BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UE 196

In the Matter of	)	**PORTLAND GENERAL ELECTRIC COMPANY'S OPENING BRIEF IN RE-OPENED DOCKET**
PORTLAND GENERAL ELECTRIC COMPANY	)	
Application to Amortize the Boardman Deferral.	)	

I. INTRODUCTION

Portland General Electric Company ("PGE") submits this Brief following the re-opening of the record in this amortization docket. This docket concerns an October 2005 outage at the Boardman coal-fired power plant caused by a crack in the rotor of one of the low-pressure steam turbines at Boardman (the "LP1 Turbine"). In this docket, PGE seeks to recover a portion of its cost of purchasing replacement power during the Boardman outage. In the original deferral docket in this matter, UM 1234, PGE sought to recover its full cost of replacement power, approximately $45.7 million, for the period from November 18, 2005, to February 6, 2006. In its deferral order, the Commission imposed various deductions on PGE and ultimately authorized deferral of $26.439 million, or approximately 62 percent of PGE's replacement power costs. PGE did not seek recovery of the costs to repair and reinstall the rotor.

For the reasons below, PGE respectfully requests that the Commission determine that it acted prudently with respect to the LP1 Turbine and, therefore, is

entitled to amortize the portion of its replacement power costs approved by the Commission.

II. BACKGROUND

A. The Outage

This outage was caused by a crack in the rotor of the LP1 Turbine at Boardman. The LP1 Turbine is one of two low-pressure turbines that were manufactured and installed at Boardman by Siemens Westinghouse Power Company ("Siemens") in June 2000. UM 1234, PGE/200 at 3.

The upgraded LP1 and LP2 Turbines replaced existing turbines to generate more electricity from the same amount of fuel. July 23 Hearing Trans. at 104-05. When Siemens installed the new LP1 and LP2 Turbines in 2000, it contractually guaranteed the turbines would provide significant increases in electrical output for the same energy input. ICNU/103 at 61, 63-64. After the turbines were installed, electrical output at Boardman increased by about 35 megawatts for the same energy input. UM 1234, PGE/200 at 2.

The primary differences in the upgraded turbines were (1) a ruggedized (*i.e.* solid) rotor shaft and (2) lengthened and reshaped last-row blades. PGE/300; July 23 Hearing Trans. at 101-03. These new components were not unique or experimental; they had been incorporated in other turbines manufactured by Siemens. July 23 Hearing Trans. at 101-03. However, PGE's upgraded LP1 and LP2 Turbines were the first in Siemens' fleet of turbines (the BB271 fleet) to be upgraded with this particular length of last row blade. July 23 Hearing Trans. at 102. Because the upgraded BB271 turbines had not at the time of the contract been proven to deliver the promised increases in

efficiency, PGE negotiated with Siemens for contractual guarantees of increased electrical output. *Id.*

The Boardman turbine generator train consists of one combination high and intermediate pressure turbine (HPIP), two LP turbines, and one generator. PGE/100 at 8. These components are bolted together, end to end, to form a single rotor more than 100 feet in length. The rotor is supported by bearings located near the ends of each of the individual components. All of the rotor components, and the bearings that support them, must be aligned within specifications to assure proper operation. *Id.*

Since perfect alignment of such large and heavy components cannot be achieved, design criteria for the rotor include margin to allow for slight offsets of the rotor components or the bearings. *Id.* Since PGE is not an expert in the alignment of low-pressure turbines, PGE contracted with Siemens for major maintenance, including alignment of the turbine bearings and components. Between 2000 and 2005, Siemens periodically performed maintenance on the LP1 and LP2 turbines and aligned turbine train at Boardman using its proprietary methodology. July 23 Hearing Trans. at 65. PGE employees at Boardman were present for and monitored the results of maintenance and alignments. *Id.*; PGE/300 at 12-13.

After Siemens installed the LP1 and LP2 Turbines in 2000, PGE employees at Boardman monitored turbine vibration and temperature readings to detect any anomalous conditions or stresses on the turbines. July 23 Hearing Trans. at 114. In July 2005, PGE observed a slight increase in the vibration levels on the LP1 Turbine. PGE/100 at 3. Though vibrations were well within safe operating limits at that time, PGE continued to monitor the condition. Siemens and PGE' independent vibration

consultant, RK Ltd., visited Boardman, reviewed vibration data, collected additional data, and performed their own analyses. *Id.* They both suspected that the data indicated a turbine "rub" due to a bowed shaft. *Id.* at 3-4. On Siemens' recommendation, the LP1 Turbine was shut down and partially disassembled to allow Siemens and PGE to look for the rub. *Id.* at 4.

