

BROWNS FERRY NUCLEAR PLANT

The Road to Recovery

PEOPLE | PROCESSES | PLANT



Nuclear

Welcome to Browns Ferry – an important part of the nuclear fleet at TVA.

We are striving for excellence in our work, in the material condition of our units, and always in their safe operation. When done right, nuclear energy is a low cost option and with TVA's focus on competitive rates, quality performance is the key.

Our goal is to strive for excellence in our people, our processes and our plants. Our focus is not only to achieve excellence in operation and culture but to make it sustainable. TVA is committed to support a healthy nuclear program and as the leaders of the nuclear program at TVA, we are committed to being the best.

We understand the path we are on and the steps we are taking to reach high levels of sustainable, safe and reliable operations. As you review our progress over the past four years at Browns Ferry, keep in mind that:

- Standards make a difference.
- Behaviors matter in how we perform.
- Leadership instills pride across the fleet.

Our goal at Browns Ferry and across the fleet is easy to understand: We will be an industry leader in operational and cultural excellence because that positively impacts those whom we serve every day in the Tennessee Valley.



Preston Swafford
Executive Vice President and Chief Nuclear Officer
Tennessee Valley Authority



THE BROWNS FERRY ROAD TO RECOVERY

PEOPLE





THE BROWNS FERRY ROAD TO RECOVERY – PEOPLE

2009

- **CNO Strategy Deployed**
 - Organization & alignment
 - Action on top priorities
 - Vision & goals
 - Employee Engagement
 - Assess Results & Adjust
- **Nuclear Operating Model Deployed**
 - How We Do Business
 - Common policies, processes & procedures
 - Mission, standards, & values
 - Operating philosophy
 - Roles and Responsibilities
- **Standard Organization Defined**
 - Functional alignment and staffing
- **Focus on Talent Management & Succession Planning**
- **Focus on increasing number of Licensed personnel (RO/SRO)**
- **Initial Organizational Health Survey = 41% positive**

2010

- Improved focus on Organizational Effectiveness:
 - Site leadership and OD consultants
 - Leadership assessments
 - Individual development planning
 - Management Coaching
- Improved Succession Planning and Development:
 - Achieved 82% internal selection rate
- Increased number of Licensed personnel (Added 11 RO/SRO):
 - Increase operational knowledge in line
- Increased site headcount in critical areas:
 - + 16 System Engineers
 - + 12 T&L Instructors
 - + 4 SRO Instructors
- BFN 1 achieved 500-day continuous run for 1st time
- BFN 1 set continuous record run of 586 days



THE BROWNS FERRY ROAD TO RECOVERY – PEOPLE

2011

- BFN Operations Training Accreditation Renewed
- Increased number of Licensed personnel (Added 19 RO/SRO)
- New Level 4 maintenance technician training program with emphasis on:
 - Motor Operated Valves
 - Air operated Valves
 - Breakers
 - Welding
- 2nd Organizational Health Survey = 51% positive
- 3 Unit Record Run – 100 consecutive days
- All 3 units safety systems and plant personnel respond properly following loss of all offsite power from tornadoes





THE BROWNS FERRY ROAD TO RECOVERY – PEOPLE

2012

- Excellent Safety Performance
 - OSHA Injury Rate = 0.10
- Excellent use of ALARA principles
 - Lowest U3 outage dose exposure in 10 years
- Added 13 new Licensed personnel (RO/SRO) – total of 51 since 2009
- Added 91 maintenance staff:
 - 31 I&C
 - 25 Electrical
 - 35 Mechanical
- Overall increase of 13% in plant staffing since 2008:
 - Additional talent in key areas
 - Improved quality of life
- Organizational Health Survey = 57% positive
- 3 Unit Record Run-114 consecutive days

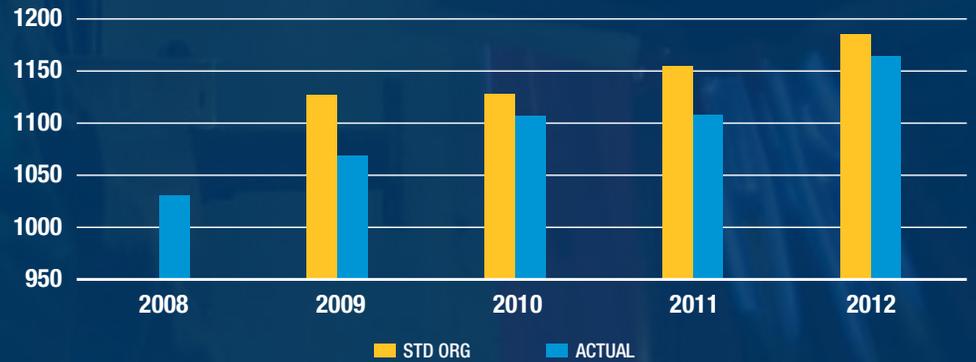


ACTIONS

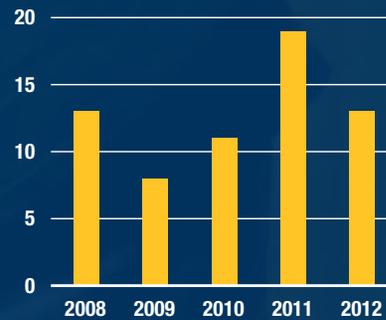
THE BROWNS FERRY ROAD TO RECOVERY – PEOPLE

2009-2012

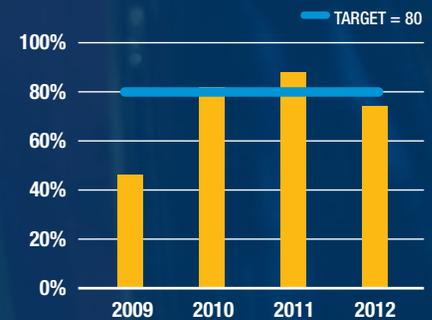
BFN Staffing



Additional BFN Licenses (SROs and ROs)



BFN Internal Selections (supervisor)

