

UNITED STATES NUCLEAR REGULATORY COMMISSION

DAVIS-BESSE REACTOR VESSEL HEAD DEGRADATION

LESSONS LEARNED TASK FORCE

**DEFENSE NUCLEAR FACILITIES SAFETY BOARD
PUBLIC MEETING**

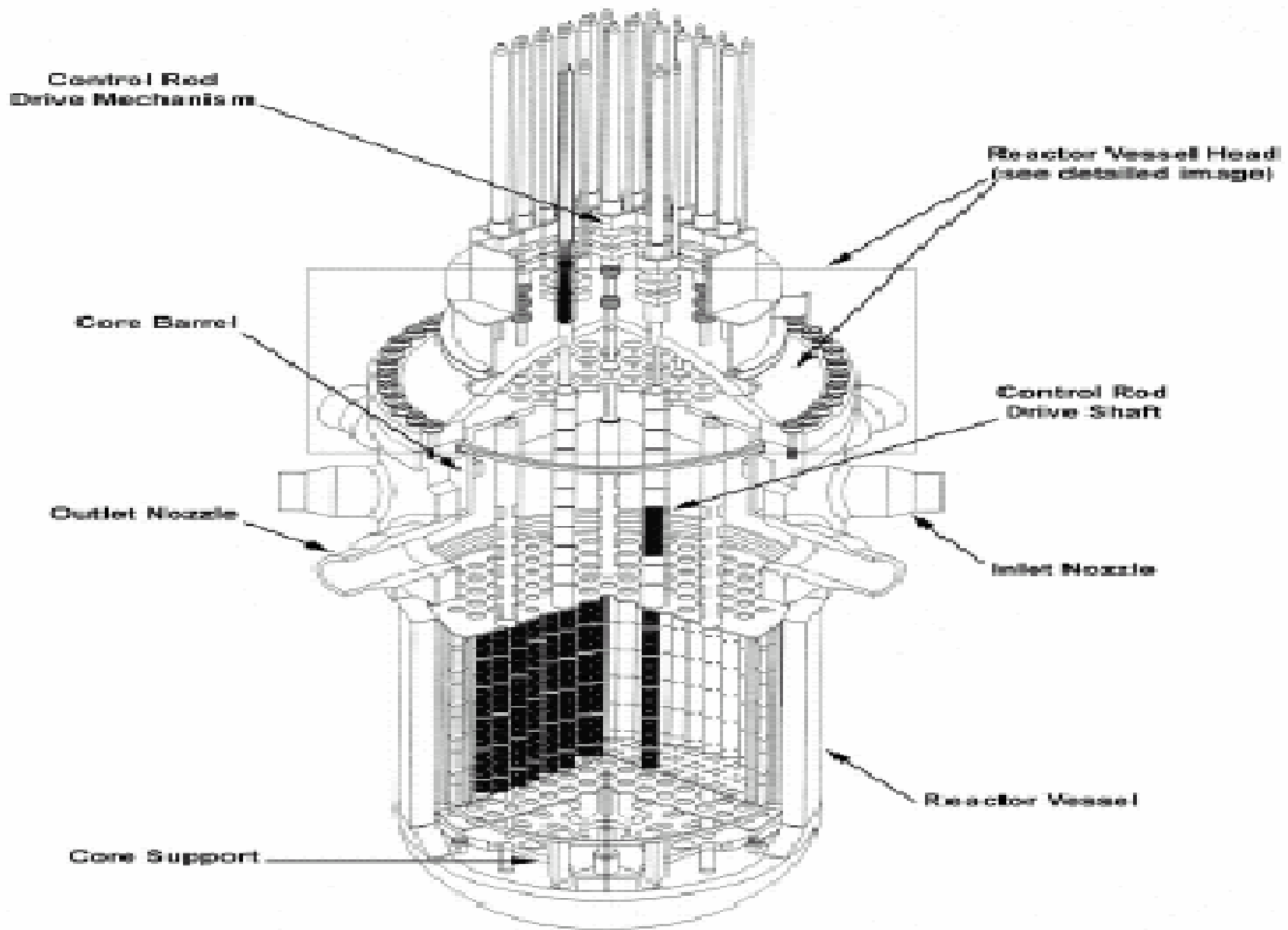
September 10, 2003

**Ed Hackett, Project Director
Project Directorate II
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
EMH1@NRC.GOV**

