Condition Monitoring at DITP

- **Lubrication / Oil Analysis**
- **Vibration**
- **Temperature**
- **Thermography**
- **Ultrasonic**

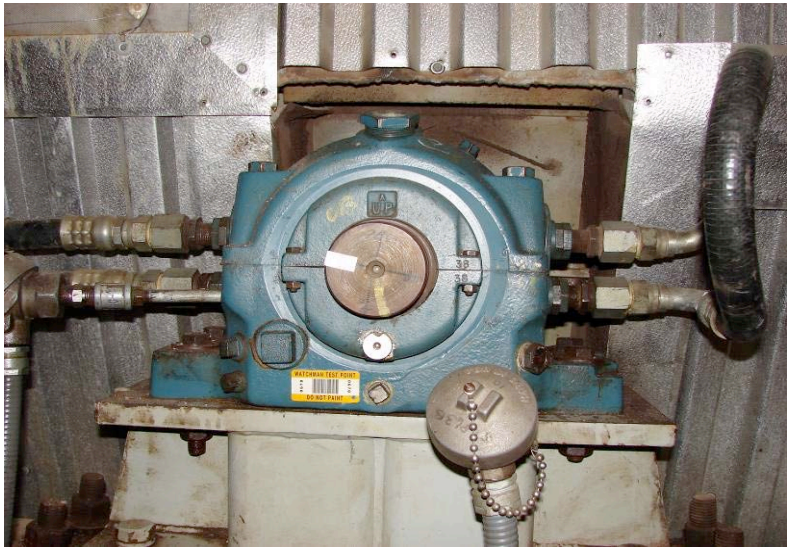




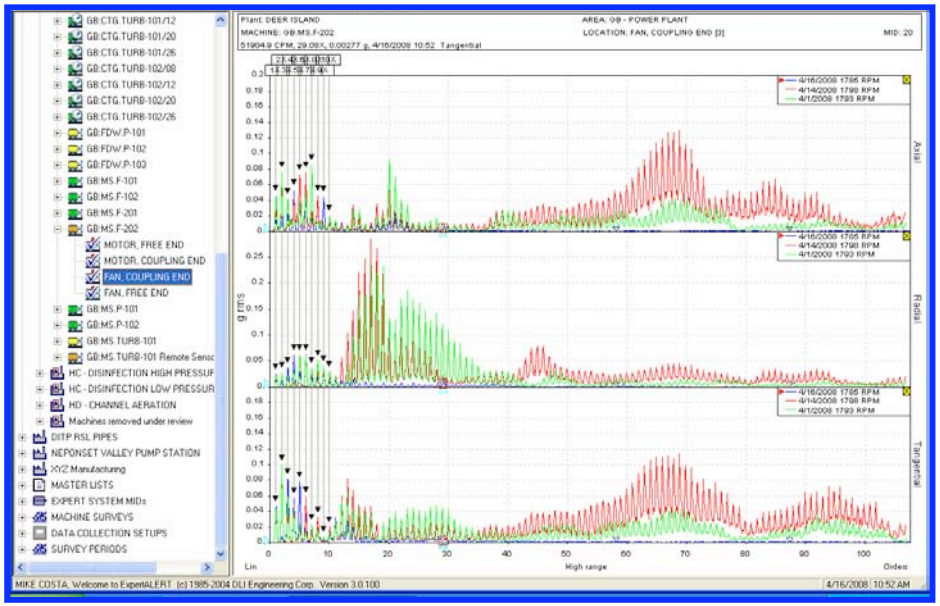
Lube oil benefits

- Recommendations
  - No change required
  - Filter oil
  - Change oil
- Results
  - OEM oil changes would cost $83,514.00
  - Cost - Sample/filtering/oil change $26,372
  - Cost avoidance **$57,142**