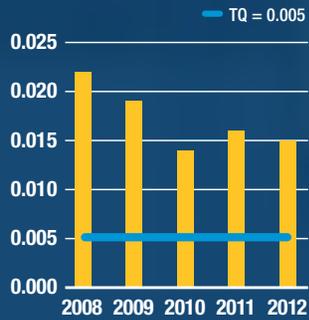


THE BROWNS FERRY ROAD TO RECOVERY – PEOPLE

2009-2012

RESULTS

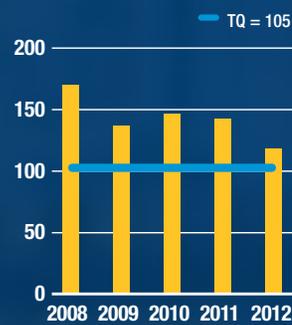
BFN HU Error Rate



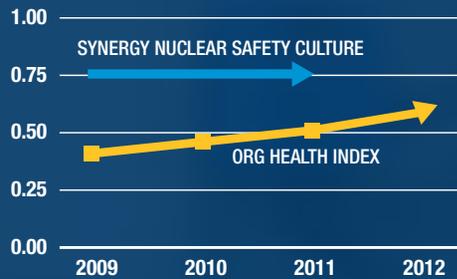
BFN Safety Recordable Injury Rate



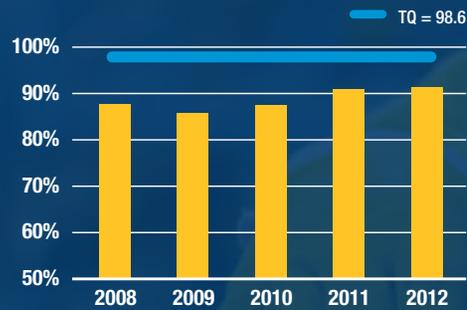
BFN – Collective Rad Exposure



BFN – Organizational Health (Culture)



BFN Equivalent Availability Factor



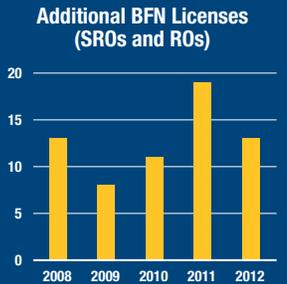
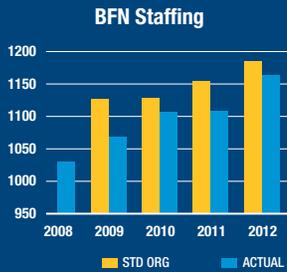
THE BROWNS FERRY ROAD TO RECOVERY – PEOPLE



2009-2012

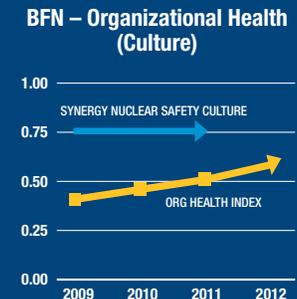
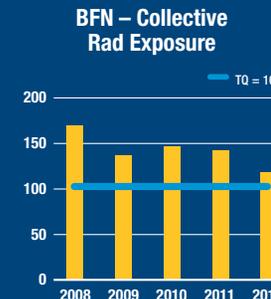
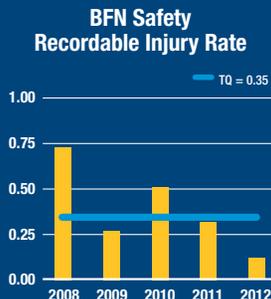
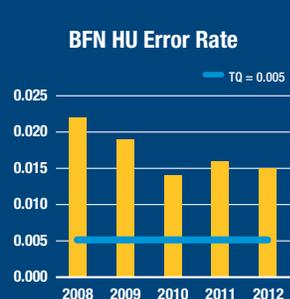


ACTIONS



	2009	2010	2011	2012
92%	<ul style="list-style-type: none"> CNO Strategy Deployed <ul style="list-style-type: none"> Organization & alignment Action on top priorities Vision & goals Employee Engagement Assess Results & Adjust Nuclear Operating Model Deployed <ul style="list-style-type: none"> How We Do Business Common policies, processes & procedures Mission, standards, & values Operating philosophy Roles and Responsibilities Standard Organization Defined <ul style="list-style-type: none"> Functional alignment and staffing Focus on Talent Management & Succession Planning Focus on increasing number of Licensed personnel (RO/SRO) Initial Organizational Health Survey = 41% positive 	<ul style="list-style-type: none"> Improved focus on Organizational Effectiveness: <ul style="list-style-type: none"> Site leadership and OD consultants Leadership assessments Individual development planning Management Coaching Improved Succession Planning and Development: <ul style="list-style-type: none"> Achieved 82% internal selection rate Increased number of Licensed personnel (Added 11 RO/SRO): <ul style="list-style-type: none"> Increase operational knowledge in line Increased site headcount in critical areas: <ul style="list-style-type: none"> + 16 System Engineers + 12 T&L Instructors + 4 SRO Instructors BFN 1 achieved 500-day continuous run for 1st time BFN 1 set continuous record run of 586 days 	<ul style="list-style-type: none"> BFN Operations Training Accreditation Renewed Increased number of Licensed personnel (Added 19 RO/SRO) New Level 4 maintenance technician training program with emphasis on: <ul style="list-style-type: none"> Motor Operated Valves Air operated Valves Breakers Welding 2nd Organizational Health Survey = 51% positive 3 Unit Record Run – 100 consecutive days All 3 units safety systems and plant personnel respond properly following loss of all offsite power from tornadoes 	<ul style="list-style-type: none"> Excellent Safety Performance <ul style="list-style-type: none"> OSHA Injury Rate = 0.10 Excellent use of ALARA principles <ul style="list-style-type: none"> Lowest U3 outage dose exposure in 10 years Added 13 new Licensed personnel (RO/SRO) – total of 51 since 2009 Added 91 maintenance staff: <ul style="list-style-type: none"> 31 I&C 25 Electrical 35 Mechanical Overall increase of 13% in plant staffing since 2008: <ul style="list-style-type: none"> Additional talent in key areas Improved quality of life Organizational Health Survey = 57% positive 3 Unit Record Run-114 consecutive days
91%				
90%				
89%				
88%				
87%				
86%				
85%				
84%				

