

Appendix G

Heat Pipe Operations and Test Program History - Milliken Station

**Heat Pipe Operations and Test Program History - Milliken Station
June 1994 to April 1998**

- 06/18/94 - 12/11/94 Unit 2 outage for boiler and ESP modifications, heat pipe installation and scrubber tie-in.
- 10/17/94 - 10/18/94 Locations of heat pipe test ports selected by NYSEG, ABB API, and CONSOL.
- 12/11/94 - 02/12/95 Boiler brought on line -- initial operation of heat pipe. Thermal performance
10:58 00:05 appeared to be less than design (i.e. outlet flue gas temperatures greater than 250°F). ABB API obtains diagnostic data on heat pipe operation during last week of January 1995.
- 01/10/95 CONSOL issues first draft of heat pipe performance test plan to NYSEG.
- 01/19/95 ABB API requests an uncertainty analysis for the heat pipe performance calculations of the air and flue gas flows, weighted average temperatures, and air leakage.
- 02/09/95 ABB API presents data to NYSEG indicating there are flow distribution problems at the heat pipe gas and air inlets. Recommendations are to install perforated plates at the FD fan outlets, install special condenser end baffles, install additional diagnostic thermocouples, and sample several naphthalene tubes to determine if there are gas blocks.
- 02/12/95 - 02/12/95 Unit 2 boiler off line.
00:05 17:02
- 02/27/95 - 03/03/95 Unit 2 shutdown for turbine screen cleaning. ABB API makes initial repairs
22:35 to heat pipe. Installs perforated plate distribution screens on outlets of primary and secondary air fans and deflector plates in heat pipe sootblower lanes. Vacuum checked in approximately 110 tubes. When units back on line performance of Unit 2B primary air heating section improved.
- ABB API testing of heat pipe contents reveals that gas containing hydrogen, carbon dioxide, and ethylene is being generated in some naphthalene filled tubes and is reducing performance.
- 03/10/95 - 03/11/95 Unit 2 boiler off line.
23:53 12:40
- 03/18/95 - 03/18/95 Unit 2 boiler off line.
05:58 10:45

03/26/95 - 03/27/95 Unit 2 boiler off line for turbine balancing.
09:09 08:30

04/02/95 - 04/03/95 Unit 2 boiler off line.
09:36 06:10

04/06/95 - 04/07/95 Unit 2 boiler off line.
22:30 15:08

05/16/95 CONSOL report on naphthalene contamination issued to NYSEG.

05/19/95 - 05/19/95 Unit 2 boiler off line.
09:52 21:32

06/16/95 Revised heat pipe performance test plan issued to NYSEG. Plan incorporated changes requested by ABB API.

06/22/95 CONSOL issues a second naphthalene analysis report which indicates that naphthalene does not contain any strong inorganic acids.

06/16/95 CONSOL issues first Uncertainty Analysis report to NYSEG.

07/17/95 Flue gas side of heat pipes appeared to be slowly fouling. To improve cleaning, NYSEG and ABB API agree to change the sequencing of sootblowing to eliminate possible air supply line water condensate discharge onto coldest tubes.

08/20/95 - 08/20/95 Unit 2 boiler off line.
00:10 08:23

09/15/95 - 10/02/95 Unit 2 shutdown. ABB API modifies heat pipes to allow venting of naphthalene filled tubes either under cold or hot conditions. Approximately 2400 tubes are evacuated to remove non-condensable gases. Heat pipes are partially washed to remove cold-end deposits.
21:17 08:37

10/02/95 - 03/15/96 Washing the heat pipes improved the thermal performance of both units; particularly the 2A unit. The partial cleaning done during the turnaround also reduced flue gas side pressure drops. However, fouling of both units was again experienced with the worse fouling occurring in the 2A heat pipe.
08:37 21:24

10/20/95 ABB API indicates to NYSEG that heat pipes are functioning as designed and recommends that the units be tested within 60 days.

12/05/95 ABB API submits to NYSEG additional recommended procedures for water washing of the heat pipes.

