

Davis-Besse RI-IST Submittal for AOVs

- Ken Byrd - PSA Engineer
- Greg Estep - AOV Component Engineer
- Brett Gallatin - Supervisor - Codes
- Tim Thompson - IST Engineer
- Gerry Wolf - Licensing Engineer

Davis-Besse RI-IST Submittal for AOVs

- Objectives
 - ◆ Gain NRC Acceptance of Davis-Besse Submittal
 - ◆ Present Davis-Besse AOV Program Details

RI-IST Demonstration Project

- Topical Report BAW-2359
 - ◆ Davis-Besse is B&WOG Lead Plant
 - ◆ B&WOG approach follows ASME RI-IST Methodology and RG 1.175
 - ◆ B&WOG Topical Report contains generic RI-IST Program Description
 - Modify test strategy for other component types
 - ◆ Plant-specific implementation by referencing and/or adapting Program description in Topical Report

Davis-Besse Submittal

- Serial 2668
 - ◆ Requests Alternative to 10 CFR 50.55a(f)
 - ◆ AOVs Target Component
 - ◆ Process will apply to other target components
 - ◆ Code of Record Update for remaining components

Davis-Besse Submittal

- Key Points
 - ◆ Takes credit for the AOV Program to satisfy IST Program Objectives
 - ◆ Utilizes ASME Code Cases for Categorization and Test Strategies
 - ◆ Utilizes B&WOG Demonstration Project as Snapshot of differences in Safety Significant Equipment at B&W Plants
 - ◆ Meets minimum requirements of the JOG AOV Program

Davis-Besse AOV Program

- AOV Program Elements
 - ◆ Scope & Categorization
 - ◆ Design Basis Reviews
 - ◆ Setpoint Control
 - ◆ Testing
 - ◆ Preventive Maintenance
 - ◆ Training
 - ◆ Feedback
 - ◆ Documentation/Data Management
 - ◆ Tracking & Trending

Davis-Besse AOV Program

- Scope
 - ◆ AOV Inclusion Criteria
 - ✦ AOVs modeled explicitly or implicitly in the PSA
 - ✦ AOVs confirmed to actively support a Maintenance Rule Function
 - Emergency Operating Procedure Function
 - ✦ AOVs currently in the IST Program
 - ✦ All Q-Related AOVs
 - ✦ All AQ-Related AOVs
 - ✦ All PQ-Related AOVs
 - ✦ Historical Poor Performers

Davis-Besse AOV Program

- Categorization
 - ◆ OMN-3 Code Case
 - ✦ HSSC/LSSC Determination
 - ✦ Importance Measures
 - Fussell-Vesely (F-V)
 - Risk Achievement Worth (RAW)
 - ✦ Sensitivity Studies
 - ✦ Qualitative Assessments
 - ✦ Aggregate Risk
 - ✦ Expert Panel

Davis-Besse AOV Program

- Categorization
 - ◆ Davis-Besse PSA Analysis
 - ✦ Pilot for B&WOG Peer Certification Review Process in November 1999
 - ✦ Update process in place to reflect plant changes including changes to component reliability
 - ✦ Analysis provided Level 1 (CDF) and Level 2 (LERF) results

Davis-Besse AOV Program

- Categorization
 - ◆ Davis-Besse PSA Analysis
 - Key initiating events are explicitly modeled
 - PSA Analysis for AOV risk ranking performed at truncation sufficient to generate about 40,000 cutset
 - Level 3 PSA Model recently completed and external event modeling is in progress

Davis-Besse AOV Program

- Categorization
 - ◆ Davis-Besse PSA Analysis
 - Calculation of Fussell-Vesely and Risk Achievement Worth
 - Sensitivity Studies
 - Data Uncertainties
 - Testing and Maintenance Unavailabilities
 - Human Actions
 - LSSC Failure Rates
 - Common Cause
 - Truncation

Davis-Besse AOV Program

- Categorization
 - ◆ Davis-Besse PSA Analysis
 - Importance Measures
 - $F-V > 0.005$
 - $RAW > 2$
 - Design Criteria
 - Quadrant A
 - $F-V < 0.005$ and $RAW < 2$
 - Quadrant B
 - $F-V < 0.005$ and $RAW > 2$
 - Quadrant C
 - $F-V > 0.005$ and $RAW > 2$
 - Quadrant D
 - $F-V > 0.005$ and $RAW < 2$

