PSEG Nuclear

Hope Creek

NRC Public Meeting
January 12, 2005

AGENDA

Introduction	Chris Bakken
Hope Creek Root Cause	Michael Gallagher

INTRODUCTION

Chris Bakken

President and Chief Nuclear Officer

INTRODUCTION

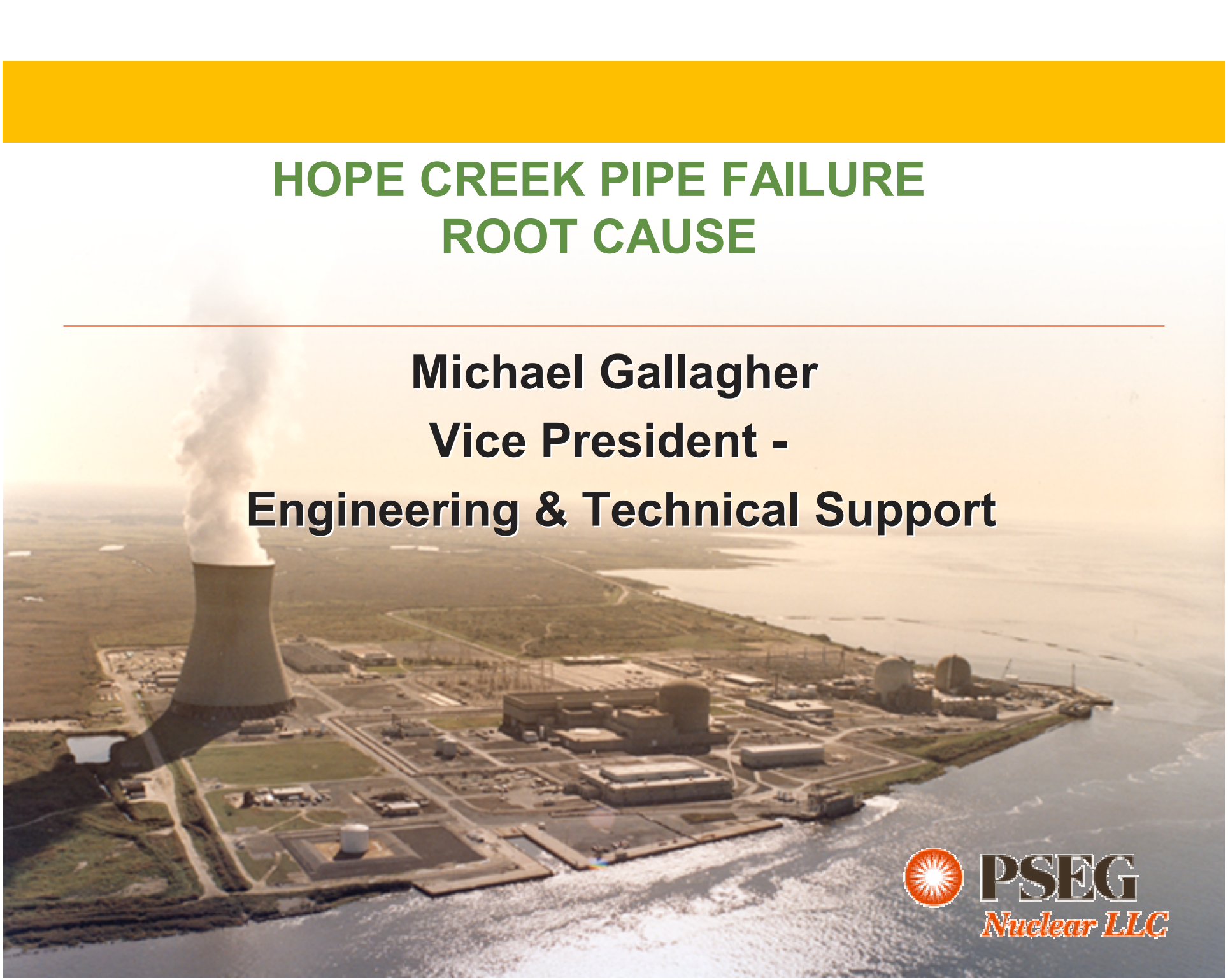
- **We Agree With the NRC's Assessment and Findings**
- **We Have Taken Appropriate Corrective Actions for Each Finding**