Boiler Force Draft Fan Bearing

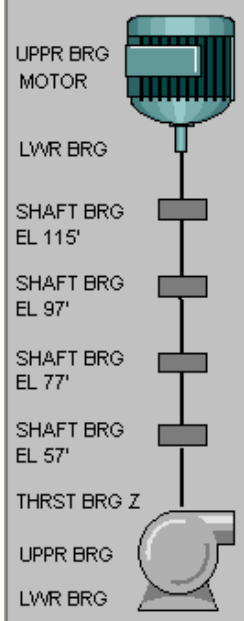


Vibration analysis on GB:MS.F-202 fan had increased vibration levels. The vibration analysis detected a loose torque bolt avoiding a unexpected shut down.



Green – Original data – grease and change oil
Red – high range vibration – bearing issue
Blue – Vibration after bearing repair – excellent vibration

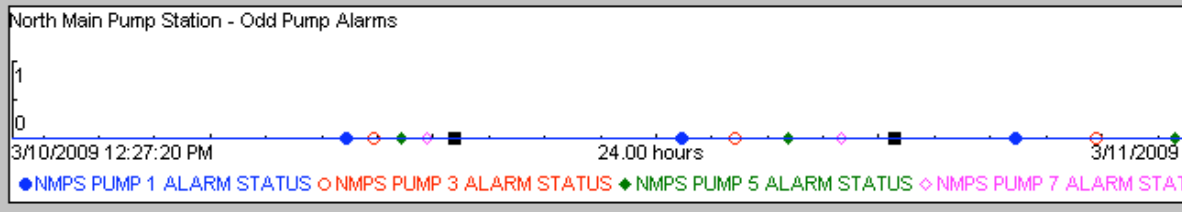
NMPS VIBRATION AND TEMPERATURES EVEN PUMPS



	RWW:P-2	RWW:P-4	RWW:P-6	RWW:P-8	RWW:P-10
	-0.59 (MILS)	4.30 (MILS)	1 (MILS)	1.21 (MILS)	-0.98 (MILS)
	X Y TEMP (IN/SEC) (DEG F)	X Y TEMP (IN/SEC) (DEG F)	X Y TEMP (IN/SEC) (DEG F)	X Y TEMP (IN/SEC) (DEG F)	X Y TEMP (IN/SEC) (DEG F)
UPPR BRG MOTOR	0.02 0.03 63	0.02 0.02 116	0.02 0.02 64	0.02 0.02 115	0.02 0.02 60
LWR BRG	0.02 0.02 64	0.02 0.02 69	0.02 0.02 65	0.02 0.03 66	0.03 0.02 59
SHAFT BRG EL 115'	0.01 0.01 69	0.01 0.01 98	0.01 0.01 66	0.01 0.01 91	0.01 0.01 63
SHAFT BRG EL 97'	0.01 0.01 68	0.01 0.01 137	0.01 0.01 67	0.01 0.02 88	0.01 0.01 65
SHAFT BRG EL 77'	0.01 0.01 73	0.01 0.02 89	0.01 0.01 64	0.01 0.01 132	0.01 0.01 62
SHAFT BRG EL 57'	0.01 0.01 63	0.02 0.03 90	0.02 0.02 61	0.02 0.02 80	0.01 0.01 60
THRST BRG Z	0.05 0	0.20 103	0.04 56	0.15 94	0.05 81
UPPR BRG	0.05 60	0.28 108	0.09 60	0.21 107	0.09 60
LWR BRG	0.03 59	0.10 113	0.03 59	0.09 112	0.04 59
	0 4 MGD RPM	75 293 MGD RPM	0 1 MGD RPM	77 306 MGD RPM	0 4 MGD RPM

