UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
612 EAST LAMAR BLVD, SUITE 400
ARLINGTON, TEXAS 76011-4125

October 19, 2010

Michael Perito, Site Vice President
Entergy Operations, Inc
River Bend Station
5485 US Highway 61N
St. Francisville, LA 70775

SUBJECT: SUMMARY OF PUBLIC MEETING FOR RIVER BEND STATION

Dear Mr. Perito:

This refers to the public meeting conducted at the NRC Region IV Office in Arlington, Texas, on October 18, 2010, to discuss initiatives to improve plant reliability.

Topics discussed during the meeting included proposed modifications and updates to the emergency diesel generators and control building chillers. The meeting was open to public observation and a telephonic bridge was established to allow public participation. Members of the public were allowed to ask questions and comment on the proceedings.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this matter, I will be pleased to discuss them with you.

Sincerely,

/RA/

Vincent Gaddy, Chief
Project Branch C
Division of Reactor Projects

Docket: 50-458
License: DPF-47

Enclosure:
1. Attendance List
2. Licensee Presentation Slides

Electronic distribution by RIV:
Regional Administrator (Elmo.Collins@nrc.gov)
Deputy Regional Administrator (Chuck.Casto@nrc.gov)
DRP Director (Kriss.Kennedy@nrc.gov)
DRP Deputy Director (Anton.Vegel@nrc.gov)
DRS Director (Roy.Caniano@nrc.gov)
DRS Deputy Director (Troy.Pruett@nrc.gov)
Senior Resident Inspector (Grant.Larkin@nrc.gov)
Branch Chief, DRP/C (Vincent.Gaddy@nrc.gov)
RBS Administrative Assistant (Lisa.Day@nrc.gov)
Senior Project Engineer, DRP/C (Bob.Hagar@nrc.gov)
Project Engineer, DRP/C (Rayomand.Kumana@nrc.gov)
Public Affairs Officer (Victor.Dricks@nrc.gov)
Public Affairs Officer (Lara.Uselding@nrc.gov)
Project Manager (Alan.Wang@nrc.gov)
Branch Chief, DRS/TSB (Michael.Hay@nrc.gov)
RITS Coordinator (Marisa.Herrera@nrc.gov)
Regional Counsel (Karla.Fuller@nrc.gov)
Acting Regional Counsel (David.Roth@nrc.gov)
Congressional Affairs Officer (Jenny.Weil@nrc.gov)
OEMail Resource

Inspection Reports/MidCycle and EOC Letters to the following:
ROPreports

Only inspection reports to the following:
OEDO RIV Coordinator (Geoffrey.Miller@nrc.gov)

R:_Reactors\2010\RB\RB MS 10182010pkg.docx

ADAMS: ☐ No ☒ Yes	☒ SUNSI Review Complete	Reviewer Initials:VGG
	☒ Publicly Available	☒ Non-Sensitive
	☐ Non-publicly Available	☐ Sensitive

RIV:C/PBC			
VGaddy			
/RA/			
10/21/2010			

OFFICIAL RECORD COPY T=Telephone E=E-mail F=Fax

Senior Vice President and COO
Entergy Operations, Inc
P. O. Box 31995
Jackson, MS 39286-1995

Vice President, Oversight
Entergy Operations, Inc.
P. O. Box 31995
Jackson, MS 39286-1995

Senior Manager, Nuclear Safety & Licensing
Entergy Nuclear Operations
P. O. Box 31995
Jackson, MS 39286-1995

Manager, Licensing
Entergy Operations, Inc.
5485 US Highway 61N
St. Francisville, LA 70775

Attorney General
State of Louisiana
P. O. Box 94005
Baton Rouge, LA 70804-9005

Ms. H. Anne Plettinger
3456 Villa Rose Drive
Baton Rouge, LA 70806

President of West Feliciana
Police Jury
P. O. Box 1921
St. Francisville, LA 70775

Mr. Brian Almon
Public Utility Commission
William B. Travis Building
P. O. Box 13326
Austin, TX 78701-3326

Mr. Jim Calloway
Public Utility
Commission of Texas
1701 N. Congress Avenue
Austin, TX 78711-3326

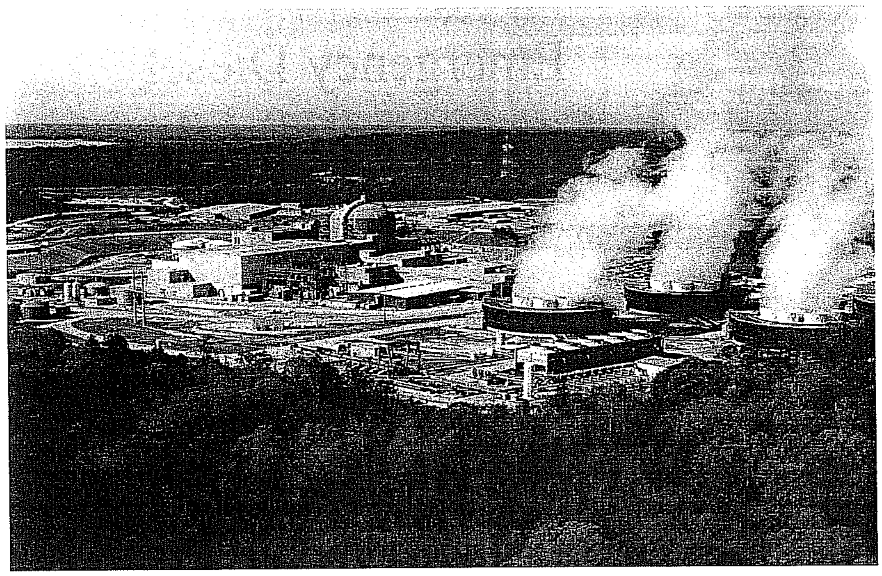
Louisiana Department of Environmental Quality
Radiological Emergency Planning and
Response Division
P. O. Box 4312
Baton Rouge, LA 70821-4312