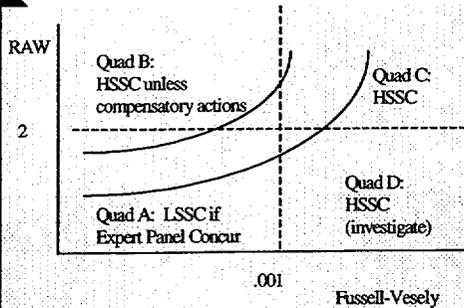
Davis-Besse AOV Program

- Categorization
 - ◆ Davis-Besse PSA Analysis
 - ✦ Aggregate Risk
 - All LSSC AOVs set to Maximum Interval
 - Sensitivities were performed to evaluate impact of higher failure rate
 - Δ CDF and Δ LERF effectively zero

Davis-Besse AOV Program

- Categorization
 - ◆ Expert Panel Decision Criteria
 - ◆ Quantitative
 - ✦ Importance Measures
 - Modeled Components
 - F-V > 0.001
 - RAW > 2
 - Non-modeled Components
 - Redundant Train
 - Quad Chart
 - 4 Quadrants

Importance Classification



Davis-Besse AOV Program

- Categorization
 - ◆ Expert Panel Decision Criteria
 - ✦ Qualitative
 - Modeled/Non-Modeled IST Components
 - Impact of Initiating Events
 - Consequences of Shutdown
 - Response to External Events
 - Conditions and Events not Modeled
 - Prevent or Mitigate Accidents
 - Reach/Maintain Safe Shutdown
 - Preserve Reactor Coolant Pressure Boundary
 - Maintain Containment Integrity

Davis-Besse AOV Program

- Categorization
 - ◆ Expert Panel Decision Criteria
 - ✦ Qualitative
 - Additional Assessments
 - Safety Function
 - Redundancy
 - Ability to recover from failure
 - Performance History
 - Technical Specifications
 - EOP Functions
 - ✦ Consensus/Reconciliation

Davis-Besse AOV Program

- Categorization
 - ◆ Expert Panel Decision Criteria
 - ✦ Expert Panel Composition
 - Operations, PSA, Regulatory Affairs, Maintenance, Systems, IST, Component
 - ✦ Documentation of Basis
 - DB-PF-00003 - Maintenance Rule
 - HSSC/LSSC Decision Criteria
 - DB-PF-01000 - Programs
 - AOV Program Scoping Sheet

Davis-Besse AOV Program

- Categorization
 - ◆ 3 Categories
 - ✦ Category 1
 - Active, HSSC
 - ✦ Category 2
 - Active, LSSC or Expert Panel Deliberations
 - ✦ Category 3
 - Active/Passive LSSC, or Remaining Safety-Related not Category 1 or 2, or Expert Panel Deliberations

Davis-Besse AOV Program

- Categorization
 - ◆ Grouping
 - ✦ Category 1 & 2
 - Grouped based upon valve, actuator and service conditions
 - ✦ Category 3
 - Based on Actuator
 - Cross pollination with Category 1 & 2

Davis-Besse AOV Program

- Active Definition
 - ◆ IST Definition
 - ✦ IWA-9000 (1986 Code)
 - A valve that must perform a mechanical motion during the course of accomplishing a system safety function
 - ✦ ISTC 1.3 (1996 Addenda)
 - Valves that are required to change obturator position to accomplish the required function(s) as specified in para. ISTC 1.1

Davis-Besse AOV Program

- Active Definition
 - ◆ PSA Model Definition
 - ✦ AOVs explicitly modeled
 - Failure Modes Analyzed
 - Fail to Open
 - Fail to Close
 - Fail to Remain Open
 - Fail to Remain Closed

Davis-Besse AOV Program

- Active Definition
 - ◆ AOVs in non-safety position
 - ✦ Ultimately determined by SRO
 - Maintenance
 - Operability determined by SRO Review
 - Testing
 - Operability typically addressed by Procedure

Davis-Besse AOV Program

- Design Basis Reviews
 - ◆ Category 1
 - ✦ Vendor supplied data under 10 CFR 50 Appendix B
 - ✦ First Principles
 - ✦ Available Validated Methodologies
 - ✦ Valve/Actuator Weak Link
 - ◆ Category 2
 - ✦ Vendor supplied available data
 - ✦ First Principles
 - ✦ Available Validated Methodologies

Davis-Besse AOV Program

- Design Basis Reviews
 - ◆ Category 3
 - ✦ Based upon issues identified during DBRs of Category 1 & 2

Davis-Besse AOV Program

- Design Basis Reviews
 - ◆ System Level Reviews
 - ✦ Minimum and Maximum Worst Case Operating Conditions
 - ◆ Component Level Reviews
 - ✦ Valve minimum required thrust or torque
 - ✦ Actuator Capability
 - ✦ Margin