RESULTS





THE BROWNS FERRY ROAD TO RECOVERY

PROCESSES



THE BROWNS FERRY ROAD TO RECOVERY – PROCESSES

2009

- **CNO Strategy Deployed**
 - Organization & alignment
 - Action on top priorities
 - Vision & Goals
 - Employee engagement
 - Assess results & adjust
- **Nuclear Operating Model Deployed**
 - How We Do Business
 - Common policies, processes & procedures
 - Mission, standards, & values
 - Operating philosophy
 - Roles and Responsibilities
- **Engineering Excellence Plan integrated with CNO Strategy and NPG Focus Areas**
 - Implemented Engineering Peer Team
 - Implemented Engineering Fundamentals
- **Increased focus on human performance & safety**
 - Use of fleet books in turnover and briefs

2010

- New Gap Based Business Planning Rolled Out
 - 29 specific performance metrics with Gaps to Excellence
- Monthly Fleet Metric Report
 - Better understanding of performance and gaps
- Strong Governance & Oversight
 - CFAMS/Standardization
 - Engineering Peer Team
- Central Governance for Training
 - Corporate Training Organization
- Implemented:
 - Equipment Reliability Index
 - System, Component, and Program health monitoring
 - Plant IQ – Condition Monitoring
 - Material Condition Improvement Plans (MCIPS)
- BFN 1 achieved 500-day continuous run for 1st time
- BFN 1 set continuous record run of 586 days





THE BROWNS FERRY ROAD TO RECOVERY – PROCESSES

2011

- Implemented System, Component, and Program health monitoring
- Began use of Long Term Asset Management
- BFN Motor Program receives INPO strength for reliability improvements
- Operations Excellence Plan deployed
 - Improved operations fundamentals
 - Improvements in clearance and tagging processes
 - Improved risk management
 - Improved operations performance management – use of crew metrics
- All 3 units safety systems and plant personnel respond properly following loss of all offsite power from tornadoes
- Record run 100 consecutive days with all 3 units on line



2012

- Implemented Behavior Based Safety Program
 - OSHA Injury Rate = 0.10
- Excellent use of ALARA
 - Lowest U3 outage dose exposure in 10 years
- BFN Integrated Improvement Plan
 - 15 Areas for Improvement
 - 5 Focus Areas
- CAP Vision of Excellence Model
- Established 3-year BFN Project Plan
- Developed Critical Spares Program
- Improved Project Management Oversight Plan
 - Implemented TVA Standards for Project Management (34 Series Procedures)
 - Implemented TVA Capital Project Justification process improvements
- Culture of Excellence model rolled out
- Record run 114 consecutive days with all 3 units on line





ACTIONS

THE BROWNS FERRY ROAD TO RECOVERY – PROCESSES

2009-2012

Training

- CNO Strategy
- Nuclear Operating Model
- Business Plan – Gap Analysis

Corrective Action and Human Performance

- Corrective Action Program – CAP the GAP
- Implemented Behavior Centered Safety Program

Work Management and Outage Execution

- Operations Excellence Plan
- Engineering Excellence Plan integrated with CNO Strategy and NPG Focus Areas

Equipment Reliability

- Implemented System, Component, and Program health monitoring

Governance, Oversight, and Support

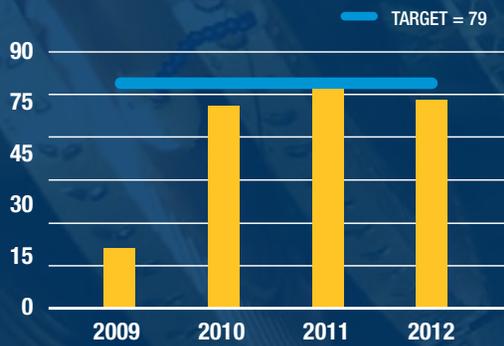
- Long Term Asset Management

THE BROWNS FERRY ROAD TO RECOVERY – PROCESSES

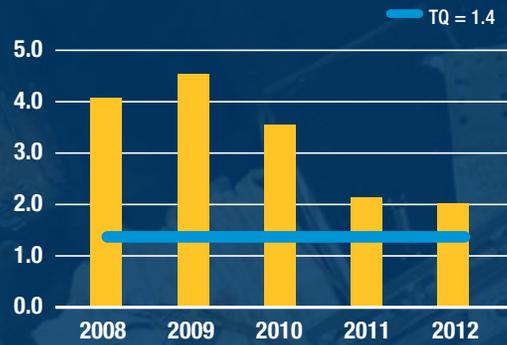
2009-2012

RESULTS

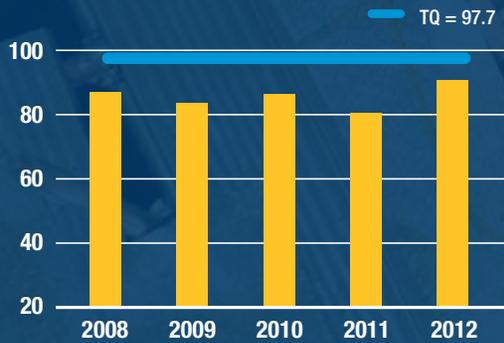
BFN Equipment Reliability Index



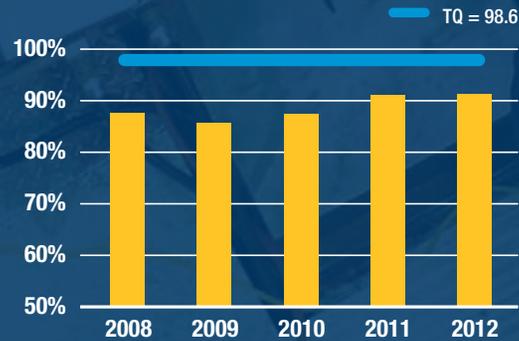
BFN Forced Loss Rate



BFN Net Capacity Factor



BFN Equivalent Availability Factor



THE BROWNS FERRY ROAD TO RECOVERY - PROCESSES

2009-2012



ACTIONS

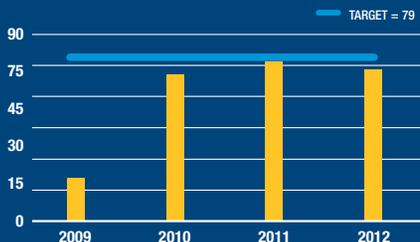


- CNO Strategy
- Nuclear Operating Model
- Business Plan – Gap Analysis
- Corrective Action Program – CAP the GAP
- Implemented Behavior Centered Safety Program
- Operations Excellence Plan
- Engineering Excellence Plan integrated with CNO Strategy and NPG Focus Areas
- Implemented System, Component, and Program health monitoring
- Long Term Asset Management