HOPE CREEK PIPE FAILURE
ROOT CAUSE

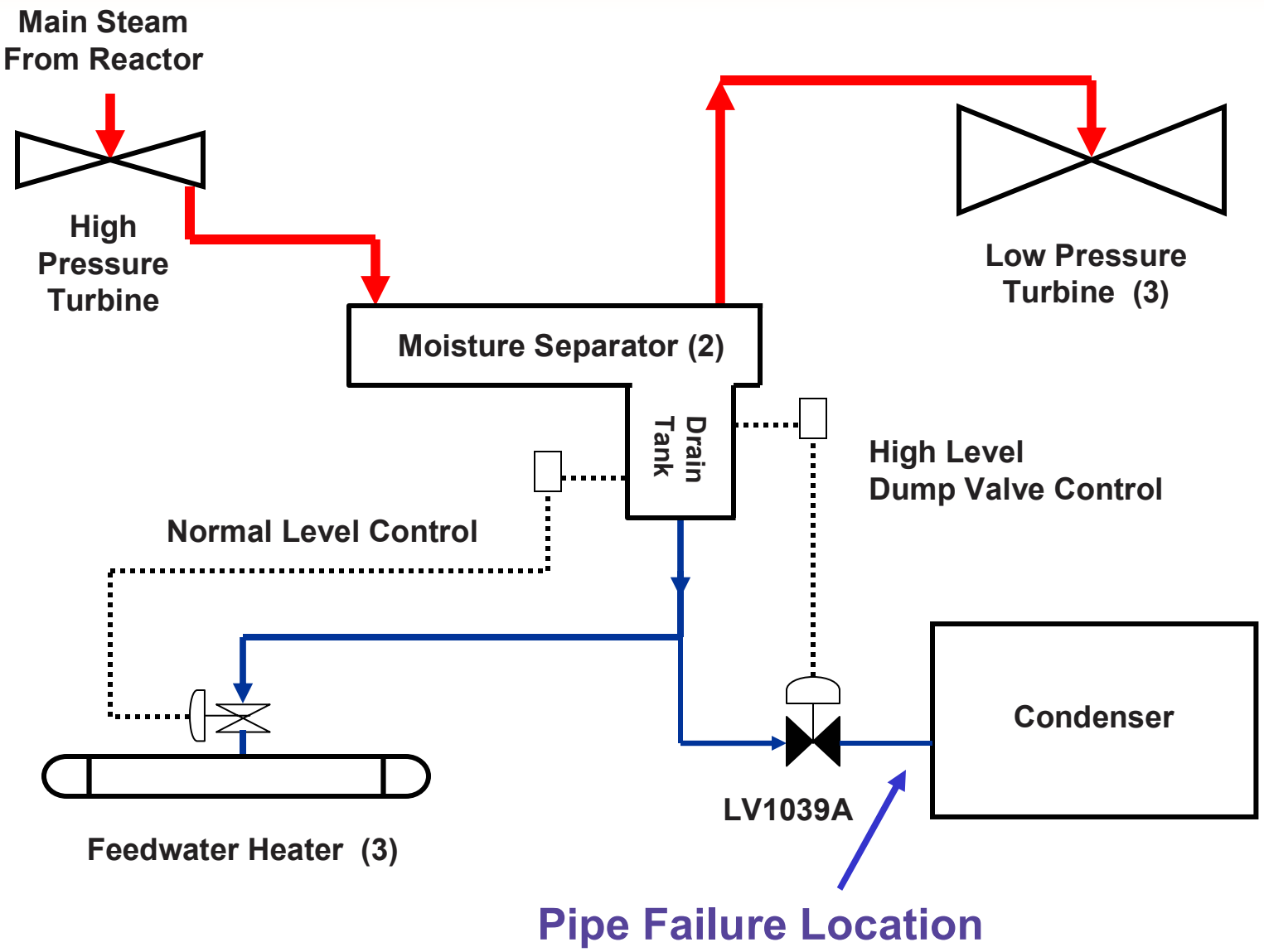
Michael Gallagher

Vice President -

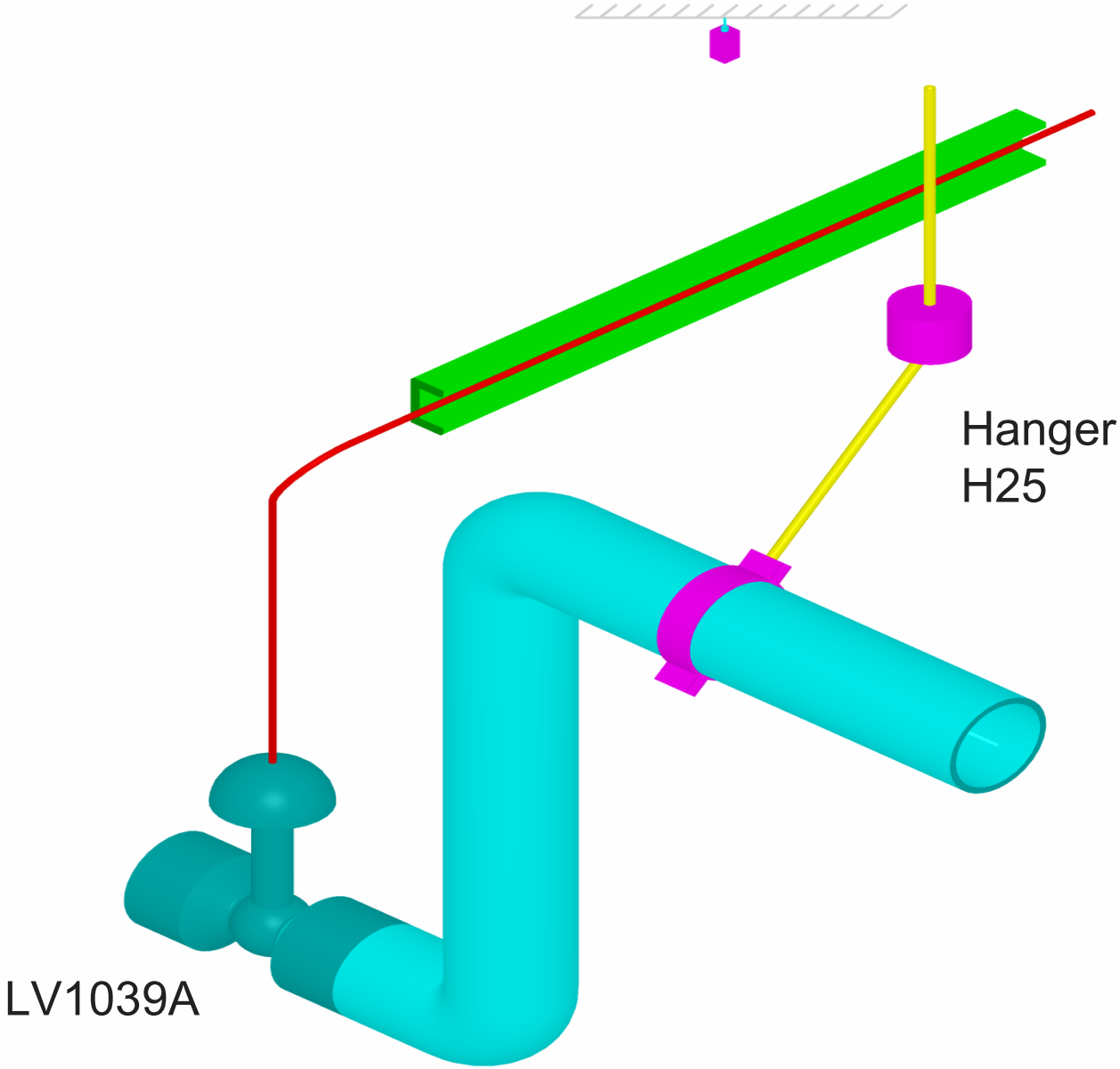
Engineering & Technical Support



PIPE FAILURE



FAILED HANGER



ROOT CAUSES/ACTIONS TAKEN

Root Cause	Actions Taken
Extended operation with the dump valve open caused the pipe to fail due to fatigue.	• Piping repaired • Nozzle design improved • Vibration monitoring on piping
Operating procedures did not limit operation with the dump valve open.	Procedure changes to incorporate limitations
The evaluation and decision to operate with the dump valve open did not consider all of the possible failure mechanisms.	A formal Operational & Technical Decision Making process to enable the execution of consistently good decisions

EXTENT OF CONDITION REVIEWS

- Hangers
- Condenser Nozzles
- Operating Procedures
- Operational & Technical Decision Making

CONCLUSIONS

- We have identified the root causes of the pipe failure event.
- We have completed all of the actions needed to safely startup and operate the plant.
- We have completed extent of condition reviews and have verified no similar conditions exist.

AGENDA

Chris Bakken

President and Chief Nuclear Officer

AGENDA

Introduction	Chris Bakken
HPCI Turbine Exhaust Line	Joe Williams
‘B’ Recirculation Pump and System	Steve Robitzski
Conclusion	Chris Bakken