Davis-Besse AOV Program

- Design Basis Reviews
 - ◆ Margin
 - ✦ Acceptable is > 0% including all uncertainties and degradations
 - ✦ Margin improvement for the AOVs with < 20% margin
 - ◆ Verification of Component Capabilities
 - ✦ Solenoid, Positioner, Controller, Booster, Regulator, Other Accessories

Davis-Besse AOV Program

- Design Basis Reviews
 - ◆ Degradation
 - ↳ Valves
 - Valve & Bearing Friction
 - EPRI PPM Bounding Values
 - Dynamic Testing
 - JOG Periodic Verification
 - ↳ Actuators/Accessories
 - Spring relaxation
 - Setpoint Drift
 - Actuator Friction

Davis-Besse AOV Program

- Setpoint Control
 - ◆ Controlled via the Mod Process
 - ↳ Procedure NG-EN-00301
 - ◆ Maintained on a Setpoint List
 - ↳ Drawing M720-I
 - ◆ Field Implementation via I&C Data Package
 - ↳ Procedure DB-MI-00001

Davis-Besse AOV Program

- Setpoint Control
 - ◆ Source
 - ↳ Category 1 & 2 AOVs
 - Established/Confirmed via DBR
 - ↳ Category 3
 - Vendor Supplied Values
 - ◆ Controlled Setpoints
 - ↳ Regulator
 - ↳ Bench Set
 - ↳ Travel

Davis-Besse AOV Program

- Testing
 - ◆ Category 1
 - ✦ Baseline
 - Stroke Time & Diagnostic
 - Static
 - Dynamic if appropriate
 - Confirm Setpoints
 - Establish Reference Parameters
 - ✦ Periodic
 - Stroke Time & Diagnostic
 - Static
 - Dynamic if appropriate
 - Verification of Setpoints
 - Verification of Reference Parameters
 - Potential Degradation

Davis-Besse AOV Program

- Testing
 - ◆ Category 2
 - ✦ Baseline
 - Diagnostic
 - Static
 - Confirm Setpoints
 - Establish Reference Parameters
 - ✦ Periodic
 - Diagnostic
 - Static
 - Verification of Setpoints
 - Verification of Reference Parameters
 - Potential Degradation

Davis-Besse AOV Program

- Testing
 - ◆ Category 3
 - ✦ Baseline
 - Pre/Post Maintenance Diagnostic
 - Static
 - Confirm Setpoints
 - Establish Reference Parameters
 - ✦ Periodic
 - Pre/Post Maintenance Diagnostic
 - Static
 - Verification of Setpoints
 - Verification of Reference Parameters
 - Cross Pollination with Category 1 & 2

Davis-Besse AOV Program

- Testing
 - ◆ Acceptance Criteria
 - ↳ Category 1
 - Stroke Time
 - Setpoints
 - Margin
 - ↳ Category 2
 - Margin
 - Setpoints
 - ↳ Category 3
 - Setpoints

Davis-Besse AOV Program

- Testing
 - ◆ Test Intervals - Performance Based
 - ↳ Category 1
 - Once per cycle going to once per two cycles max
 - ↳ Category 2
 - Once per three cycles going to once per five cycles max
 - ↳ Category 3
 - Once per five cycles max

Davis-Besse AOV Program

- Preventive Maintenance
 - ◆ Applies to Category 1, 2 & 3
 - ↳ EPRI Template
 - ↳ Davis-Besse Experience
 - ↳ Industry Experience
 - ◆ Focus on Elastomer Replacement
 - ◆ Replacement of Accessories
 - ◆ Actuator/Valve Inspections
 - ◆ Packing

Davis-Besse AOV Program

- Preventive Maintenance
 - ◆ Procedures
 - ✦ Category 1
 - Valve/Actuator Specific
 - Inspection
 - Repair
 - Rebuild
 - ✦ Category 2 & 3
 - May be Valve/Actuator Specific
 - Inspection
 - Repair
 - Rebuild

Davis-Besse AOV Program

- Preventive Maintenance
 - ◆ Procedures
 - ✦ Diagnostic
 - ✦ Calibration

Davis-Besse AOV Program

- Training
 - ◆ Mechanical
 - ✦ Valve Inspection/Repair/Rebuild
 - ✦ Packing
 - ◆ I&C
 - ✦ Actuator Inspection/Repair/Rebuild
 - ✦ Calibration
 - ✦ Setpoint Control
 - ✦ Diagnostics

Davis-Besse AOV Program

- Training
 - ◆ Engineering
 - ✦ Calculations
 - ✦ Software
 - ✦ Diagnostic
 - Test Methods
 - Trace Interpretation

Davis-Besse AOV Program

- Tracking & Trending
 - ◆ Category 1
 - ✦ Setpoints
 - Regulator Setpoint
 - Bench Set
 - Travel
 - ✦ Reference Parameters
 - Valve/Actuator Friction
 - Seating Force
 - Unseating Force
 - Stroke Time