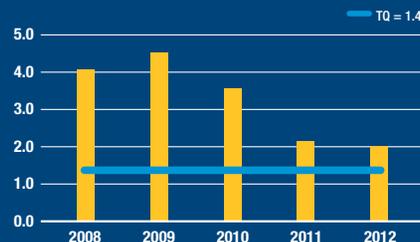
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91%	<ul style="list-style-type: none"> - Mission, standards, & values - Operating philosophy 	<ul style="list-style-type: none"> • Monthly Fleet Metric Report <ul style="list-style-type: none"> - Better understanding of performance and gaps 	<ul style="list-style-type: none"> • Began use of Long Term Asset Management 	<ul style="list-style-type: none"> • Excellent use of ALARA <ul style="list-style-type: none"> - Lowest U3 outage dose exposure in 10 years
90%	<ul style="list-style-type: none"> • Nuclear Operating Model Deployed <ul style="list-style-type: none"> - How We Do Business - Common policies, processes & procedures 	<ul style="list-style-type: none"> • Strong Governance & Oversight <ul style="list-style-type: none"> - CFAMS/Standardization - Engineering Peer Team 	<ul style="list-style-type: none"> • BFN Motor Program receives INPO strength for reliability improvements 	<ul style="list-style-type: none"> • BFN Integrated Improvement Plan <ul style="list-style-type: none"> - 15 Areas for Improvement - 5 Focus Areas
89%	<ul style="list-style-type: none"> - Roles and Responsibilities 	<ul style="list-style-type: none"> • Central Governance for Training <ul style="list-style-type: none"> - Corporate Training Organization 	<ul style="list-style-type: none"> • Operations Excellence Plan deployed <ul style="list-style-type: none"> - Improved operations fundamentals - Improvements in clearance and tagging processes - Improved risk management - Improved operations performance management – use of crew metrics 	<ul style="list-style-type: none"> • CAP Vision of Excellence Model • Established 3-year BFN Project Plan
88%	<ul style="list-style-type: none"> • Engineering Excellence Plan integrated with CNO Strategy and NPG Focus Areas <ul style="list-style-type: none"> - Implemented Engineering Peer Team - Implemented Engineering Fundamentals 	<ul style="list-style-type: none"> • Implemented: <ul style="list-style-type: none"> - Equipment Reliability Index - System, Component, and Program health monitoring - Plant IQ – Condition Monitoring - Material Condition Improvement Plans (MCIPS) 	<ul style="list-style-type: none"> • All 3 units safety systems and plant personnel respond properly following loss of all offsite power from tornadoes 	<ul style="list-style-type: none"> • Developed Critical Spares Program • Improved Project Management Oversight Plan <ul style="list-style-type: none"> - Implemented TVA Standards for Project Management (34 Series Procedures) - Implemented TVA Capital Project Justification process improvements
87%	<ul style="list-style-type: none"> - Increased focus on human performance & safety <ul style="list-style-type: none"> - Use of fleet books in turnover and briefs 	<ul style="list-style-type: none"> • BFN 1 achieved 500-day continuous run for 1st time • BFN 1 set continuous record run of 586 days 	<ul style="list-style-type: none"> • Record run 100 consecutive days with all 3 units on line 	<ul style="list-style-type: none"> • Culture of Excellence model rolled out • Record run 114 consecutive days with all 3 units on line
86%				
85%				
84%				

RESULTS

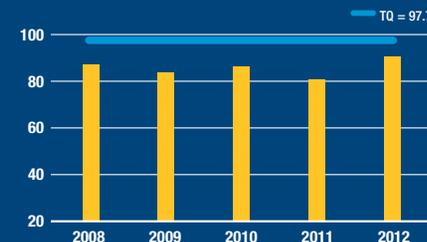
BFN Equipment Reliability Index



BFN Forced Loss Rate



BFN Net Capacity Factor



THE BROWNS FERRY ROAD TO RECOVERY

PLANT





THE BROWNS FERRY ROAD TO RECOVERY – PLANT

2009

- Motor Refurbish/Replacement:
 - A1 RHRSW
 - 2B/D Core Spray
 - 2A CRDM
 - 3D/E Raw Cooling Water
 - 2B/D RHR
- Replaced 3 heat exchanger floating heads
- Main Transformer Replacement

THE BROWNS FERRY ROAD TO RECOVERY – PLANT

2010

- **Motor Refurbish/Replacement:**
 - 3B/D Core Spray
 - 1B CRDM
 - 3B/D RHR
 - 3A/B Reactor Recirc
- **HP Turbine Rotor Replacement/
Steam Leak**
- **11 of 12 heat exchanger floating
heads replaced**
- **Hydrogen Water Chemistry
Modification**
- **On-line Noble Metals Mods**
- **NFPA805 – Fire Protection Mods**
- **Joint Owner Group MOV
Modifications – Unit 1**