INTRODUCTION

Chris Bakken

President and Chief Nuclear Officer

INTRODUCTION

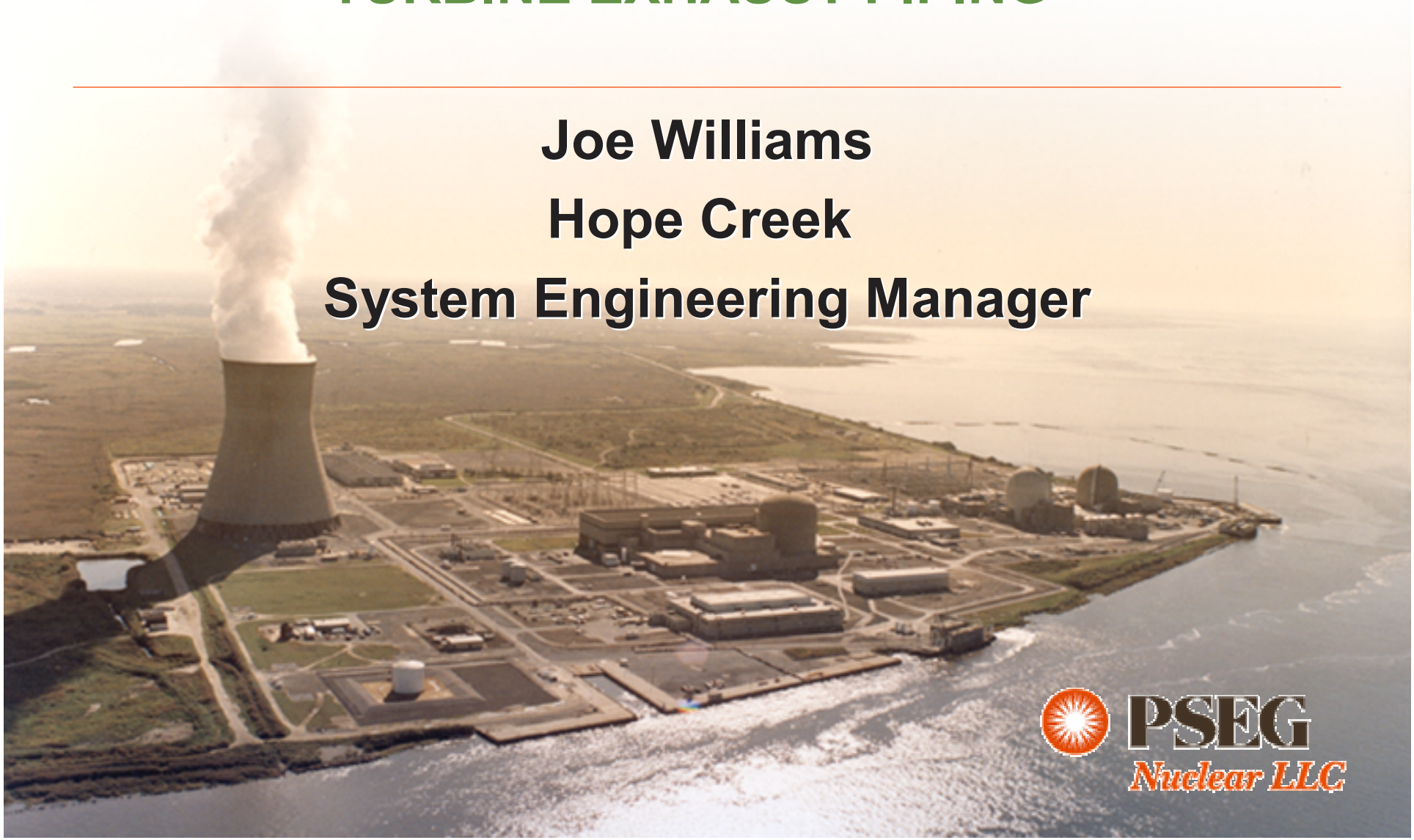
We Will Replace the ‘B’ Recirculation Pump Shaft During the Next Outage of Sufficient Duration