Joseph A. Aluise
Associate General Counsel - Nuclear
Entergy Services, Inc.
639 Loyola Avenue
New Orleans, LA 70113

Chief, Technological Hazards
Branch
FEMA Region VI
800 N. Loop 288
Denton, TX 76209-3606

EOI/NRC Public Meeting

October 18, 2010



Agenda

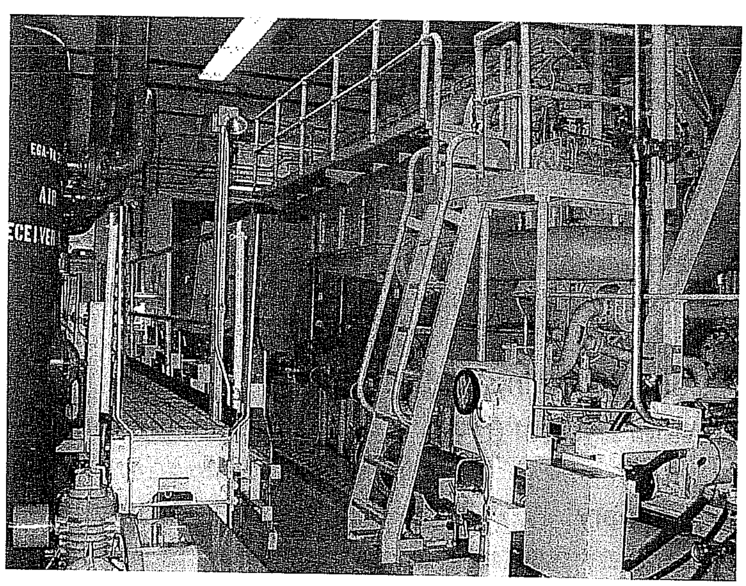
Introductions	Mike Perito
Overview	Harry Goodman
Emergency Diesel Generator Reliability	Tom Watkins
Control Building Chilled Water System (HVK)	Reginald French
Summary	Jerry Roberts

2

Emergency Diesel Generator Reliability

Tom Watkins
System Engineer

Emergency Diesel Generator



4

Emergency Diesel Generator

- Brief System Description
- Major System Issues (2008-2010)
- Corrective Actions

5

System Description

- Transamerica Delaval - Enterprise / DSR-48
- In-Line Eight Cylinder / 4-Stroke / 450 RPM
- Turbocharged / Intercooled
- Generator Output of 3130 KW continuous / 4160 Volts
- Slow Start Capable for monthly testing

6

Emergency Diesel Generator

- M-Rule Functions (include but are not limited to)
  - Upon receiving an emergency start signal, start from a standby condition and achieve steady state voltage & frequency within the prescribed time limits and supply connected loads with rated voltage & frequency for the required duration…
  - Regulate DG voltage & frequency such that DG can:
    - Be sequentially loaded while maintaining voltage & frequency within prescribed limits
    - Sustain a full load reject without exceeding over-voltage or over-speed limits.

7

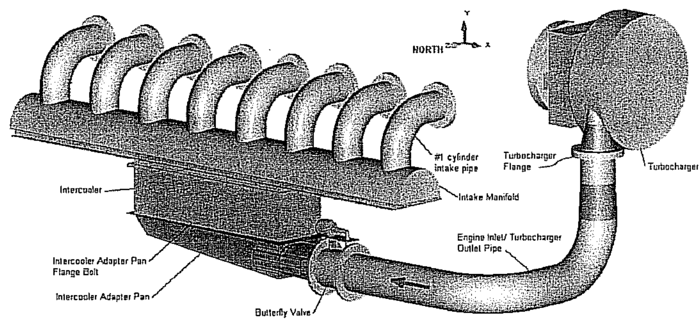
Emergency Diesel Generator

- **Technical Specification Requirements:**
  - 3.8.1 – Three diesel generators shall be Operable.
  - With one required DG inoperable, required DG is to be restored to Operable status within 72 hours from discovery of an inoperable Div. III DG AND 14 days for Division I and II DGs.
  - 14-day completion time applies to an inoperable Div. I or II DG. Use of the extended allowed out of service time (AOT) for voluntary planned maintenance should be limited to once within an operating cycle for each DG (Div. I and II).