2011

- Motor Refurbish/
Replacement:
 - A2 RHRSW
 - 2A/C Core Spray
 - 2A/3A CCW
 - 2A/C RHR
- 2A Reactor
Recirculation Pump
Seal Replacement
- Fire Pump A
- H₂/O₂ Analyzer
Replacement
- Raw Service Water
Valve Replacement
- Generator Circuit
Breaker Upgrades
- Diesel Generators:
 - Speed Switch Upgrade
 - New Heat Exchangers
 - Air System Cactus
Dryers and Batteries
- ADS Mods for AREVA
Fuel Transition
- Flow Accelerated
Erosion/Corrosion –
Pipe Replacement
- Joint Owner
Group MOV
Modifications – Unit 2
- U2 Drywell DP
Compressor
Replacement
- Unit 2 Automatic
Voltage Regulator
Replacement
- GE AK Low Voltage
Circuit Breaker
Replacement
- NFPA805 – Fire
Protection Mods
- 95003 – Recovery

THE BROWNS FERRY ROAD TO RECOVERY – PLANT

2012

- **ABB** Motor Refurbish/Replacement:
 - 3A/C Core Spray
 - 3A CRDM
 - 3A/C RHR
 - 3A/B/C CBP
 - 3A/B/C Condensate
 - 3A 5A/B 6A/B CTLP
- 3B Reactor Recirculation Pump Seal Replacement
- Generator Circuit Breaker Upgrades
- Main Transformer Replacement
- Unit 3 Automatic Voltage Regulator Replacement
- Joint Owner Group MOV Modifications – Unit 3
- Replace CR 120 Relays
- Diesel Generator reliability improvements
- NFPA805 – Fire Protection Mods
- GE AK Low Voltage Circuit Breaker Replacement
- 95003 – Recovery
- #7 Cooling Tower addition





THE BROWNS FERRY ROAD TO RECOVERY – PLANT

2013

- Motor Refurbish/
Replacement:
 - 1 RHRSW
 - 1 RHR
 - 1 Core Spray
 - 1 CRD
 - 1 CCW
 - 2 RCW
- HPCI Steam addition
valve 73-16 (3 units)
- AUX Boiler Controls
- Chiller Roof/Off Gas
Dehumidification
- Chiller Replacement/
Replace Obsolete
Sample Chillers –
RWCU/Cond (6 total)
- Complete Masterpact
Breaker Replacement
- Generator breaker
Replacement/CT
Replacement
- Voltage Regulator
Replacement
- Diesel Generator life
extension and
reliability (Power
Packs, Lube oil Mod,
Governor Redundant
Start)
- ADS Mods for AREVA
Fuel Transition
- Flow Accelerated
Erosion/Corrosion
Additional Pipe
Replacement
- Raw Water Cleanup
Check Valve
Replacement
- 95003 – Recovery
- NFPA 805 – Fire
Protection Mods



THE BROWNS FERRY ROAD TO RECOVERY – PLANT

2009-2012



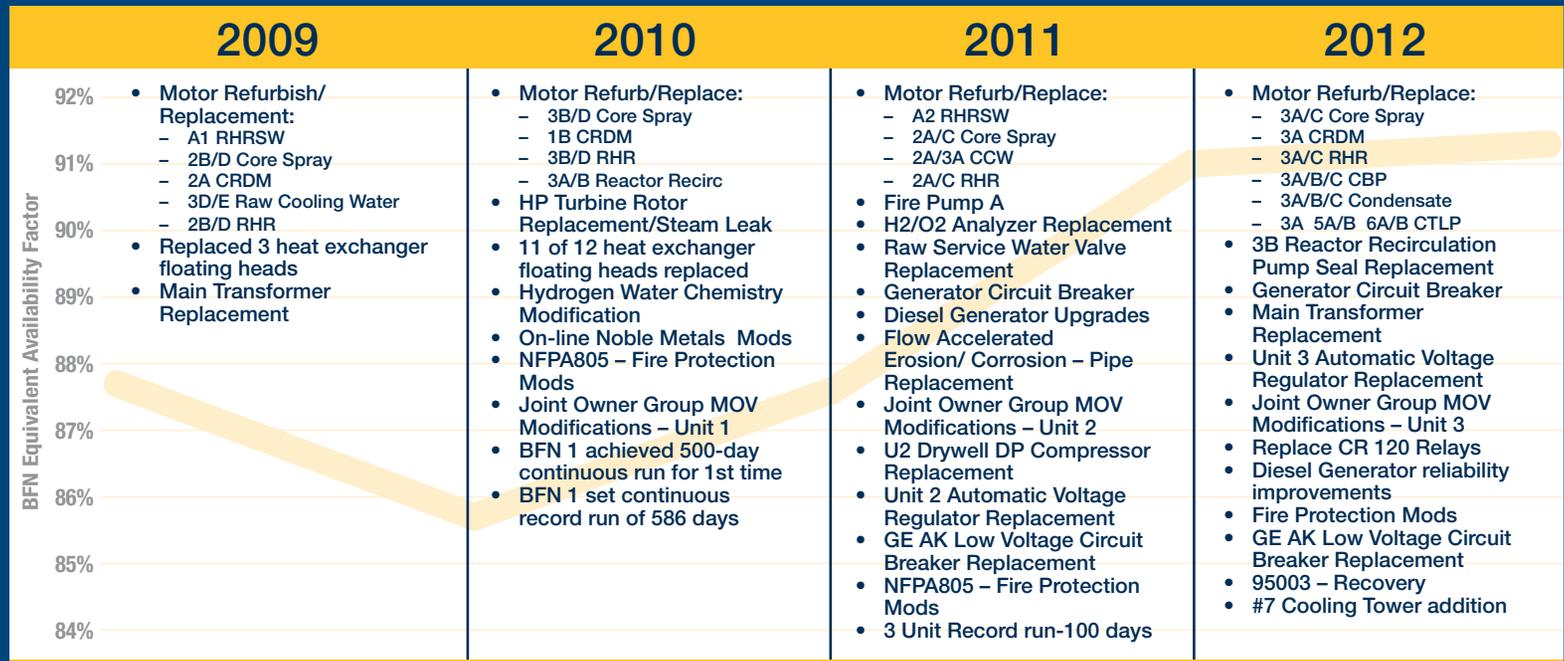
ACTIONS

Additional Plant Investments

Incremental Increase by Year	Capital	O&M
2009	N/A	\$34M
2010	\$27M	\$70M
2011	\$81M	\$26M
2012	\$99M	\$70M