DAVIS-BESSE REACTOR VESSEL HEAD DEGRADATION BACKGROUND

- ❑ FEBRUARY, 2002 - CORROSION CAVITY DISCOVERED ON THE DAVIS-BESSE REACTOR VESSEL HEAD DURING INSPECTIONS FOR VESSEL HEAD PENETRATION CRACKING
- ❑ EXTENT OF THE CORROSIVE ATTACK FROM A CONCENTRATED BORIC ACID SOLUTION WAS UNPRECEDENTED IN PREVIOUS NUCLEAR PLANT EXPERIENCE:
- ❑ OVER 6 INCHES OF CARBON STEEL WAS DEGRADED
- ❑ ONLY THE STAINLESS STEEL CLADDING (0.3 INCH THICKNESS) REMAINED AS PRESSURE BOUNDARY OVER THE DEGRADED AREA
- ❑ NRC CHARTERED A LESSONS-LEARNED TASK FORCE (May 2002) TO ANSWER "WHY WAS THIS EVENT NOT PREVENTED?"

Typical Pressurized Water Reactor



Reactor Vessel Head Degradation Location

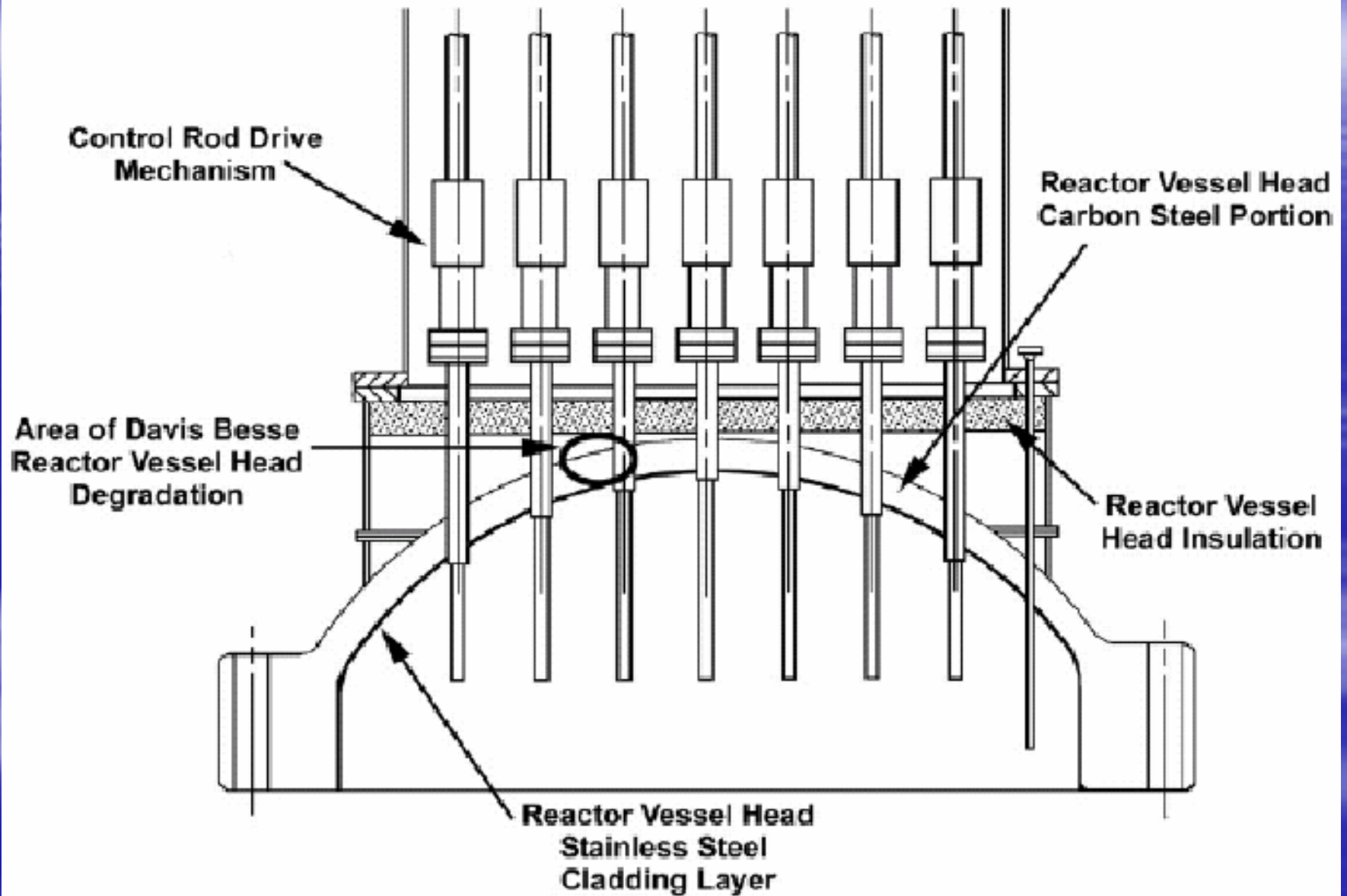
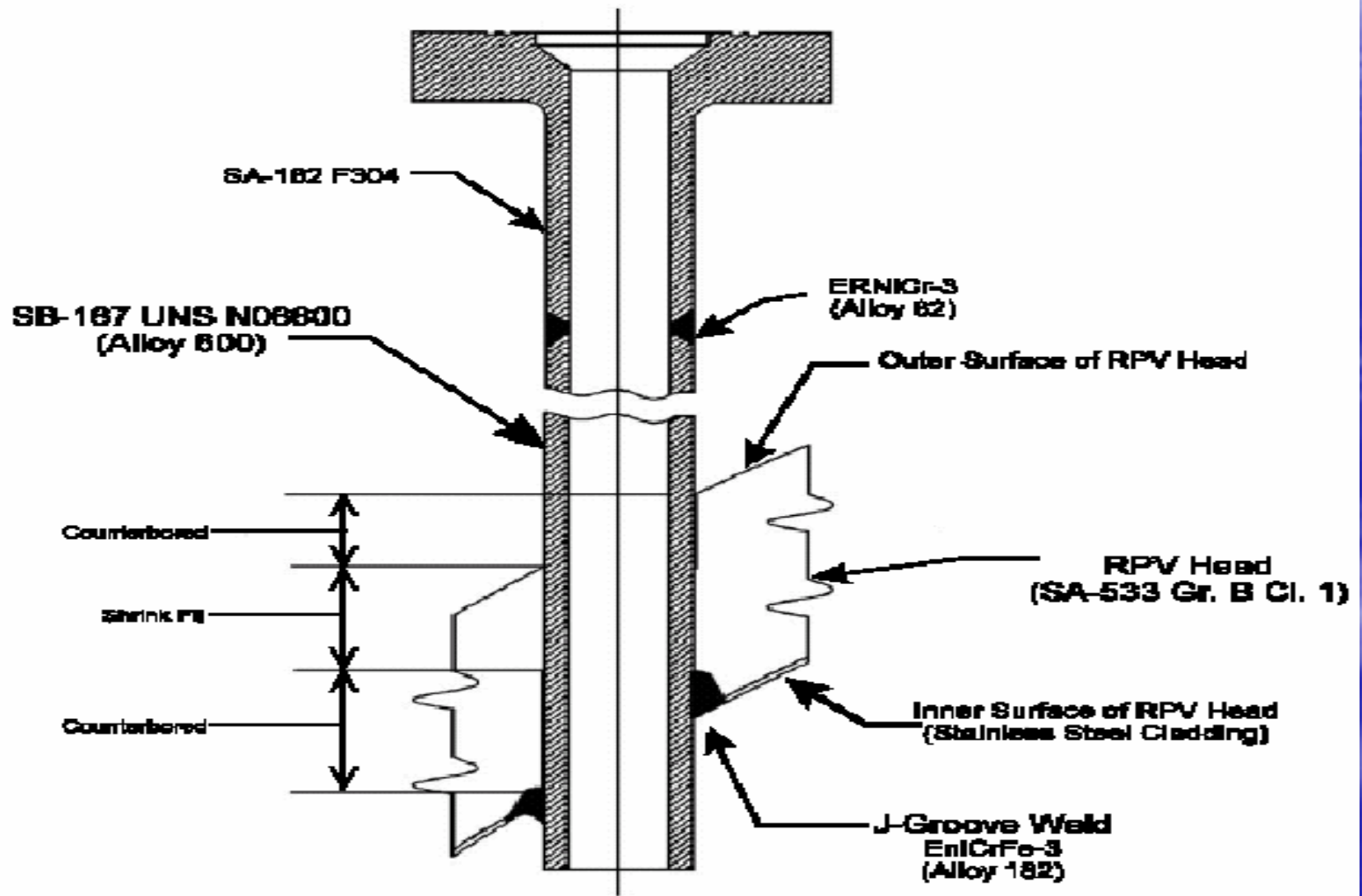
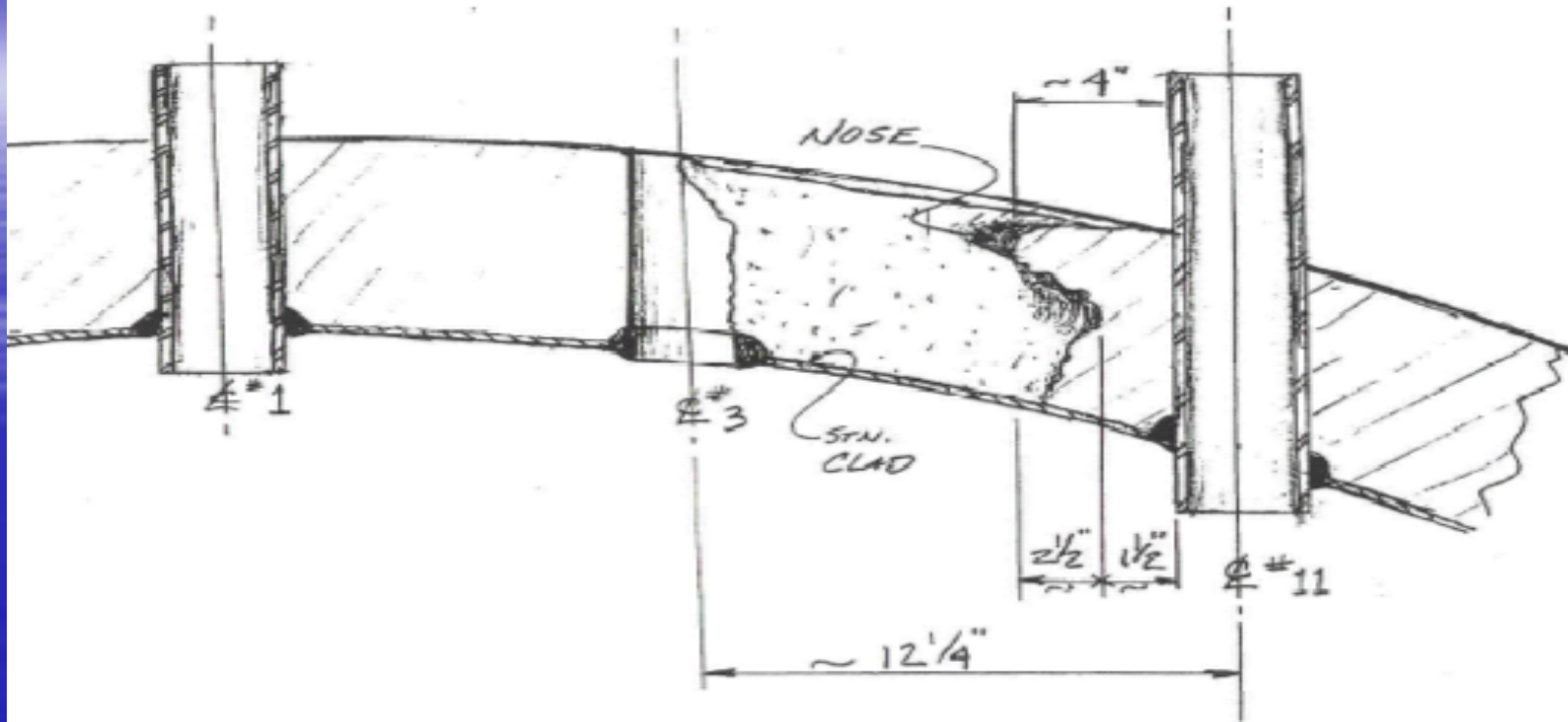