8

Background Information

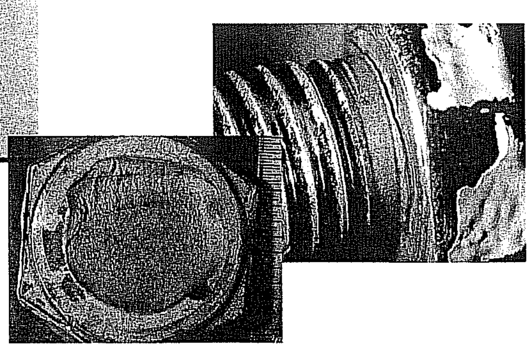
- Intake Air System
  - Turbocharger
  - Intercooler adapter pan
  - Adapter pan flange
  - Intake air manifold

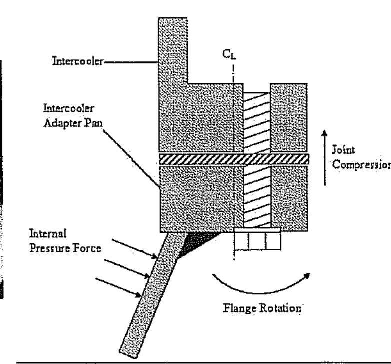


9

Background Information

- Evaluation of adapter pan flange determined:
  - High cycle fatigue lead to bolt failures
  - Bolt failure at head indicative of prying/flange rotation
  - Joint stiffness results in 65% of applied load being taken by the bolts





10

Potential Causes of Loading

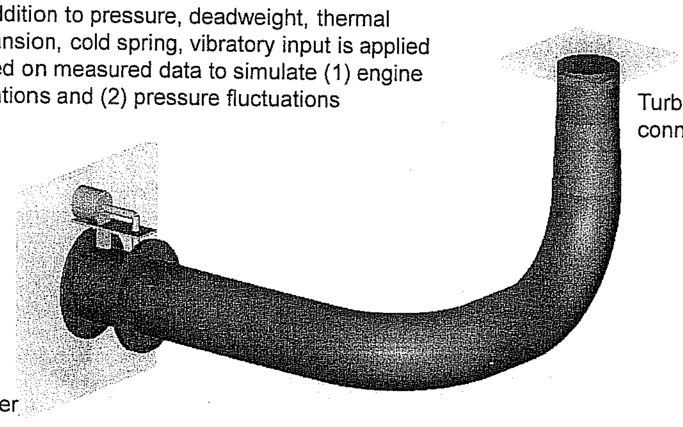
- High Cycle Fatigue is due to oscillating loads
- Loads driven by:
  - Diesel engine motion (mechanical vibration)
  - Flow induced vibration (FIV) of inlet adapter, intercooler tubes, etc.
  - Diesel inlet valve pressure pulsation and system acoustics (pressure pulse loading)
- Observations:
  - Engine runs at 450 RPM = 7.5 Hz
  - Four stroke engine: Cylinders fire and inlet valves close at: 450 x 8 x ½ = 30 Hz

11

Structural Evaluation

Piping Model

In addition to pressure, deadweight, thermal expansion, cold spring, vibratory input is applied based on measured data to simulate (1) engine vibrations and (2) pressure fluctuations

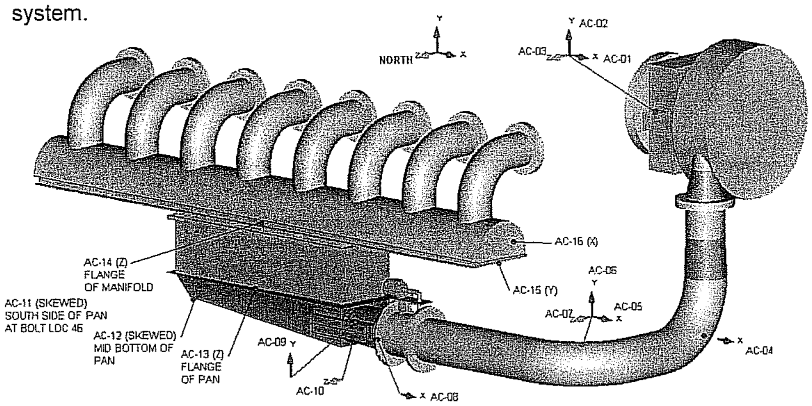


12

Structural Evaluation

Accelerometer Location

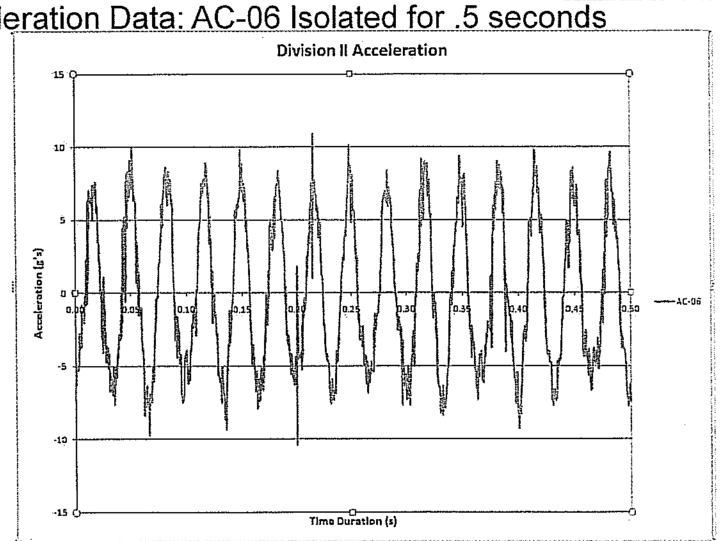
Accelerometers were located on the turbo, intake piping, intercooler adapter pan, intercooler and manifold to monitor response of the system.