NMPS VIBRATION AND TEMPERATUR

	RWW:P-1	RWW:P-3	RWW:P-5	RWW
	3.69 (MILS)	-0.49 (MILS)	-0 (MILS)	5.21
	X Y TEMP (IN/SEC) (DEG F)	X Y TEMP (IN/SEC) (DEG F)	X Y TEMP (IN/SEC) (DEG F)	X Y (IN/SEC)
UPPR BRG MOTOR	0.05 0.04 118	0.02 0.01 62	0.020.01 63	0.04 0.0
LWR BRG	0.04 0.03 64	0.03 0.01 59	0.01 0.01 60	0.03 0.0
SHAFT BRG EL 115'	0.01 0.01 103	0.01 0.01 66	0.01 0.01 66	0.01 0.0
SHAFT BRG EL 97'	0.01 0.01 95	0.01 0.01 67	0.01 0.01 66	0.01 0.0
SHAFT BRG EL 77'	0.01 0.01 89	0.01 0.01 63	0.01 0.01 61	0.01 0.0
SHAFT BRG EL 57'	0.01 0.01 79	0.02 0.01 62	0.02 0.02 60	0.02 0.0
THRST BRG Z	0.17 102	0.04 59	0.02 62	0.10
UPPR BRG	0.25 105	0.11 61	0.06 61	0.1
LWR BRG	0.12 100	0.05 60	0.03 61	0.12
	72 287 MGD RPM	0 1 MGD RPM	0 -0 MGD RPM	97 MGD



North Main Pump Station

P01 -	72.4 BMD	P02 -	
P03 -		P04 -	74.6 BMD
P05 -		P06 -	
P07 -	96.9 NMET	P08 -	76.7 NMET

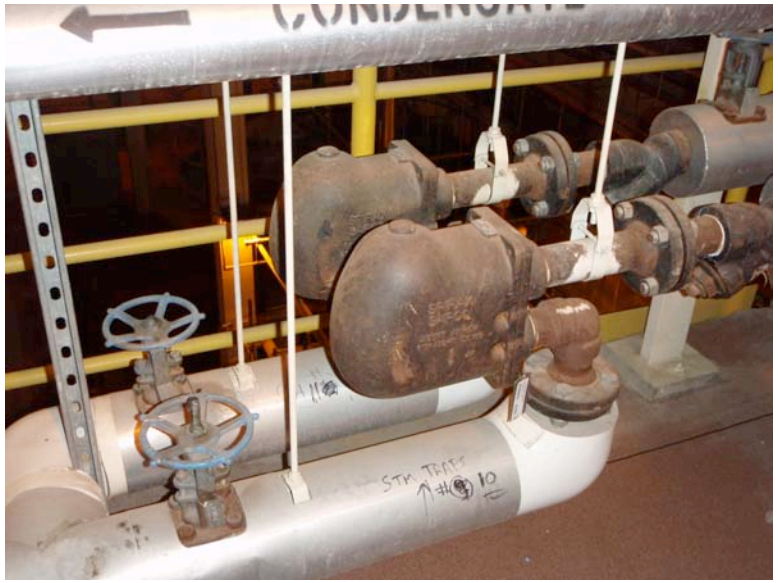
Ready

Server Time

start | Inbox - Microsoft Out... | PI ProcessBook - [NM... | PI ProcessBook - [NM... | CaptureEze97 Previe...

Thermography

- Steam Trap testing using Infrared Imaging
- Ensure steam traps are operating as designed
- High heat or yellow would indicate a problem



Steam Traps

Infrared Image

Ultrasonic Program

- Thickness Ultrasonic
  - Carbon Absorbers
  - Heat exchangers
- Acoustic Ultrasonic
  - Mixer Aerators
  - Centrifuge
  - RWW Motors