Figure 2-3 SCHEMATIC VIEW OF TYPICAL B&W VHP NOZZLE



Davis Besse Reactor Vessel Head Degradation Head Cutaway View



above figure shows the Davis Besse reactor vessel head degradation between nozzle #3 and nozzle #11. This sketch was provided to the NRC by the Licensee.



Figure 2-5 BORIC ACID DEPOSITS ON RPV HEAD FLANGE



Refueling Outage 12 (2000)

DAVIES-BESSE REACTOR VESSEL HEAD DEGRADATION LESSONS LEARNED TASK FORCE WHY WAS THE EVENT NOT PREVENTED?

- ❑ **TWO MAJOR CAUSES - TECHNICAL AND ORGANIZATIONAL**

- ❑ **TECHNICAL**

- ❑ **PREVIOUS NRC AND INDUSTRY ASSESSMENTS OF AXIAL CRACKING IN REACTOR VESSEL HEAD PENETRATIONS (VHPs) CONCLUDED THAT THE CRACKING WAS NOT AN IMMEDIATE SAFETY CONCERN (MID 1990's)**

- ❑ **MINDSET - BORIC ACID ON THE REACTOR VESSEL HEAD WAS CONSIDERED TO BE NOT HIGHLY CORROSIVE SINCE THE HEADS WERE HOT (600F) AND DRY**

- ❑ **LINKAGE BETWEEN CRACKING IN VHPs AND BORIC ACID ATTACK WAS MISSING EVEN THOUGH EVIDENCE WAS AVAILABLE**

DAVIES-BESSE REACTOR VESSEL HEAD DEGRADATION LESSONS LEARNED TASK FORCE WHY WAS THE EVENT NOT PREVENTED

- ORGANIZATIONAL - THE EVENT WAS PREVENTABLE
- NRC, THE LICENSEE AND INDUSTRY FAILED TO ADEQUATELY REVIEW, ASSESS AND FOLLOW-UP ON RELEVANT OPERATING EXPERIENCE
- THE LICENSEE FAILED TO ASSURE THAT PLANT SAFETY ISSUES WOULD RECEIVE APPROPRIATE ATTENTION
- NRC FAILED TO INTEGRATE INFORMATION INTO ASSESSMENTS OF THE LICENSEE SAFETY PERFORMANCE
- OTHER INFLUENCES ALSO CONTRIBUTED:
 - REQUIREMENTS AND GUIDANCE
 - RESOURCES AND STAFFING
 - QUALITY OF LICENSEE INFORMATION

DAVIS-BESSE REACTOR VESSEL HEAD DEGRADATION LESSONS LEARNED TASK FORCE *BACKGROUND*

❑ TASK FORCE CHARTER OBJECTIVES

- ❑ CONDUCT AN INDEPENDENT EVALUATION OF THE NRC'S REGULATORY PROCESSES
- ❑ IDENTIFY AND RECOMMEND AREAS FOR IMPROVEMENT APPLICABLE TO THE NRC AND/OR THE INDUSTRY

❑ TASK FORCE CHARTER AND SCOPE

- ❑ REACTOR OVERSIGHT PROCESS ISSUES
- ❑ REGULATORY PROCESS ISSUES
- ❑ RESEARCH ACTIVITIES
- ❑ INTERNATIONAL PRACTICES

- ❑ REPORT COMPLETED - SEPT. 30, 2002. Available at www.nrc.gov

DAVIES-BESSE LESSONS LEARNED TASK FORCE RECOMMENDATION AREAS

- INSPECTION GUIDANCE
- ASSESSMENT OF OPERATING EXPERIENCE
- ASME CODE INSPECTION REQUIREMENTS
- LEAKAGE MONITORING REQUIREMENTS AND METHODS
- TECHNICAL INFORMATION AND GUIDANCE
- NRC LICENSING PROCESSES
- PREVIOUS NRC LESSONS LEARNED REVIEWS

DAVIES-BESSE LESSONS LEARNED TASK FORMCE

SELECTED SPECIFIC RECOMMENDATIONS

- NRC SHOULD REVISE ITS PROCESSES TO REQUIRE SHORT-TERM AND LONG-TERM FOLLOW-ON VERIFICATION OF LICENSEE ACTIONS TO ADDRESS SIGNIFICANT GENERIC COMMUNICATIONS [3.1.2(1)]
- NRC SHOULD EVALUATE THE AGENCY'S CAPABILITIES TO RETAIN OPERATING EXPERIENCE INFORMATION AND TO PERFORM LONGER-TERM OPERATING EXPERIENCE REVIEWS [3.1.6(1)]
- NRC SHOULD REVISE ITS INSPECTION GUIDANCE TO PROVIDE ASSESSMENTS OF THE SAFETY IMPLICATIONS OF ... CORRECTIVE ACTIONS PHASED IN OVER SEVERAL YEARS [3.2.5(2)]
- NRC SHOULD EVALUATE THE ADEQUACY OF ANALYSIS METHODS INVOLVING THE ASSESSMENT OF RISK ASSOCIATED WITH PASSIVE COMPONENT DEGRADATION [3.3.7(3)]

[] - citations to report recommendations

PREVENTING STRUCTURAL FAILURES SOME COMMON ELEMENTS (Petroski, 1992)

- ❑ COMMUNICATIONS AND ORGANIZATION
- ❑ INSPECTION
- ❑ ENGINEERING DESIGN
- ❑ TIMELY DISSEMINATION OF DATA AND INFORMATION

NRC "ENVIRONMENT" SOME ADDITIONAL LESSONS

- TECHNICAL ELEMENTS ARE ONLY PART OF THE STORY
 - Regulatory Framework and Issues
 - Policy issues
- CRITICAL NATURE OF THE PUBLIC INTERFACE
- COMMUNICATION IS THE "KEY"
- IMPORTANCE OF RISK-ACTUAL AND PERCEIVED