13

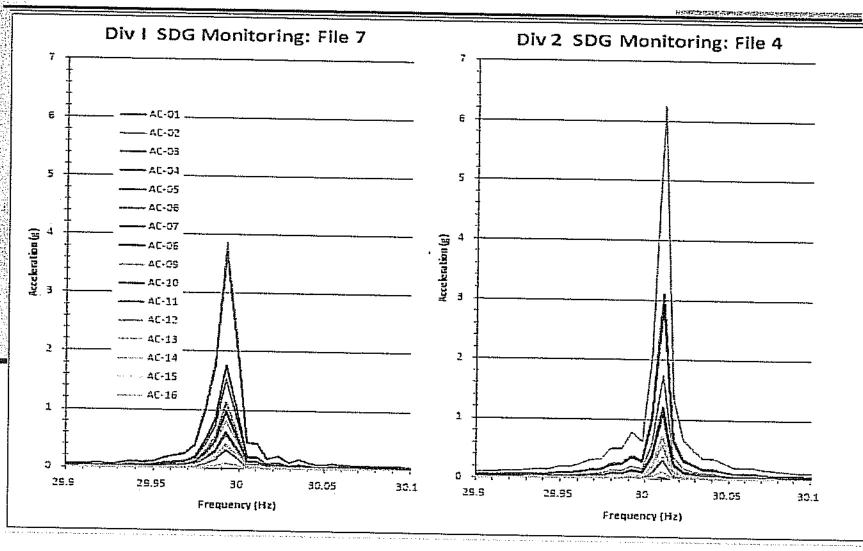
Structural Evaluation

Acceleration Data: AC-06 Isolated for .5 seconds



14

Structural Evaluation

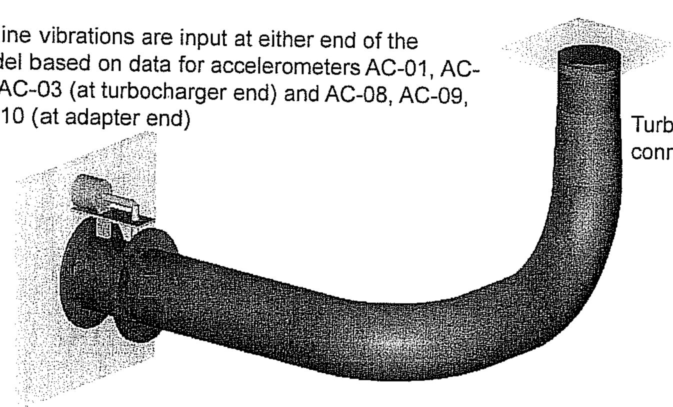


15

Structural Evaluation

Piping Model (cont)

Engine vibrations are input at either end of the model based on data for accelerometers AC-01, AC-02, AC-03 (at turbocharger end) and AC-08, AC-09, AC-10 (at adapter end)



Turbocharger connection

Intercooler adapter connection

16

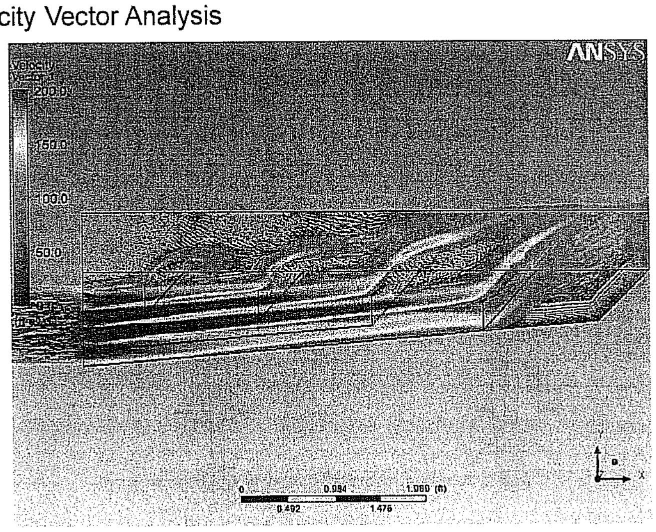
Computational Fluid Dynamics (CFD)

- Purpose is to understand the flow physics inside the intercooler adapter pan, using Computational Fluid Dynamic (CFD) analysis.
- Vortex shedding off the four baffles is postulated to cause pressure oscillations in the pan.
- Apply the pressure oscillations to a structural model to determine the effects on the pan.
  - Fluid: Air at Specified Temperature and Pressure
  - Physical Models:
    - Momentum conservation
    - Mass Conservation
    - Turbulence (k-ω)
    - Transient
    - Isothermal
  - Boundary Conditions:
    - Inlet: Massflow of 10K CFM
    - Outlet: Mean pressure of 41 inHg

17

Computational Fluid Dynamics (Cont'd)

