BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of an Incident on February 4, 2009 at the Iatan Generating Plant Operated by Kansas City Power & Light Company.	))))	Case No. ES-2010-0009

STAFF'S NOTICE OF CORRECTED INCIDENT REPORT

COMES NOW the Staff of the Missouri Public Service Commission (Staff), by and through counsel, and for its *Notice of Corrected Incident Report* respectfully states as follows:

1. Attached hereto as Exhibit 1, Staff submits its *Corrected Incident Report* on the February 4, 2009 incident at the Iatan 1 Generating Plant operated by Kansas City Power & Light Company, Inc. which includes Staff's recommendations. Staff's initial *Incident Report's* cover page stated the incident as "February 4, 2008." The attached *Incident Report* correctly dates the incident at Iatan 1 as February 4, 2009.

WHEREFORE, Staff respectfully requests the Commission accept this *Corrected Incident Report*.

Respectfully submitted;

/s/ Jaime N. Ott
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CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing have been mailed, hand-delivered, transmitted by facsimile or electronically mailed to all counsel of record this 4th day of February, 2010.

/s/ Jaime N. Ott

Missouri Public Service Commission

Electric Incident Report

Kansas City Power & Light Company
Case No. ES-2010-0009

Iatan Unit 1 Turbine High Pressure Rotor Bow
Iatan Plant
Weston, Missouri
Incident date: February 4, 2009

Energy Department ... Utility Operations Division
January 29, 2010… Jefferson City, Missouri

TABLE OF CONTENTS

ATTACHMENTS

1.0 PURPOSE

The purpose of this Staff incident report is (1) to identify the events leading up to the high pressure turbine rotor bow, (2) to determine if the findings of the investigation reports prepared by Kansas City Power & Light Company (KCPL) and General Electric Company (GE) are accurate and reasonable, (3) to review actions taken by KCPL to prevent a recurrence of the incident and (4) to make relevant operational recommendations to KCPL in order to reduce the possibility of the incident re-occurring in the future.

It is not the purpose of this report to make any determination regarding the prudence or imprudence of the actions of KCPL or GE with respect to this incident.

2.0 SYNOPSIS

On Wednesday, February 4, 2009, KCPL commenced a cold startup of the Iatan Unit 1 to end its winter planned outage. During this outage the high pressure turbine section of the turbine/generator had been replaced along with a number of other major modifications to the plant. The Iatan Unit 1 was heated up and the generator was synchronized to the grid. When the load on the generator increased to approximately 100 megawatts (MW), the turbine experienced high vibration problems and tripped due to high vibration on number 2 turbine bearing. The turbine/generator rotor began to decelerate immediately following the trip and a severe vibration event occurred on turbine bearings numbered 1, 2 and 3.

Normally after a shutdown of any nature, the turbine/generator is placed on a turning gear to prevent the rotor from bowing. The Iatan 1 turbine/generator was placed on turning gear operation after its rotor speed had coasted down enough to do so. However, the eccentricity of the rotor remained excessive, in the 9 to 10 mils range, and did not improve. The eccentricity measures the bow in the turbine rotor and normally is 2 to 3 mils. This continued excessive eccentricity indicated that perhaps some bowing and internal damage was done during the startup and/or shutdown of the turbine/generator.

On February 5, various checks were performed with the turbine assembled to determine the condition of the rotor. KCPL and GE, the contractor on site conducting work during the turbine/generator, determined that the unit should not be restarted and needed to be disassembled for repair. Upon disassembly, damage was observed to rotor shaft seals and

packing, and turbine stage seals and packing. Minor bearing and journal damage on the high pressure section rotor was also noted. The high pressure section rotor was subsequently removed and sent to a GE facility in Chicago, Illinois on February 10, 2009 for repairs.

Over the next few weeks the repairs were completed and the high pressure section rotor was reinstalled. The unit was restarted and available for service on March 18, 2009 and achieved full load on March 25, 2009.