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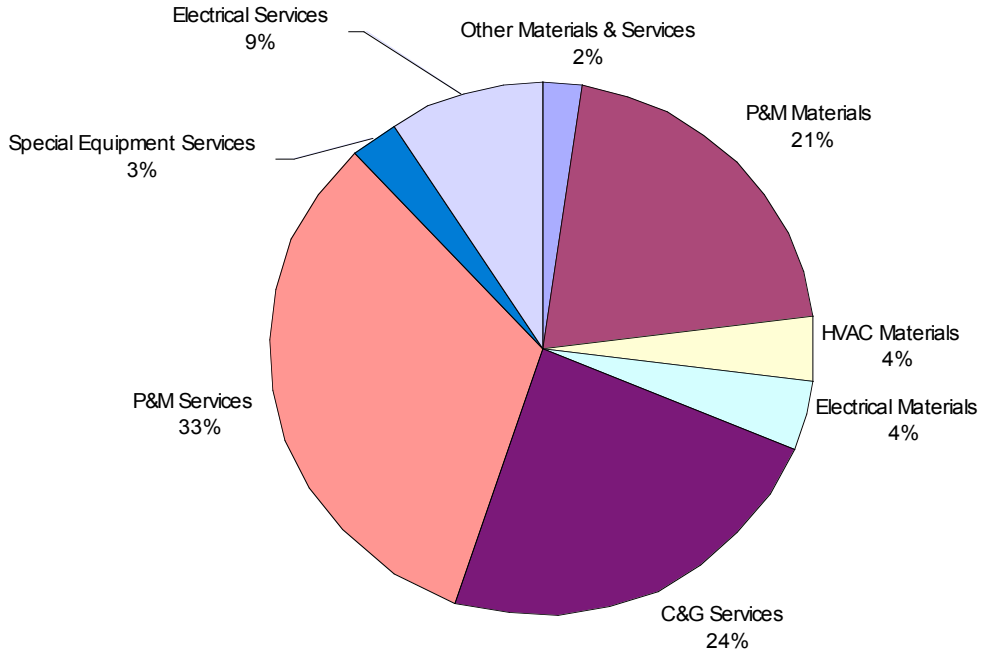
Components of FY09 Maintenance CEB