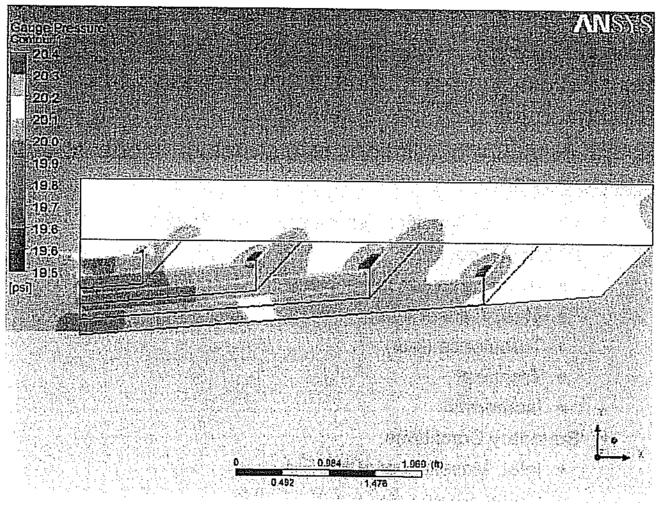
Velocity Vector Analysis



18

Computational Fluid Dynamics (Cont'd)

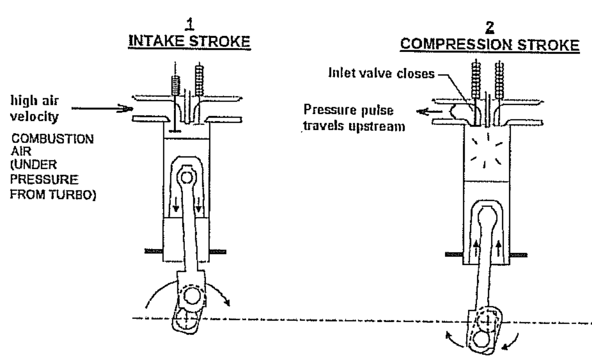
Pressure Contour Analysis



19

Inlet Valve Pressure Pulsation

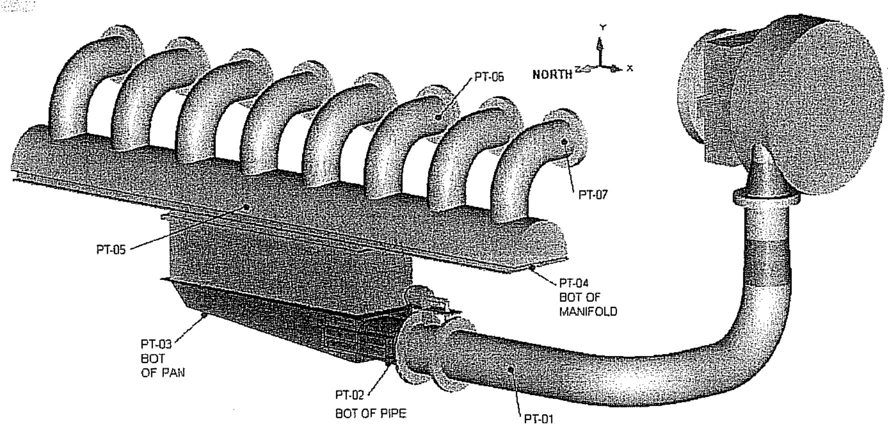
- Open valves draw air into the cylinder at high velocity
- Rapid valve closure stops moving air, producing a pressure pulse



20

Pressure Measurement

- Location of Pressure Transducers

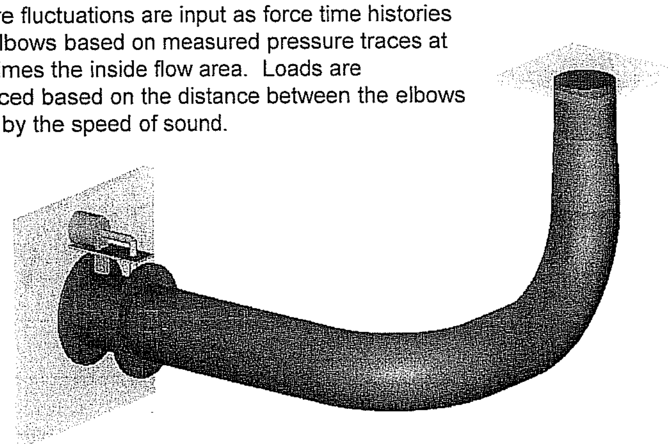


21

Structural Evaluation

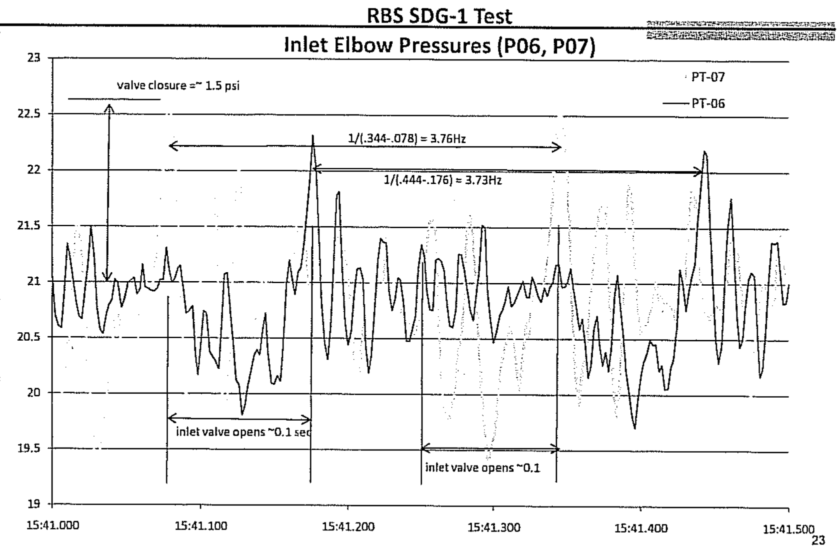
Piping Model (cont)