As a result of this incident KCPL has modified its startup procedures and operator's control screen graphics. Since the repair and corrective actions by KCPL no high vibration or differential expansion events with the high pressure turbine have recurred.

3.0 FACTS

3.1 History

Iatan Unit 1 is a 673 MW plant located north of Weston, Missouri, of which KCPL has a 70% ownership. KPCL-Greater Missouri Operations Company and The Empire District Electric Company own 18% and 12%, respectively. Major construction projects at the Iatan Plant site have been ongoing since January 2007 for the purposes of constructing a second unit, Unit 2, and adding selective catalytic reduction equipment, a baghouse, a scrubber and to make numerous other improvements to Unit 1. An outage was scheduled for October 2008, to complete the major improvements to Unit 1. Other work performed during the outage included replacement of the Unit 1 high pressure turbine section, installation of a new distributed control system for Unit 1, and rewind of the Unit 1 generator. KCPL contracted with GE for the work on Unit 1 and to help startup the unit with the new high pressure turbine section. Startup for Unit 1 was scheduled for December 2008.

Various problems during the outage delayed the startup until late January 2009. On February 2, 2009, the Unit 1 boiler had been fired with coal, plant systems heated up, the turbine/generator was brought from standstill to 3600 rotations per minute (rpm), synchronized to the grid and achieved 50 MW of output. However, while increasing the load, the turbine tripped due to a high vibration in the number 4 bearing.

The number 4 bearing is located between the intermediate pressure turbine section and the low pressure turbine section bearing and was not part of the high pressure turbine change out. KCPL personnel stated that the number 4 bearing has been an intermittent problem

during startups of the unit since the mid- to late- 1980's. Consequently, a high vibration on bearing number 4 on this startup was not unexpected. KCPL stated in its response to data request number 564, made in case number ER-2010-0089, that KCPL worked with GE to minimize the problem with bearing number 4 during startups and that during full load operations the bearing vibrations are not a problem. Problems with the number 4 bearing have not impeded the unit's long term operation. However, in a second attempt to startup on February 4, 2009, high differential expansion and high vibration on number 2 bearing, located on the high pressure turbine section, was experienced, which again tripped the unit. It was then that the numbers 1, 2 and 3 bearings experienced severe vibration event. This event is the incident that is the subject of this report.

3.2 Personal Injuries

No personal injuries were reported as a result of this incident.

3.3 Commission Notification

The Commission Staff (Staff) received its first notification of the incident on February 9, 2009. KCPL also gave Staff a briefing on the incident at a meeting in Jefferson City on February 17, 2009. KCPL filed an Incident Report, No. I200900096, on February 26, 2009, after inspections determined the property damage would exceed the 4 CSR 240-3.190(3)(A) $100,000 limit for reporting an incident.

3.4 Company Actions before the Incident

Because of numerous new modifications to Iatan Unit 1, KCPL operations personnel were busier than typical during the first startup of the unit after the outage. Various operators and supervisory personnel had attended numerous meetings and received training on the startup of the unit. In addition, KCPL personnel verified actual clearances on the turbine/generator before any attempt to start it up. Personnel in the control room or in the adjacent Digital Control System room at the time of the event other than KCPL operations personnel included: one GE startup engineer, one GE turbine vibrations expert, two controls consultants and a control room simulator trainer. Brent Davis, the KCPL Iatan Unit 1 Project Director who submitted testimony on behalf of KCPL in Case No. ER-2009-0089, was not present in the control room at the time of the incident.

As mentioned earlier in this report, on February 2, 2009, the Unit 1 boiler had been fired with coal and the Unit 1 systems heated up. The turbine/generator was brought from standstill to 3600 rpm, synchronized to the grid and achieved 50 MW of output. However, while increasing the load, the turbine tripped due to high vibration on the number 4 bearing. The turbine was returned to the turning gear until another attempt could be made.