Deer Island's Maintenance Amended Budget $14,559,850

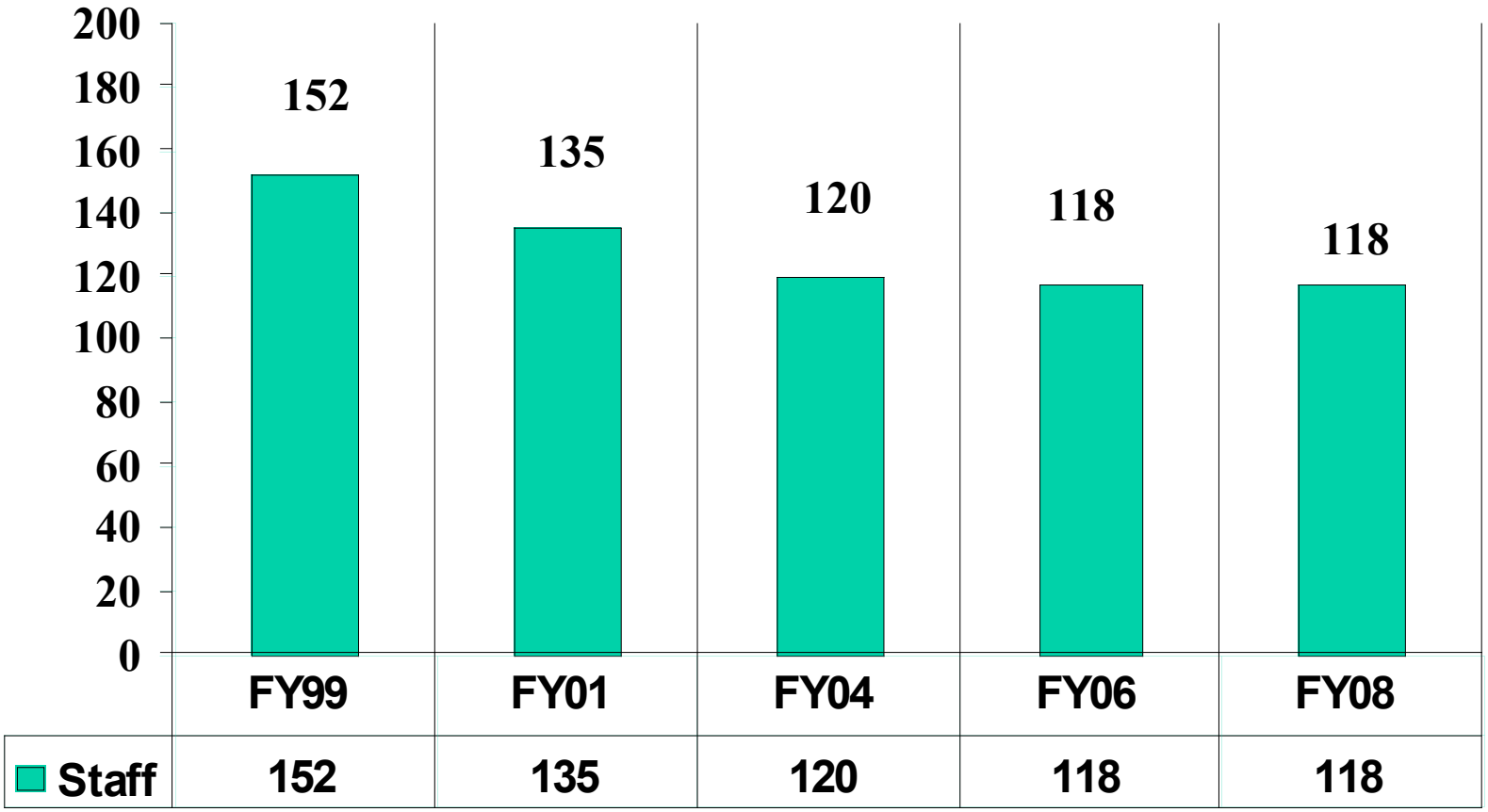
Maintenance at DITP

- 118 staff (Technicians & Supervisor's)
- 32,435 total work orders per year
- Maintenance Craft Hour Distribution
  - 24% Preventive/Predictive Maintenance
  - 57% Corrective Maintenance
  - 17% Projects
  - 1% Emergency
  - 1% Other (Warranty, Event)