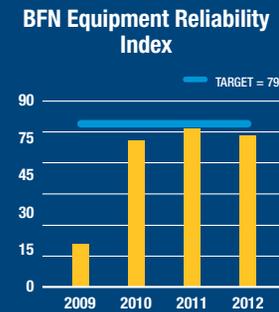
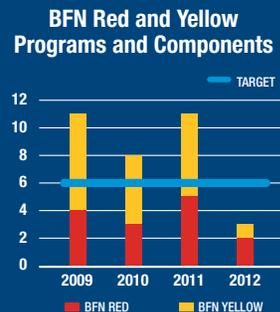
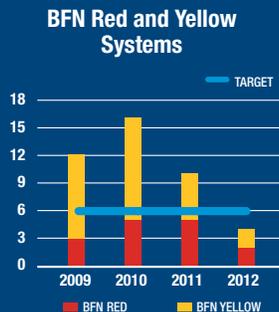
Reliability Improvements

- Significant Motor replacements
- Heat exchanger head replacements
- Transformer replacements
- Diesel Generator Reliability Improvements
- Motor Operated Valve upgrades, etc.

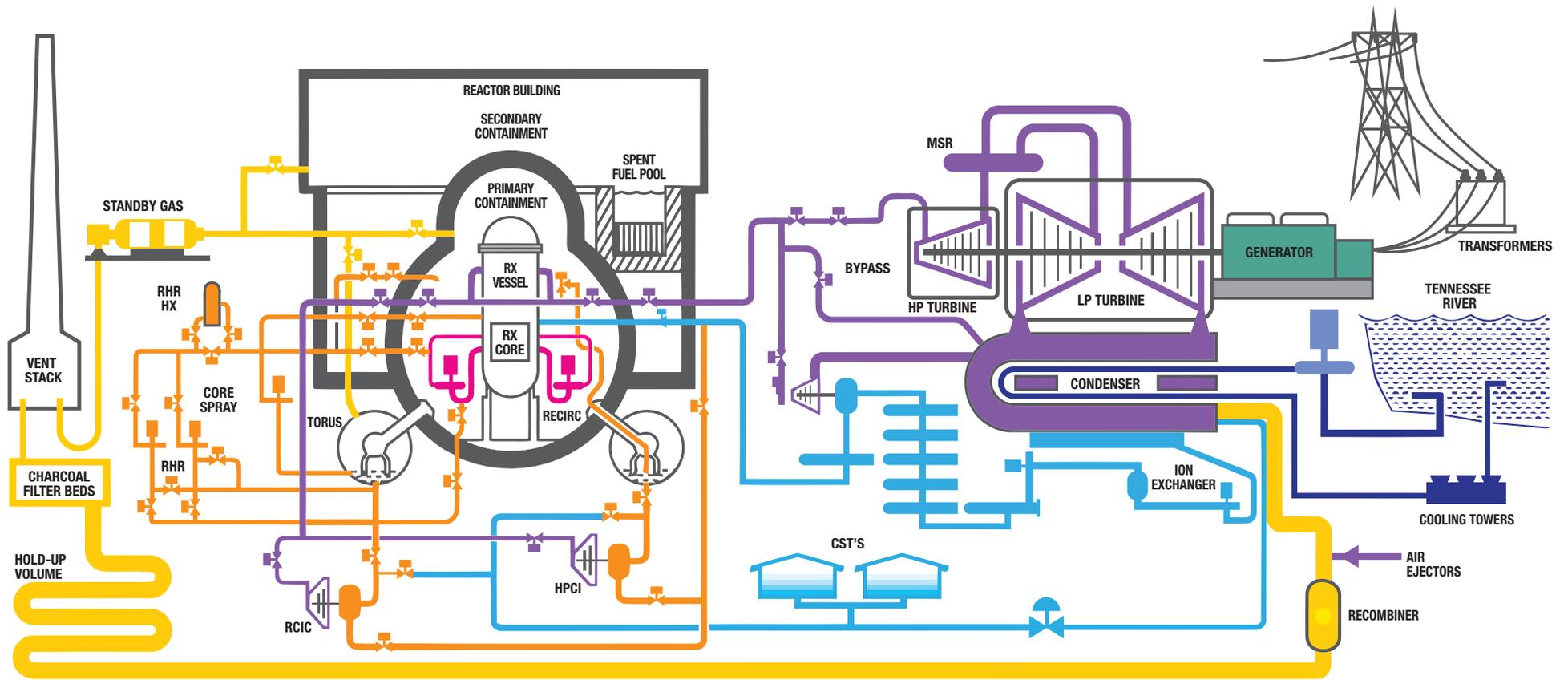