Pressure fluctuations are input as force time histories at the elbows based on measured pressure traces at PT-01 times the inside flow area. Loads are sequenced based on the distance between the elbows divided by the speed of sound.



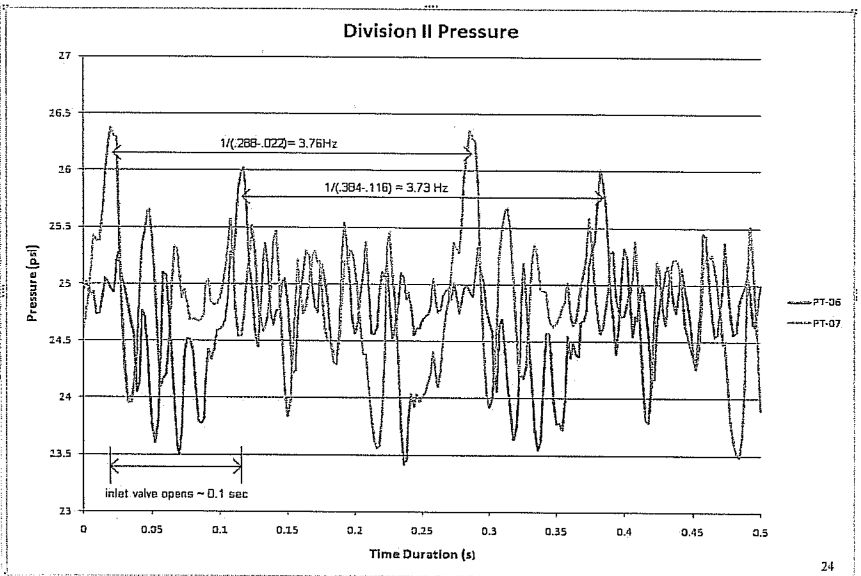
22

Inlet Valve Pressure Pulse Confirmation



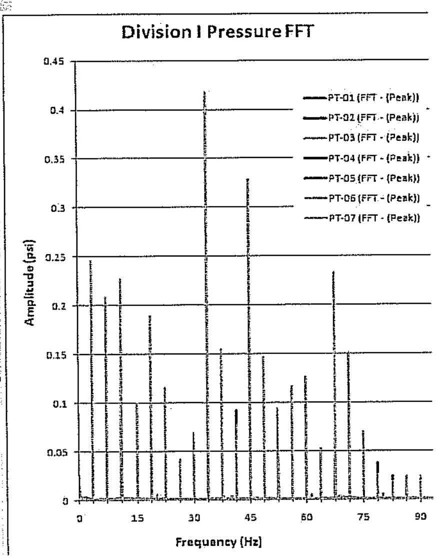
23

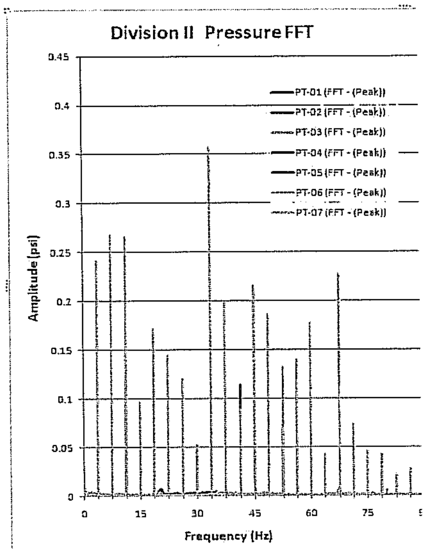
Inlet Valve Pressure Pulse Confirmation



24

Inlet Valve Pressure Pulse Confirmation

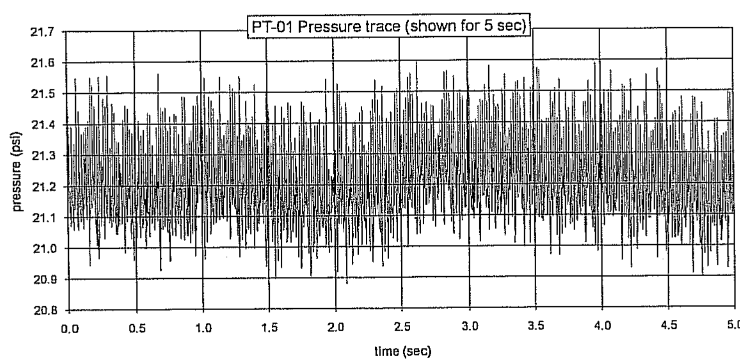




25

Structural Evaluation

Piping Model (cont)