A second attempt at startup was made on February 4, 2009. The turbine/generator was brought from stand still to 3600 rpm, synchronized to the grid and output was increased to 100 MW. After approximately an hour at this output, the turbine high differential expansion trip alarm activated. This trip alarm was not wired to shutdown the turbine at this time, but only to alarm. Thus, the turbine did not shutdown at this time. KCPL stated in a telephone conversation on September 17, 2009, that KCPL operations personnel had been firing the boiler at an increasing rate because steam pressure was sagging. This action increased pressure and temperature in the turbine section. KCPL also stated in the same telephone conference that both KCPL operations personnel and the GE consulting engineers agreed to continue to operate Unit 1. Operation of Unit 1 at 100 MW continued for another fifteen minutes at which time vibrations on the number 2 bearing began to increase. The turbine tripped two minutes later due to high vibration on the number 2 bearing.

3.5 Company Actions after the Incident

Brent Davis, the KCPL Iatan Unit 1 Project Director, described KCPL's actions after the event in his rebuttal testimony in Case No. ER-2009-0089, as follows;

> On February 5, 2009 KCP&L Operations performed various checks with the turbine assembled to determine the condition of the high-pressure rotor. On February 6, 2009, KCP&L Operations with assistance from GE determined the high-pressure turbine would need to be disassembled and inspected, which GE began the following day. On February 9 the high-pressure rotor was exposed and was determined to be permanently bowed in the N-1 packing area near the front of the turbine. Considerable damage to the stationary components, including the shaft and blade packing, was discovered. No damage was noted to blades or buckets. On February 10, 2009, GE removed the high-pressure rotor and shipped it to a GE repair facility in Chicago, where it was received the following day. In the meantime, the site crew continued checking turbine bearings #1 through #4 and checking the condition of the intermediate pressure turbine.

KCPL and GE each formed independent investigative teams to determine the cause of the incident and to work on actions to prevent its recurrence. In a joint meeting on February 26, 2009, representatives from both companies agreed that the root cause of the rotor bowing incident was excessive turbine differential expansion which caused a combined axial rub and radial rub. On February 17, 2009, KCPL briefed Staff of the incident in a meeting in Jefferson City. As a result of the incident KCPL has modified its startup procedure to have operators monitor and verify the differential temperatures and expansion in the turbine. The unit was successfully restarted on March 18, 2009.

3.6 PSC Staff Investigation

Staff's Energy Department was notified by phone on February 9, 2009 of the event and that the current outage would have to be extended. Staff informed KCPL that it was a reportable incident if the damage exceeded $100,000. KCPL briefed Staff on February 17, 2009, in a meeting in Jefferson City, and again by conference call on February 27, 2009. The Staff next visited the Iatan Plant on April 1, 2009 after Unit 1 had already been on line for two weeks.

Staff issued numerous data requests in the KCPL rate case, Case No. ER-2009-0089, which was ongoing at the time of the incident, concerning the incident. On July 7, 2009, Staff requested the Commission to open a docket to receive Staff's report of its investigation of the incident. On July 9, 2009, the Commission opened Case No. ES-2010-0009. Staff issued additional data requests in that case. Staff reviewed the KCPL and GE investigation reports, the alarm logs, operators' logs, control room logs and operating system data for the period of the incident. Staff also reviewed the Iatan 1 startup procedures, and revised startup procedures. Staff conducted telephone calls with KCPL personnel regarding the incident. Staff reviewed the monthly outage data that it receives from KCPL in compliance with 4 CSR 240-3.190. Staff attempted to obtain access to the GE personnel that were present in the control room and the adjacent Digital Control System room at the time of the incident. GE did not make its personnel available to Staff. Staff sent to KCPL specific questions directed to GE on January 12, 2009. GE did not provide answers to the specific questions. GE's response is attached as Appendix 4.