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RESULTS



Material Condition Improvements

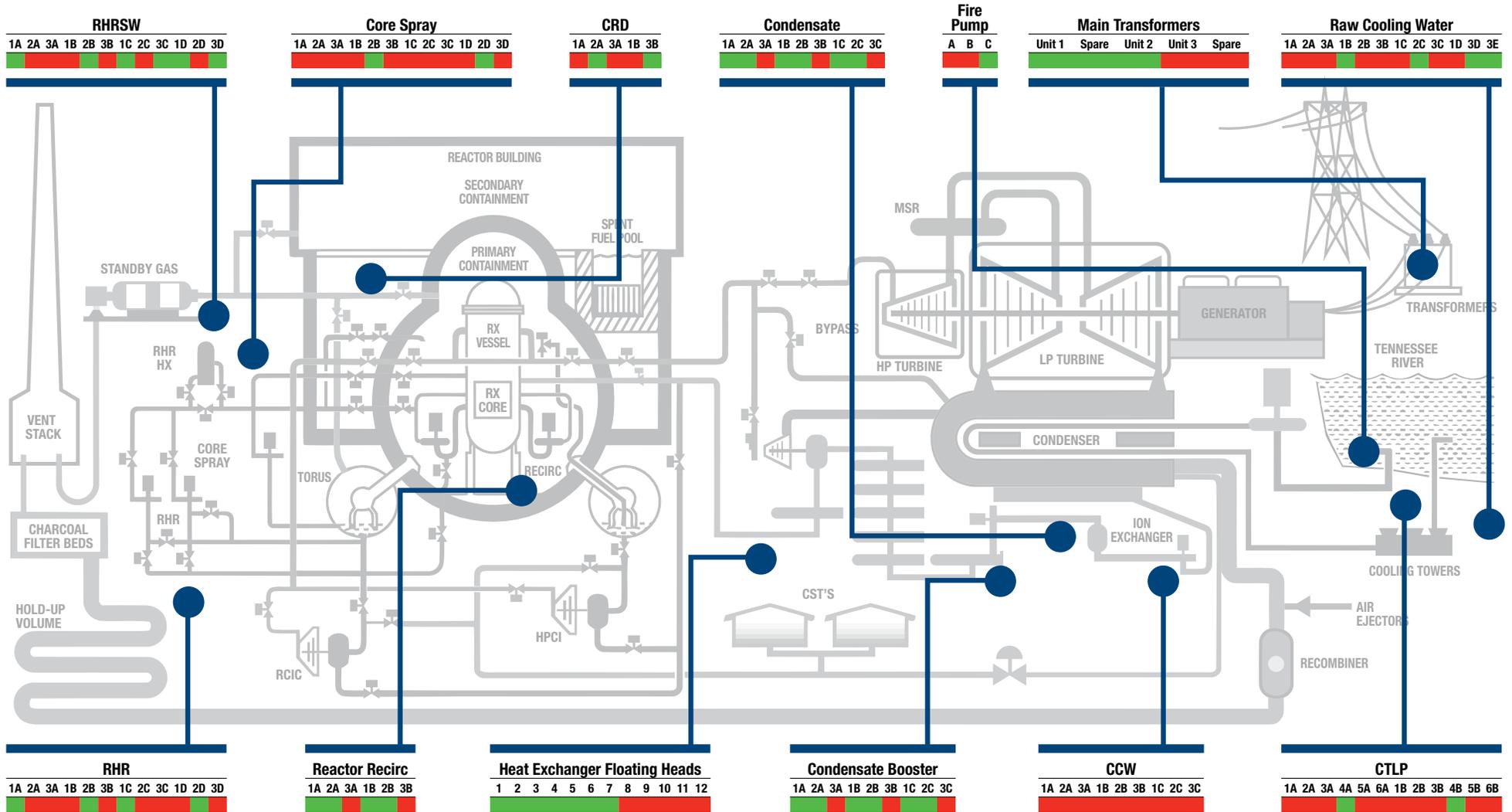


2009

Capital (N/A)
O&M (\$34M)

Component/System Material Condition Status

- Meeting NPG Expectations for Excellence
- Meet Regulatory Requirements, but not meeting NPG Expectations for Excellence



2010

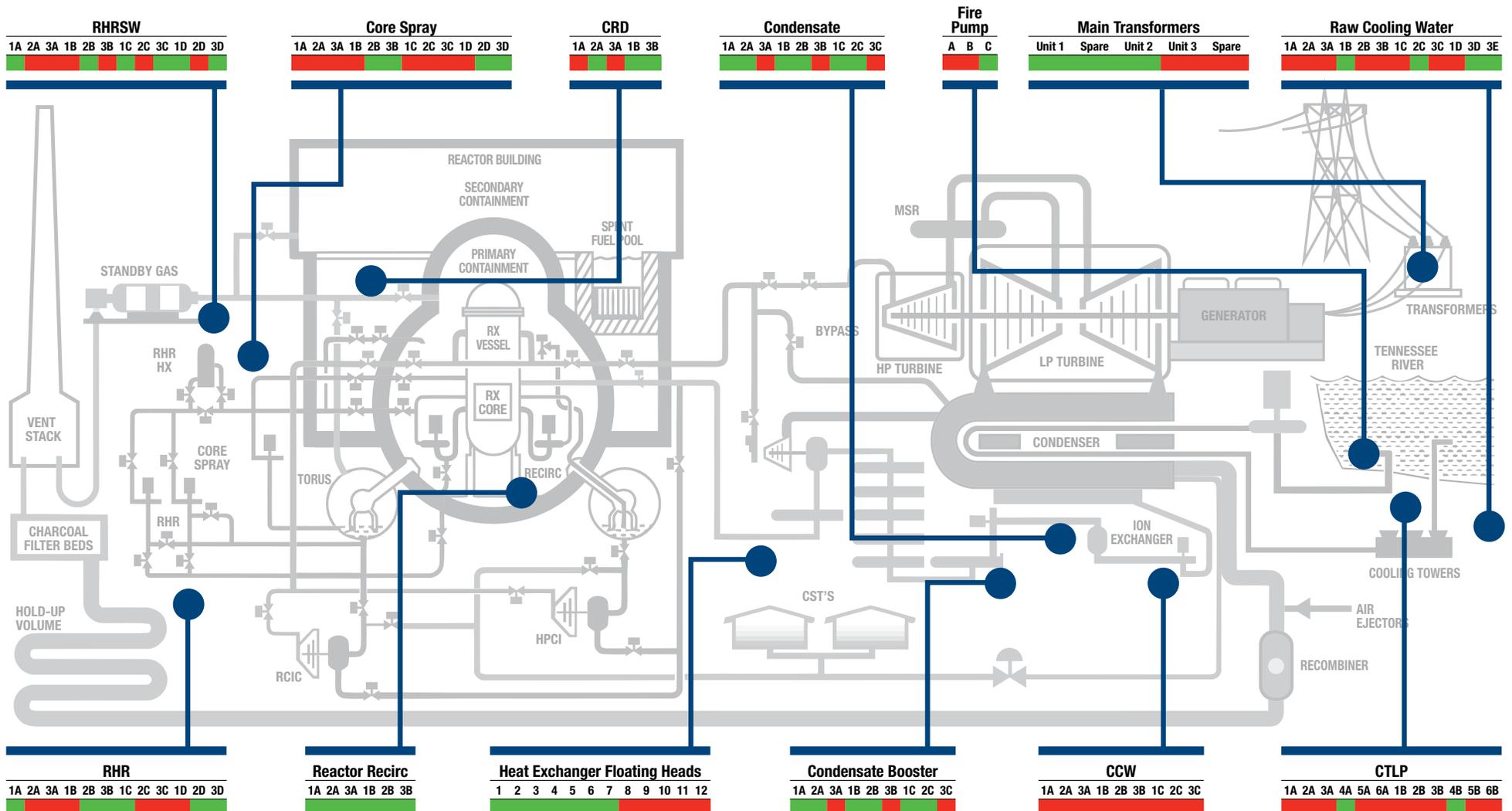
Capital (\$27M)
O&M (\$70M)