26

Structural Evaluation

- Accelerations from the analysis resulting from engine vibrations and pressure fluctuations are compared with measured accelerations on the pipe at accelerometers AC-04, AC-05, AC-06 and AC-07
- Comparison between measured values and combined values (from engine vibrations and pressure fluctuations) are good and indicate the strong contribution from pressure
- Structural model response confirms the pressure pulse loading

27

Recap

- Bolts have failed due to high cyclic fatigue
- Cyclic fatigue is due primarily to pressure pulsation
  - Measured pressure pulses at cylinder inlet valves match predictions
  - Phase between measured pressures indicate origination at cylinder inlets
  - Acoustics do not amplify or significantly diminish pressure waves
- A piping model with both mechanical and pressure pulse loading matches measured accelerations and confirms the dominance of the pressure pulse effects
- Adapter pan has high natural frequencies; first mode is in baffle @ 94 Hz. Therefore, minimal excitation from pressure pulsation at 30Hz.

28

Short Term Actions

- Replace adapter pan bolting with stronger (B7), longer bolts - *complete*
- Increase bolt preload from 50 ft-lb to 65 ft-lb - *complete*
- Utilize torquing sequence to ensure even load distribution of the gasket during assembly - *complete*
- Hot torque bolts and re-check torque periodically until no further torque loss evident – *PM in place*

29

Long Term Actions

- Evaluated need to stiffen other intake air system marginal joints/structures – *complete*
- Perform an instrumented run of a diesel generator similar to those at River Bend that does not have intake air problems – *complete*
- Stiffen Intercooler Lower Flange – *Div. II-Oct. 2010, Div. 1-April 2011*
  - Remove gasket and use sealant instead
- Establish a torque check PM for all bolted connections in the intake air system – *PMs issued but not performed in field.*
- Install a pipe dampener at the intake air elbow to reduce vibratory response – *Div. II-Oct. 2010 thru RF16, Div. 1-April 2011*

30

Emergency Diesel Generator

- Other Major System Issues
  - #8 Exhaust Line Failure
  - Exhaust Shroud Cracking
  - Other Bolting Issues

31

CR Binning Evaluation Summary

- Purpose - identify other areas of the Div I & II DGs that may be vulnerable to structural failures (e.g. loose bolting, broken bolting)
- CR list came from CR-RBS-2009-06148, Attachment #13
- CRs were binned in the following categories: 1) Year, 2) Location, 3) DG and 4) Failure Type
- Independently evaluated by non-RBS person
- Problem joints identified and addressed primarily by torque check PMs

32

Summary

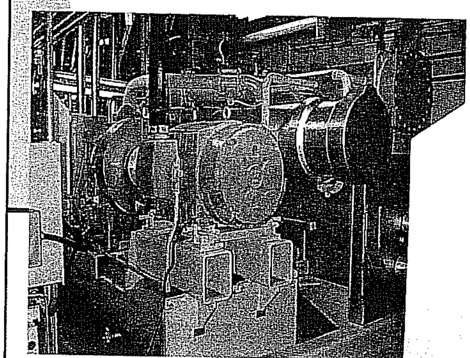
- Chronic intake air system issues
- General bolting concerns
- Past corrective actions were limited in scope
- Design changes in past did not address the generic issue
- Significant analyses performed
- Broad corrective action scope

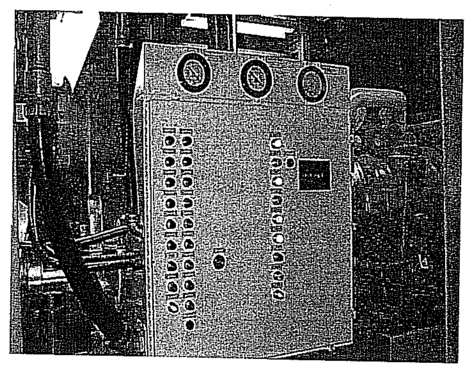
33

Control Building Chilled Water System (HVK)

Reginald French
System Engineer

Control Building Chilled Water System (HVK)





35

Control Building Chilled Water System (HVK)

- Brief System Description
- Major System Issues (2008-2010)
- Corrective Actions

36

Control Building Chilled Water System (HVK)

System Description

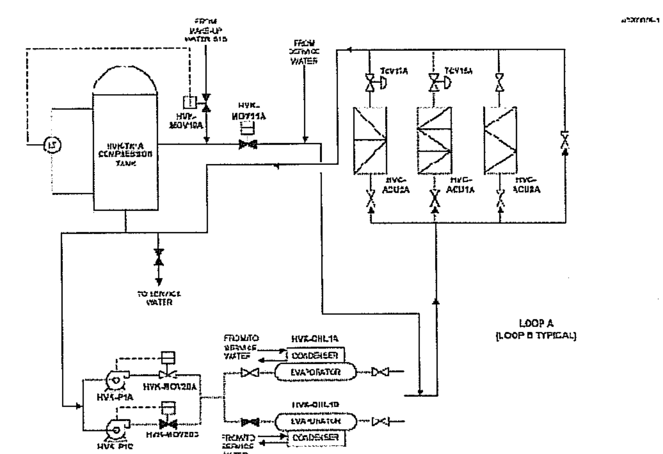
- Four 100% capacity refrigeration compressors/chillers (2 per division)
  - Division I – HVK-CHL1A & HVK-CHL1C
  - Division II – HVK-CHL1B & HVK-CHL1D

- Chillers are Carrier Model 17FA centrifugal using CFC-114 refrigerant

The chilled water system functions during normal, shutdown, and accident conditions to supply chilled water to the cooling coils in the Main Control Room, Standby Switchgear Rooms and Chiller Equipment Room Air Conditioning Units.