HIGH PRESSURE COOLANT INJECTION (HPCI) TURBINE EXHAUST PIPING

Joe Williams

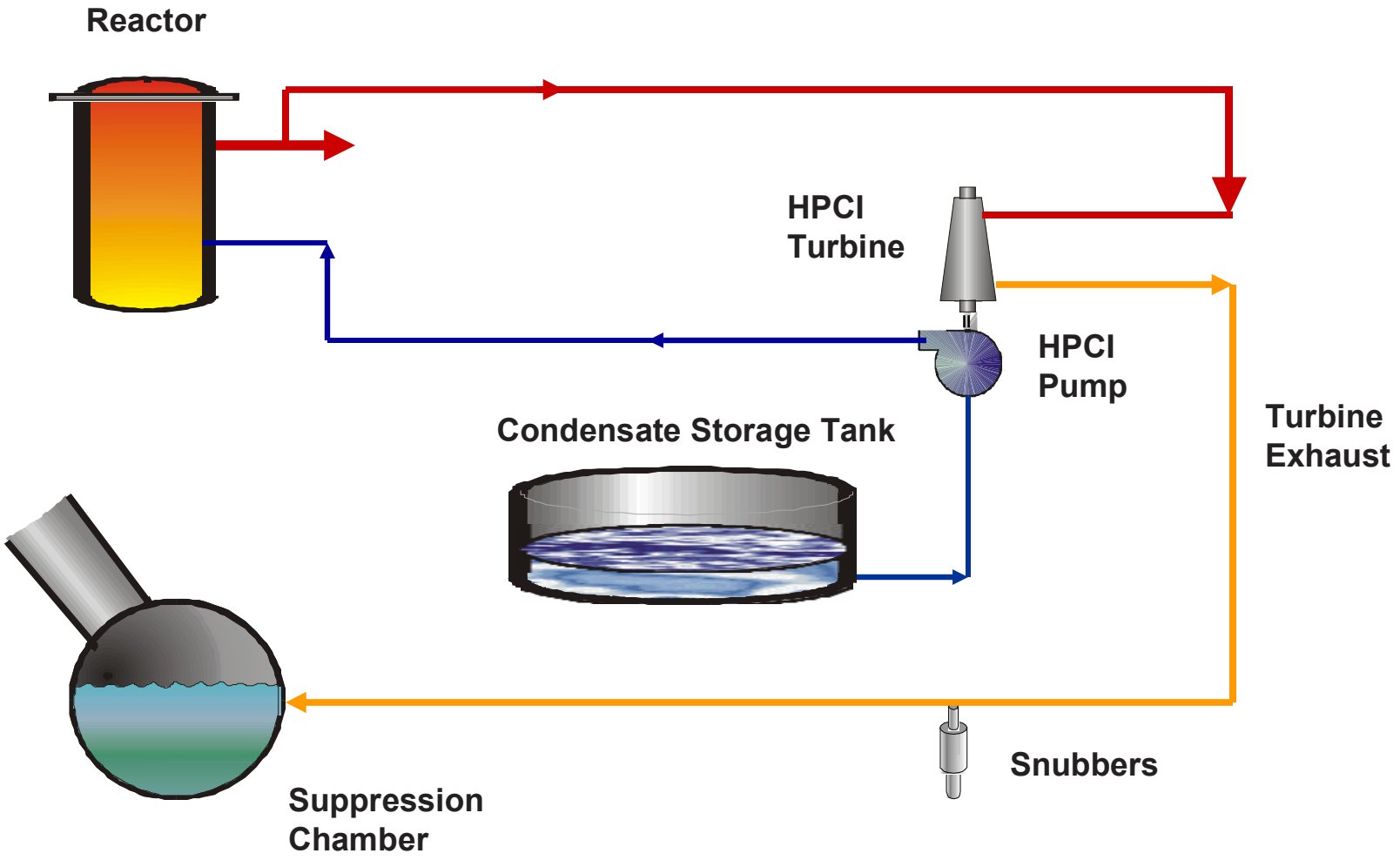
Hope Creek

System Engineering Manager



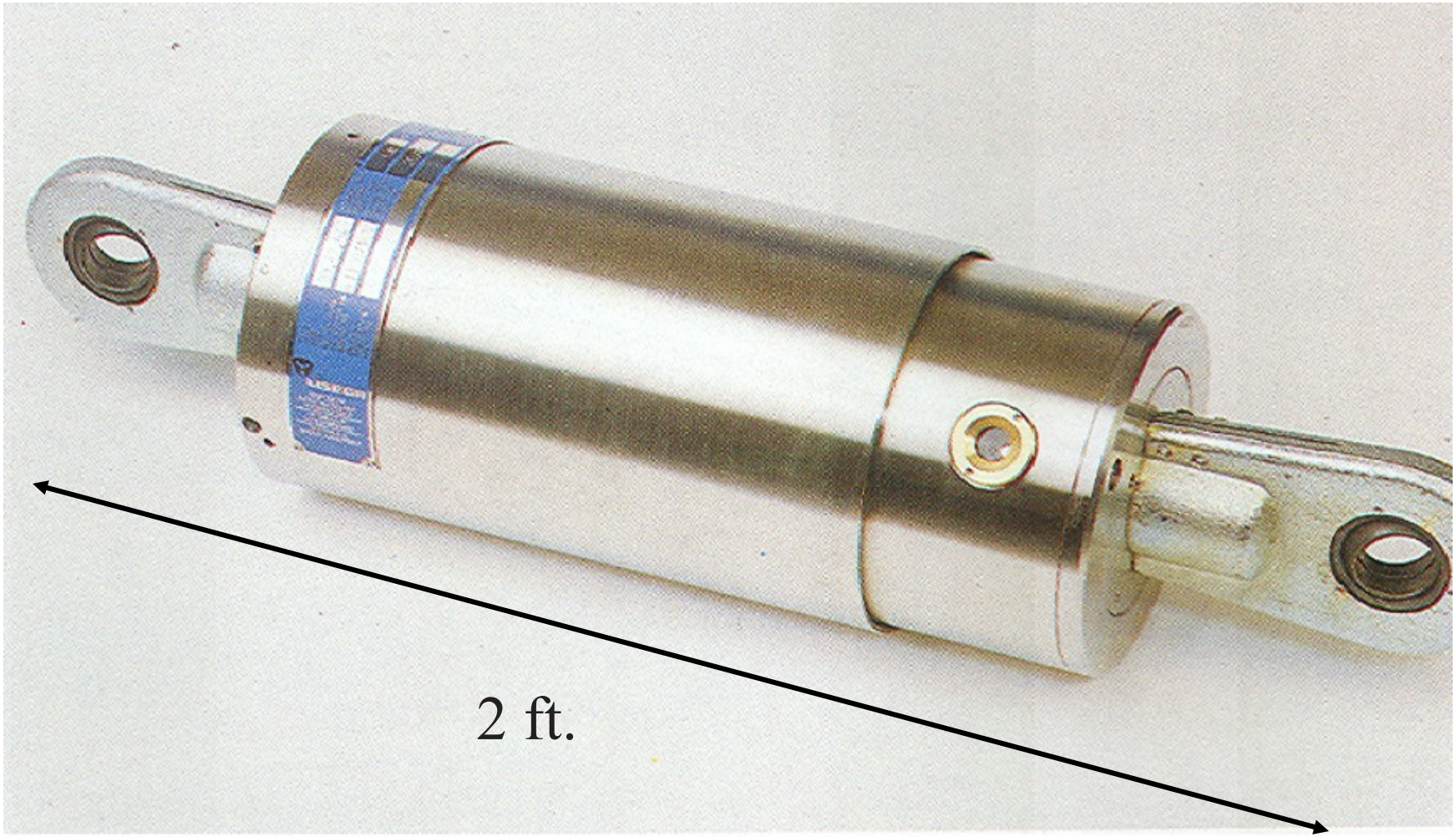
HPCI EXHAUST PIPING

HPCI System



HPCI EXHAUST PIPING

Piping Snubber



HPCI EXHAUST PIPING

What Happened?

- Two HPCI exhaust piping snubbers were damaged during dynamic bench testing.
- One additional snubber had bent extension tube.
- Performed extensive walkdowns and examinations of the system.
- The HPCI exhaust piping was not damaged.

HPCI EXHAUST PIPING

Snubber Analysis

- The damaged snubbers were returned to the manufacturer.
- The manufacturer's analysis determined that internal components were damaged.
- The bent snubber extension tube was visually examined.
- Damaged components did not prevent the snubbers from performing their function.

HPCI EXHAUST PIPING

Possible Causes of Snubber Damage

- Exhaust line check valve cycling following October 10th event because of unusual system operational alignment.
- Vibration due to presence of small amounts of water in system during system operation.
- Isolated manufacturing problem with the two damaged snubbers.

HPCI EXHAUST PIPING

Actions to Address the Three Possible Causes

- Damaged snubbers were replaced.
- System Piping Supports were inspected.
- All Exhaust Line Snubbers were inspected and tested.
- Repaired steam leakage through Turbine Inlet Valve.
- Installed modifications to improve water removal and monitoring for water accumulation in the system.
- Repaired the equipment problems to resolve the extended low flow operation of the system.
- Exhaust line components will be monitored during system startup and operation.