- 03/05/96 ABB API requests that uncertainty analysis be expanded to include the totally corrected flue gas outlet temperature calculation.
- 3/12/96 ABB API requests installation of additional test ports for primary flue gas outlet ductwork. Ports are needed so heat pipe operation can be analyzed as two separate heat exchangers rather than a combined unit. CONSOL revises the test plan to accommodate change.
- 03/15/96 - 04/03/96 Unit 2 shutdown for heat pipe washing and installation of infrasonic (low
21:24 11:45 frequency) sootblower on 2A heat pipe and expanding nozzle sootblowers on 2B heat pipe. When Unit 2 brought back on-line, fouling of both heat pipes appeared to be controlled (no rise in gas side pressure drops with operating time).
- 04/23/96 Second uncertainty analysis report issued to NYSEG.
- 04/30/96 Revised heat pipe test plan issued to NYSEG. Plan was revised to accommodate testing changes needed to allow use of the ABB API temperature correction charts for evaluation of the fully corrected flue gas outlet temperature.
- 05/13/96 - 05/17/96 Heat pipe performance test conducted.
- 05/21/96 NYSEG conducts first naphthalene leak survey.
- 07/08/96 CONSOL issues draft report covering the first performance test to NYSEG.
- 07/19/96 Operation of infrasonic sootblower caused tears in the 2A ESP inlet ductwork. Continuous operation of infrasonic sootblower discontinued until ductwork repaired and sound level survey is conducted.
- 08/05/96 Began boiler feedstock switch from a nominal 1.8 wt. % S to 2.5 wt. % S coal.
- 08/28/96 Flue gas side pressure drops for both heat pipes began trending higher.
- 08/30/96 12:00 Infrasonic sootblower put back into service at 3/4 power level.
- 09/06/96 Infrasonic sootblower operated at full power level to improve heat pipe cleaning.
- 09/18/96 Naphthalene leak survey conducted.
- 10/07/96 - 10/08/96 Conducted fouled condition heat pipe performance tests.
- 10/11/96 23:58 Boiler shutdown for heat pipe washing and SHU scrubber cleaning.

- 10/18/96 08:45 Boiler back on line. Internal stiffeners (66 four inch dia pipes) were installed in the inlet ductwork of the Unit 2 ESP to eliminate fatigue fractures caused by the operation of the infrasonic sootblower. Plant operations changed the FD fan inlet flow rate coefficient to 75% of original value to better match actual flow rate.
- 10/22/96 Measured the heat pipe flue gas side module-to-module pressure drops to establish clean condition baseline performance. Established that the secondary air outlet temperature profiles were similar to those obtained in May 1996 at full load conditions.
- 10/28/96 Naphthalene leak survey conducted.
- 11/07/96-11/08/96 Second thermal performance test conducted. Established the heat pipe performance after a water wash cleaning.
- 02/06/97 CONSOL draft report covering the second clean condition heat pipe performance tests issued to NYSEG.
- 03/04/97 Naphthalene leak survey conducted.
- 03/07/97 22:00 Unit 2 boiler shutdown to fix primary superheater tube leak.
- 03/09/97 03:30 Boiler back on line.
- 03/31/97 07:30 Unit 2 taken off line for annual boiler outage. Cracks were found in the primary/secondary flue gas divider walls in the 2A heat pipe. The cracking apparently was caused by infrasonic sootblower operation. The cracks were welded and the walls stiffened. Heat pipes were washed to remove cold-end deposits.
- 04/20/97 07:22 Boiler placed back in service. Clean condition heat pipe pressure drops were recovered. To determine if the time between cleanings can be extended, the bottom two sootblower levels will be operated once per shift on each heat pipe, the infrasonic sootblower will not be operated, and efforts will be made to keep the Unit 2 boiler operating at 80 MWs or above to prevent extreme low cold-end temperatures.
- 05/22/97 20:01 Boiler shutdown to fix superheater tube leak. Unit was available at 06:00 hrs on 5/24/97 but not put on-line since the power was not needed.
- 05/26/97 05:00 Boiler placed back on-line.
- 06/20/97 CONSOL draft report covering the fouled condition heat pipe performance tests issued to NYSEG.

1267

10/24/97 20:00 Boiler taken off-line. Convenient time for heat pipe air heater washing to remove cold-end deposits.

10/31/97 11:46 Boiler placed back into service.

04/24/98 21:00 Boiler shutdown for turnaround maintenance.