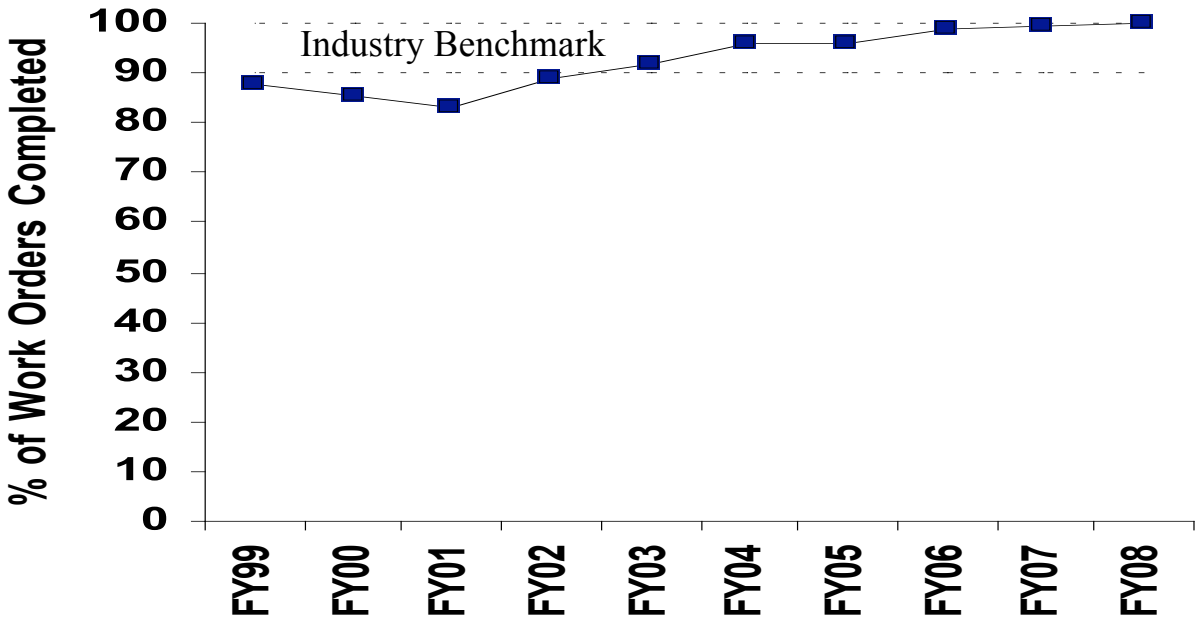
Maintenance Planning

- Maintenance Priority List
  - Meet weekly with operations/Maintenance/Engineering
  - Discuss highest priority work
  - Maintenance uses to create area Daily Dispatch
- Daily Dispatch record
  - Plan for tomorrow and schedule for the day
  - Schedule eights hour of work for all technicians
  - Includes WO#, Description, Location, # of hours
  - Priority work/PM/Projects
  - Management tracks productivity