Davis-Besse AOV Program

- Tracking & Trending
 - ◆ Category 2 & 3
 - ✦ Setpoints
 - Regulator Setpoint
 - Bench Set
 - Travel
 - ✦ Reference Parameters
 - Valve/Actuator Friction
 - Seating Force
 - Unseating Force

Davis-Besse AOV Program

- Tracking & Trending
 - ◆ Program Effectiveness
 - ✦ Corrective Work Orders
 - ✦ Preventive Work Orders
 - ✦ Condition Reports
 - ✦ Corrective Actions

Davis-Besse AOV Program

- Feedback
 - ◆ General
 - ✦ INPO EPIX Database
 - ✦ NRC Communication
 - ✦ EPRI
 - ◆ Scope & Categorization
 - ✦ Confirmation by Expert Panel
 - Work Orders
 - Condition Reports
 - PSA Updates
 - Maintenance Rule

Davis-Besse AOV Program

- Feedback
 - ◆ Design Basis
 - ✦ Testing Values
 - Friction
 - Seating/Unseating
 - Potential Degradation Where Dynamically Tested
 - ◆ Preventive Maintenance
 - ✦ Performance History
 - Work Orders
 - Condition Report
 - Inspection Procedures

Davis-Besse AOV Program

- Documentation/Data Management
 - ◆ AOV Program Document
 - ◆ Bases Documents
 - ✦ Scoping & Categorization
 - ✦ Preventive Maintenance
 - ◆ Guidelines
 - ✦ Calculation Methodologies
 - ◆ Calculations
 - ✦ System/Valve/Actuator/Margin

Davis-Besse AOV Program

- Documentation/Data Management
 - ◆ Setpoint List
 - ◆ Test Results
 - ◆ Tracking & Trending Reports
 - ◆ Training Records
- All records available at the site or upon specific request.

Davis-Besse Programs

- Air System Quality
 - ◆ Station/Instrument Air System
 - ✦ Original Plant Design
 - 2 Oil-Free Reciprocating Compressors
 - 100% Capacity
 - 1 Dryer
 - 100% Capacity
 - Coalescing Pre-filter >0.6 Microns
 - Particulate After-filter > 0.9 Microns
 - Point of Use Filter/Regulators

Davis-Besse Programs

- Air System Quality
 - ◆ Station/Instrument Air System
 - ♦ Modifications
 - Added 1 Oil-Free Centrifugal Compressor
 - 100% Capacity
 - Added 1 Dryer
 - 100% Capacity
 - Larger Station Air Automatic Blowdown Drain Valves
 - Improved Station Air Receiver Moisture Traps

Davis-Besse Programs

- Air System Quality
 - ◆ Station/Instrument Air System
 - ♦ Monitoring
 - Dewpoint
 - In-service IA Dryer Parameters monitored each shift
 - Inlet/Outlet Pressures
 - Moisture Indication
 - Filter D/Ps
 - Sampling of Safety-Related AOV Accumulators for Moisture and Particulate

Davis-Besse Programs

- Air System Quality
 - ◆ Station/Instrument Air System
 - ♦ Preventive Maintenance
 - Desiccant Replacement
 - Pre-filter/After-filter Replacement
 - Dryer Valve Maintenance
 - Dryer Solenoid Replacement
 - Moisture/Particulate Check of all AOV Accumulator Tanks
 - Point of use Filter/Regulator Replacement

Davis-Besse Programs

- Dampers
 - ◆ Scoping
 - Safety-Related Dampers in HVAC Systems
 - ◆ Categorization
 - Expert Panel Deliberation Results
 - No dampers in Category 1 or 2
 - All Safety-Related Dampers in Category 3
 - CREVs
 - ECCS Room Isolation Dampers

Davis-Besse Programs

- Dampers
 - ◆ Testing & Maintenance Strategy
 - Preventive Maintenance
 - Dampers
 - Inspection of Seats
 - Lubrication
 - Actuators
 - Leak Check
 - Replacement of elastomers
 - Replacement of accessories

Davis-Besse Programs

- Dampers
 - ◆ Testing & Maintenance Strategy
 - Testing
 - Stroke Time at Design Basis Conditions
 - Positive Pressure

Summary

- Gain NRC Acceptance of Davis-Besse Risk-Informed IST Submittal
 - ◆ Inter-Related Programs
 - ✦ AOV Program
 - ✦ PM Program
 - ✦ Instrument Air Quality Program
 - ✦ Maintenance Rule Program
 - ✦ Damper Program
 - ✦ LLRT Program