Component/System Material Condition Status

- Meeting NPG Expectations for Excellence
- Meet Regulatory Requirements, but not meeting NPG Expectations for Excellence

2010 Overall Plant Improvements

- Recirc RBCCW Pipe Replacement
- Joint Owners Group MOV Modifications
- Hydrogen Water Chemistry Improvements
- NFPA805 – Fire Risk Reduction



2011

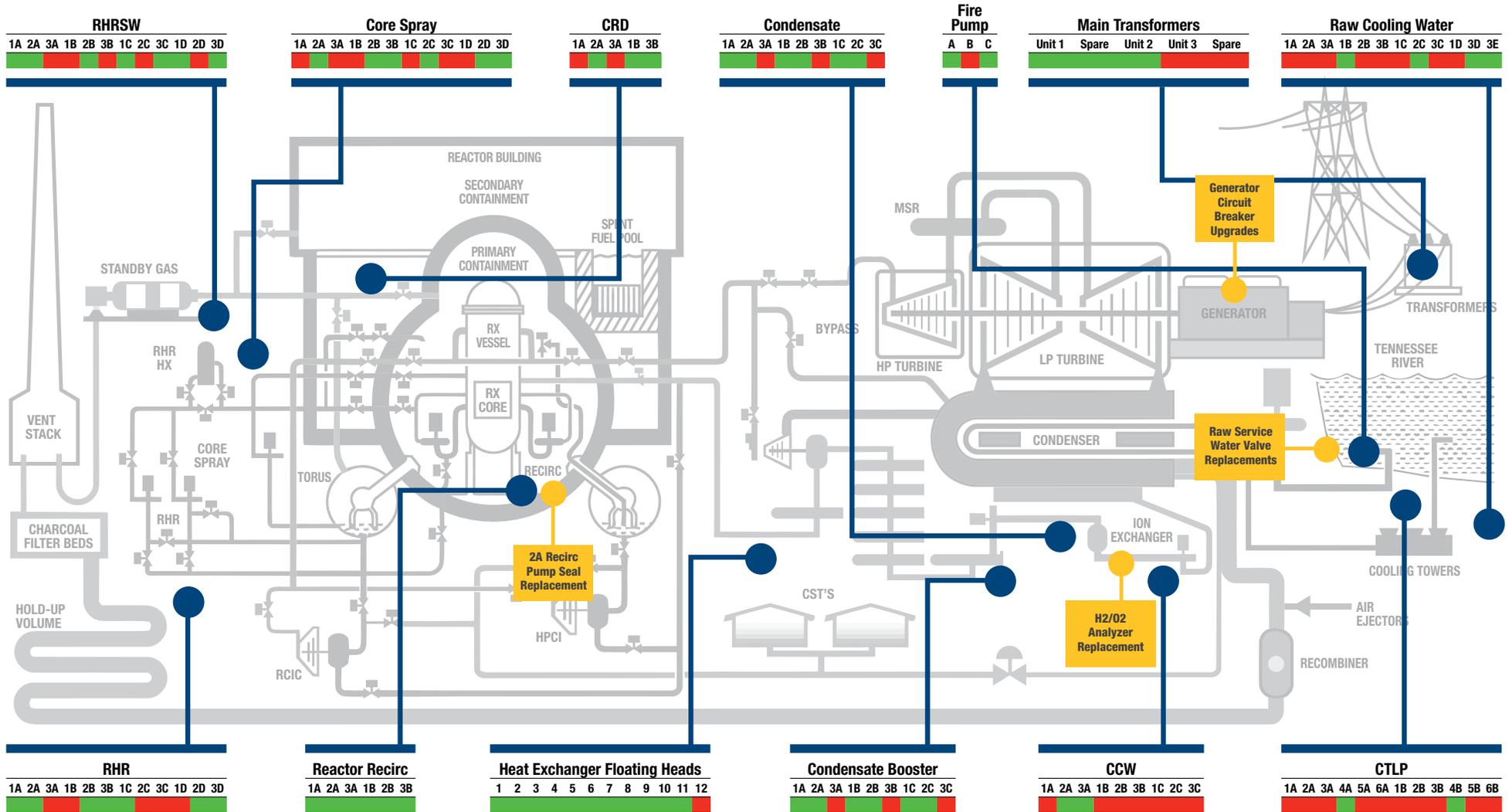
Capital (\$81M)
O&M (\$26M)

Component/System Material Condition Status

- Meeting NPG Expectations for Excellence
- Meet Regulatory Requirements, but not meeting NPG Expectations for Excellence

2011 Overall Plant Improvements

- 95003 – Recovery
- ADS Mods for AREVA Fuel Transition
- Flow Accelerated Erosion/Corrosion
- Joint Owners Group MOV Modifications
- GE AK Low Voltage Circuit Breaker Replacement
- NFPA805 – Fire Risk Reduction
- Diesel Generator Life extension and reliability



2012

Capital (\$99M)
O&M (\$70M)

Component/System Material Condition Status

- Meeting NPG Expectations for Excellence
- Meet Regulatory Requirements, but not meeting NPG Expectations for Excellence

2012 Overall Plant Improvements

- Diesel Generator Life Extension and Reliability
- NFPA805 – Fire Risk Reduction
- GE AK Low Voltage Circuit Breaker Replacement
- 95003 – Recovery