HPCI EXHAUST PIPING

Conclusions

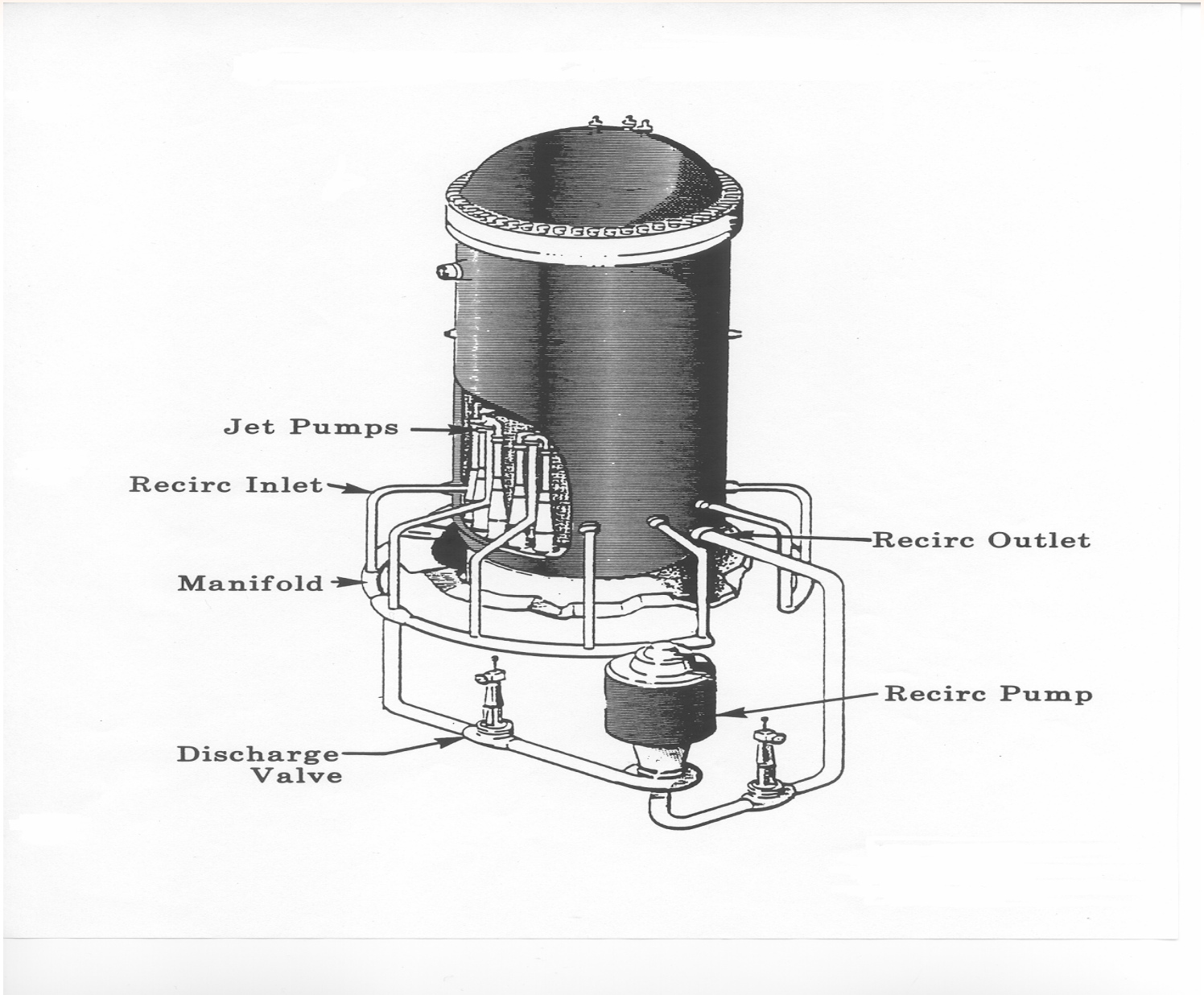
- HPCI system and piping supports operated safely during the October 10th event.
- HPCI piping was not damaged.
- We have implemented system improvements.

RECIRCULATION PUMP AND SYSTEM

Steve Robitzski

Engineering Manager

REACTOR RECIRCULATION SYSTEM



REACTOR RECIRCULATION SYSTEM

Topics to Discuss

- 'B' Recirculation Pump Shaft Vibration
- Recirculation System Vane Passing Frequency Vibration
- Containment Harmonic Vibration Noise

'B' RECIRCULATION PUMP SHAFT VIBRATION

- Vibration levels are within industry experience.
- There have been no failures of this design shaft in the industry.
- Shaft vibration level is stable and has been over several years.
- Pump shaft vibration is not significant contributor to other system vibration.