37

Control Building Chilled Water System (HVK)



CONTROL BUILDING CHILLED WATER

38

Control Building Chilled Water System (HVK)

- M-Rule Functions:
  - Maintain the capability for removing the worst case accident design heat load from the Control Building chilled water.
  - Provide the Control Building air conditioning system with a redundant source of chilled water capable of starting automatically or manually within a short period of time such that cooled area temperature limits are maintained.
  - Supply the Control Building air conditioning system with chilled water such that a temperature in the control building suitable for equipment and personnel habitation is maintained.
  - During a loss of chilled water, provides service water through the chilled water system to provide an alternate cooling path for the control building.
  - Provide local and remote indications and alarms of the control building chilled water system abnormalities and off-normal conditions.

39

Control Building Chilled Water System (HVK)

- Technical Specification Requirements:
  - Control Room AC System must be Operable to ensure that the control room temperature will not exceed equipment Operability limits.
  - With one control room AC subsystem inoperable, the inoperable control room AC subsystem must be restored within 30 days.
  - If both AC subsystems are inoperable, one subsystem must be restored within 7 days and temperature verified every 4 hours.

40

Control Building Chilled Water System (HVK)

Major System Issues (2008-2010)

- Chiller Failures to Start and/or Run (i.e. Trips) Caused By:
  - Square D Masterpact Breaker Issues
  - General Electric CR120 Relay Issues
  - SWP-PVY32(A-D) Service Water Bypass Control Valve

41

Control Building Chilled Water System (HVK)

- Masterpact Breakers
  - Issues
    - Performer Plug misalignment causing start failures
  - Actions
    - Masterpact breakers for HVK chillers replaced and are now latest version
    - Safety related breakers at RBS have been updated

42

Control Building Chilled Water System (HVK)

- GE CR120 Relays
  - Issues
    - Failure of relays caused several start failures of the HVK chillers
    - The relays are part of the chiller start/stop circuits (1X).
  - Actions
    - HVK-CHL1A, HVK-CHL1B, & HVK-CHL1D 1X relays replaced
    - HVK-CHI1C 1X replacement
    - CR120 replacement plan
      - Safety-Related High Critical Relays
      - HVK

43

Control Building Chilled Water System (HVK)

- SWP-PVY32(A-D) Service Water Bypass Control Valve Issues
  - Issues
    - SWP-PVY32C and SWP-PVY32D inoperable due to:
      - Minimum chiller operation Service Water temperature was re-calculated from 55F to 70F based on updated vendor calculation.
      - SWP-PVY32C-D had damaged diaphragms.
  - Actions
    - Valves rebuilt and pilot control housing was enhanced for better control at low refrigerant pressures.
    - Investigating intermittent cycling issue with SWP-PVY32C.

44

Control Building Chilled Water System (HVK)

- Future Upgrades
  - Issues
    - Original Equipment Design (1980s)
    - Analog components
    - Difficult to troubleshoot
    - New Direct Digital Control will improve reliability
  - Actions
    - Design started September 2010 to replace all four chiller components
    - Controls to be replaced starting 2011

45

Control Building Chilled Water System (HVK)

- Summary
  - Issues are recognized
  - Actions are in place for short and long-term reliability

46

RIVER BEND PUBLIC MEETING ATTENDANCE

LICENSEE/FACILITY	Entergy Operations, Inc River Bend Station
DATE/TIME	October 18, 2010 2:30 p.m.
LOCATION	RIV Office Arlington, TX

NAME (PLEASE PRINT)	Organization	Phone	E-mail
DAVID N. LORFING	ENTERGY	225-381-4157	dlorfin@entergy.com
MICHAEL PERITO	ENTERGY	225 381 4374	MPERITO@ENTERGY.COM
Jerry C Roberts	Entergy	225-381-4149	jrober3@entergy.com
Harry A Goodman	Entergy	225-381-4114	hgoodma@entergy.com
Reginald French	Entergy	225 381-3744	rfrenc1@entergy.com
Glenn Krause	Entergy	225 287-8339	gkrause@entergy.com
Rick McAdams	Entergy Ops Inc.	225-336-6224	rmcadam@entergy.com
Tom Watkins	Entergy	225-635-5113	twatkin@entergy.com

RIVER BEND PUBLIC MEETING ATTENDANCE

LICENSEE/FACILITY	Entergy Operations, Inc River Bend Station
DATE/TIME	October 18, 2010 2:30 p.m.
LOCATION	RIV Office Arlington, TX

NAME (PLEASE PRINT)	Organization	Phone	E-mail
Kriss Kennedy	NRC	248	kriss.kennedy@nrc.gov
Elmo Collins	NRC		elmo.collins@nrc.gov
Vince Gaddy	NRC		
Troy Pruett	NRC		
Grant Larkin	NRC		
Lara Uselding	NRC		