4.0 ANALYSIS

4.1 Timelines of Events

02/02/2009	6:00	am	Commenced warm up of turbine
02/02/2009	12:13	pm	Rolled turbine, commenced various tests
02/02/2009	2:26	pm	Turbine testing completed and turbine placed on turning gear
02/02/2009	6:00	pm	Commenced turbine roll again
02/02/2009	8:31	pm	Turbine @ 3600 rpm Synch generator to grid
02/02/2009	8:56	pm	Turbine Trip on #4 bearing vibration, returned to turning gear
02/04/2009	11:46	am	Commenced warm up of turbine
02/04/2009	2:25	pm	Commenced turbine roll again
02/04/2009	2:41	pm	Turbine trip on high vibration, rub reported on turbine
02/04/2009	3:25	pm	Turbine placed on turning gear
02/04/2009	6:53	pm	Rolled turbine
02/04/2009	7:20	pm	Turbine at 3600 RPM
02/04/2009	7:21	pm	Generator Synched and began to increase load
02/04/2009	7:43	pm	Turbine #4 bearing high vibration alarm
02/04/2009	8:15	pm	Generator load @ 100 MW
02/04/2009	9:03	pm	HP Turbine Diff Expansion high alarm Turbine #4 bearing high vibration still in alarm
02/04/2009	9:14	pm	HP Turbine Diff Expansion Trip alarm setpoint reached
02/04/2009	9:30	pm	Turbine #2 bearing high vibration alarm
02/04/2009	9:31	pm	Turbine tripped on #2 bearing high vibration
02/04/2009	9:33	pm	Turbine #1 bearing high vibration alarm
02/04/2009	9:35	pm	Turbine #2 bearing reaches 20 mills
02/04/2009	9:37	pm	Turbine #1 bearing reaches 20 mills
02/04/2009	9:37	pm	Turbine #3 bearing high vibration alarm
02/04/2009	9:40	pm	Turbine bearings #1, 2, and 3 all at 20 mills
02/04/2009	9:51	pm	Turbine coasted down and put on turning gear
02/04/2009			Turbine eccentricity high while on turning gear
02/09/2009			After disassembling, measurement indicated a bow in rotor

4.2 Damage

The high pressure turbine rotor was bowed. The rotor shaft seals and packing, and turbine stage seals and packing were damaged. No rotating or stationary blade damage was identified.

4.3 Actions Taken by KCPL to Prevent Recurrence

1. KCPL revised the Iatan Unit 1 startup operation procedures to allow for a longer temperature soak period at 50 MW to avoid high differential expansion problems.
2. KCPL revised the Iatan Unit 1 operator's control screens to include a graphic of the differential expansion values.
3. KCPL added a high differential expansion trip which would trip the unit and cause it to shutdown at a preset level of differential expansion.

5.0 CONCLUSIONS

1. On February 4, 2009, Iatan Unit 1 tripped at 9:31 pm due to high vibration on the number 2 turbine bearing.
2. Axial and longitudinal rubbing between the rotor shaft and shell caused high vibrations on the number 1, 2, and 3 bearings as the turbine rotor slowed to a stop.
3. Significant damage and bowing of the rotor resulted from the rub and localized heat generated by the rub.
4. KCPL and GE investigative teams concluded the high pressure turbine rotor was bowed due to axial and longitudinal rubbing between the rotor and shell. The high differential expansion was most probably caused by the increase in the high pressure steam flow and temperature as the turbine output was increased to 100 MW. Staff has no reason to disagree with the findings of the KCPL and GE investigations on the cause of the bowed rotor.
5. The length of the outage had to be extended to repair the bowed turbine rotor.

6.0 RECOMMENDATIONS

Based on Staff's investigation and review of this incident, Staff recommends:

1. KCPL include a review of high differential expansion and its consequences in the training of its operators of the Iatan units.
2. KCPL include the high differential expansion instrumentation in its annual maintenance plan of the Iatan units.
3. KCPL should investigate the possibility of a similar occurrence at the other coal plants owned by KCPL. If there is a possibility of a similar occurrence, KCPL

should implement the actions that it took in response to this incident with regard to these other plants.

4. The Commission order KCPL to file a response to this incident report which contains the results of its investigation at coal plants owned by KCPL and any subsequent actions taken at those plants within thirty (30) days of a Commission order adopting the Staff's recommendations.