ACTIONS

Pump Shaft Vibration

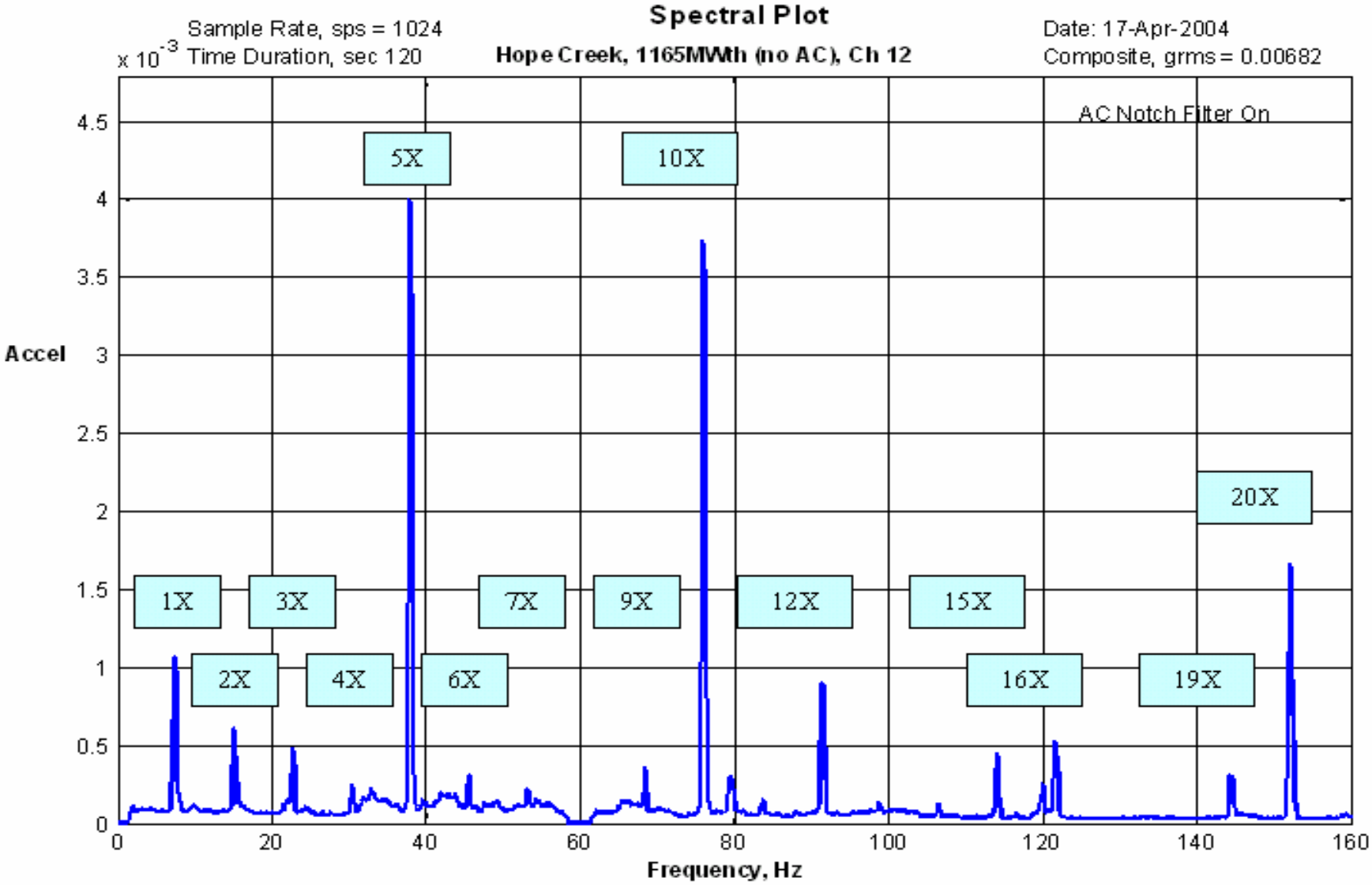
- Pump mechanical seal has been replaced.
- Coupling has been balanced and the pump/motor has been aligned.
- Pump vibration monitoring plan has been developed including action and alert levels.
- Procedures have been revised based on monitoring plan.
- We have collected information necessary to design and plan the ‘B’ pump replacement during next refueling outage.

RECIRCULATION SYSTEM VANE PASSING FREQUENCY VIBRATION

- System flow and pumps are vibration sources in piping systems.
- Vibration in piping systems is expected.
- Source of energy for vibration in the system is the Recirculation Pump impeller vane pass and not the pump shaft vibration.
- Start-up testing is performed on all new piping systems to assess vibration baselines.

RECIRCULATION SYSTEM PIPING VIBRATION

Typical Vibration Accelerations



ACTIONS

Piping System Vibration

- Damaged subcomponents have been repaired, and specific components have been reinforced.
- Instrumentation has been installed on selected components.
- Acceptance criteria has been developed.
- We will monitor system vibration during start up and steady state operation.

CONTAINMENT HARMONIC VIBRATION NOISE

- The noise is only present at Recirculation Pump speeds >1510 RPM.
- Administrative limits have been in place since at least 1995 that limit pump operation less than 1510 RPM.
- Principal source of noise is believed to be the Recirculation Pump impeller vane passing frequency, and not the pump shaft vibration.

ACTIONS

Containment Harmonic Vibration Noise

- Instrumentation has been installed on selected piping locations.
- Pump speed will continue to be restricted to <1510 RPM until testing plan developed and approved.

CONCLUSIONS

- Hope Creek ‘B’ pump shaft vibration and run hours are within industry experience.
- The pump will continue to operate safely during the next operating cycle.

CONCLUSION

Chris Bakken

President and Chief Nuclear Officer

CONCLUSION

- Hope Creek Outage Nearly Complete
- Significant Improvements Made to Plant
- Confident in Safe Reliable Operation Through Next Cycle