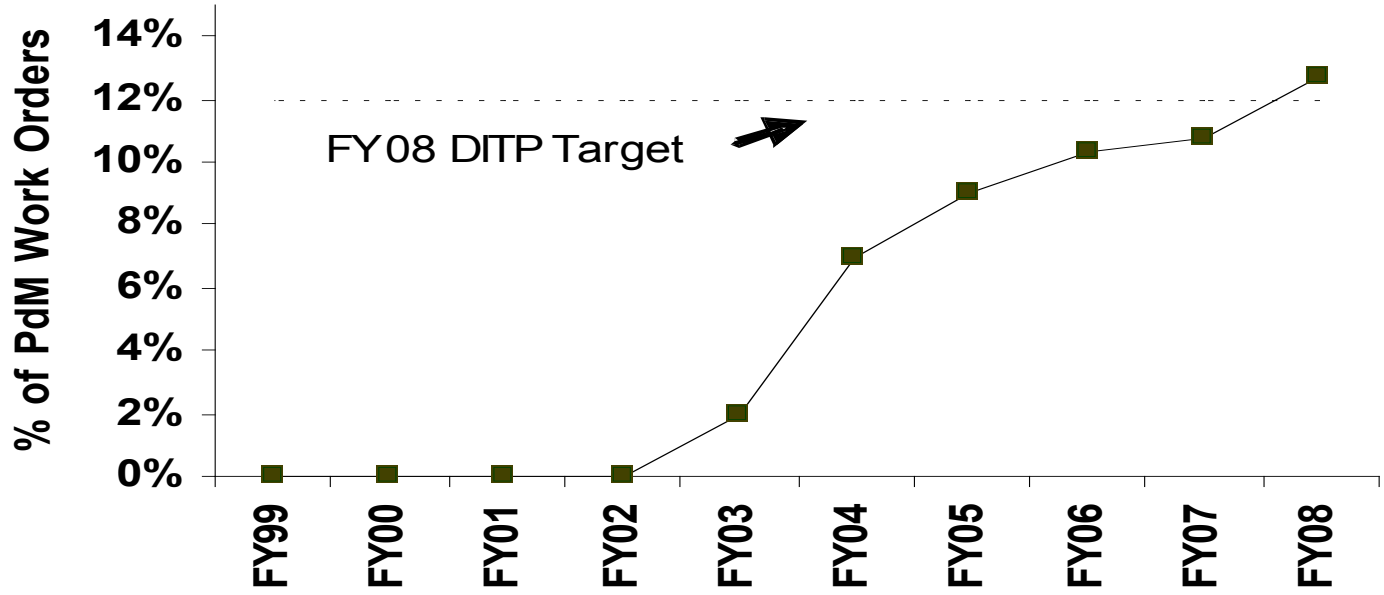
Maintenance Staffing



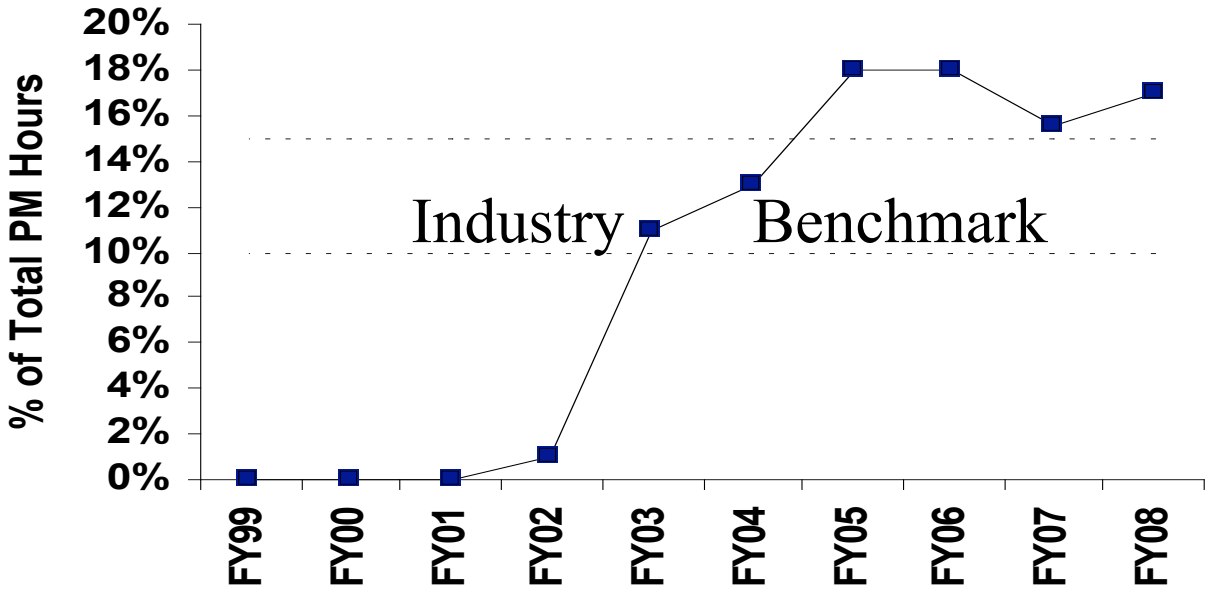
Preventive Maintenance



Predictive Maintenance



Operations Light Maintenance PMs



Maintenance Metrics

Benchmark	Industry Goal	DITP (2009)
Maint. Spending/RAV	1.0-1.5%	1.26%
Availability	97%	99.1 %
Emergency Maintenance	< 5%	< 1%
Overtime	< 5 %	4%
Operations Light Maint.	10-15%	17%
Backlog	3-6 weeks	7.9 weeks

Benchmark data was taken from industry data including Society of Maintenance & Reliability Professionals, International Benchmarking Clearinghouse, Maintenance Technology Magazine, Maintenance Handbooks, and various technical papers from Fortune 500 companies and Maintenance Consultants.

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Service contracts

- Maintenance contracts
  - Cryogenics 3yr 1.5M
  - Centrifuge 3yr 800K
  - Combustion Turbine Generator 3yr 655K
  - Steam Turbine generator 3yr 924K
  - Boiler 3yr 3.1M
  - M/V Electrical Testing 3yr 1.7M

Service Contracts

- Facility contracts
  - Janitorial 3yr 1.7M
  - Landscape 3yr 305K
  - Security 3yr 3M
  - Overhead doors 2yr 72K
  - Trash removal 2yr 251K