After partial disassembly, indications of rubbing in the steam seal area were discovered and corrected. *Id.* Following reassembly, PGE attempted to restart the turbine. *Id.* The vibration levels were more severe than before. *Id.* Siemens then tried twice to rebalance the turbine, but was not successful in reducing vibration. *Id.* PGE and Siemens disassembled the turbine and discovered that the LP1 rotor was cracked. *Id.*

After finding that the rotor had cracked, PGE obtained competitive repair bids from Siemens and from Alstom, another turbine manufacturer who has made numerous repairs to Siemens' turbines from other plants. *Id.* Although both manufacturers were highly qualified, PGE chose Alstom, because Alstom promised to finish the repairs nearly a month earlier than Siemens could have, thus saving PGE and its customers significant replacement power costs. *Id.*; July 23 hearing Trans. At 120-21. Alstom repaired the rotor and returned it to Boardman on January 25, 2006. PGE/100 at 5. Siemens' field personnel re-installed the rotor. *Id.*

In an effort to learn the causes of the rotor crack, PGE commissioned Alstom to perform a root-cause analysis of the LP1 failure. PGE/100 at 6; PGE/105C-B. Siemens and PGE also performed separate analyses. *Id.*; PGE/105C-A, PGE/105C-C. Alstom reviewed the operating data from the date of the turbine installation, and performed a metallurgical analysis at their Materials Technology Center in Tennessee.

Id. Alstom also calculated mechanical stresses and evaluated the mechanical properties of samples taken from the cracked area. PGE/105C-B. Siemens also analyzed the same type of data as Alstom, and performed analyses to determine the cause of the failure. PGE/105C-C.

Neither analysis identified a single cause. Alstom concluded that:

> [T]here has been no supporting evidence that the plant has been misoperated resulting in the failure of the LP1 turbine rotor. These results of the analysis, point in the direction of a misalignment of the train and an unsecured bearing pedestal. All the data and associated information indicate the root cause for this failure lies in a combination of factors. PGE/105C-B at 41.

Siemens concluded that the cracked rotor was not due to misoperation of the Boardman plant by PGE. PGE/105C-C at 35. Siemens further concluded that the rotor crack was caused by high-cycle fatigue due to an unknown condition or combination of conditions. PGE/105C-C at 35.

B. Procedural Background

1. The Deferral Phase

On November 18, 2005, PGE filed an Application for Deferred Accounting for $45 million of excess power costs incurred from November 18, 2005 through February 5, 2006, due to the Boardman outage. There were two outages at Boardman, one before and one after Siemens' installation of the repaired LP1 Turbine. PGE only sought to defer replacement power costs for the first outage. PGE did not seek to defer or recover from its customers any of the costs to transport, repair, or reinstall the cracked LP1 rotor.

The Application sought to defer the difference between the variable power costs for the Boardman plant, as established in the annual power cost update (PGE's

resource valuation mechanism), and replacement power costs incurred during the 105-day Boardman outage. PGE assessed that the total excess power cost impact associated with the Boardman outage, which began in October 2005, was $59 million. *See* Order No. 07-049 at 5. Because a portion of those costs were incurred before PGE filed its deferred accounting application, PGE initially calculated that approximately $45.7 million in replacement power costs were eligible for deferral. *Id.*

In the deferral phase of this proceeding, the Commission determined that the Boardman outage reflects an extraordinary event not forecasted in rates with a material financial impact on PGE. Accordingly, the Commission concluded the application met the legal requirements for deferred accounting and "that the Boardman outage satisf[ied] deferral discretionary criteria." *Id.* at 10. In addition, the Commission concluded, after making several adjustments supported by all parties, that $42.8 million in replacement power costs were eligible for deferred accounting. *See* Order No. 07-049 at 13.

In the Order granting PGE's application, the Commission required PGE to reduce the amount actually deferred substantially. To lower the deferred amount, the Commission first applied a 100-basis-point deadband on ROE to reflect a measure of "normal" business risk. *Id.* at 19. Next, the Commission adjusted the ROE deadband from 100 to 80 basis points to account for the SB 408 effect for costs incurred on or after January 1, 2006. Finally, the Commission required PGE to absorb 10 percent of the deadband-adjusted replacement costs. *Id.* at 20. As a result, the Commission authorized PGE to defer $26.439 million or 62 percent of the costs eligible for deferred accounting

treatment. This amount reflected about 45 percent of the total Boardman outage costs from the beginning of the outage in October 2005 through February 5, 2006.

2. The Amortization Phase

This proceeding was commenced in order for PGE to recover the replacement power costs approved for deferred accounting treatment. Under ORS 757.259(5), amortization of deferred amounts is subject to a prudence review and an earnings test. No party has questioned that PGE's earnings during the period support full recovery of the deferred amount. Prudence is therefore the only remaining issue.

a. The Initial Proceeding

PGE and two interveners, the Industrial Customers of Northwest Utilities ("ICNU") and the Citizens' Utility Board ("CUB") submitted testimony and briefing in the first phase of the amortization proceeding. Commission Staff also submitted testimony and briefs. Following a hearing, the ALJ closed the record by Order on August 19, 2008.

b. The Reopened Record

The Commission re-opened the record in this docket by an Order dated December 8, 2008. In its Order, the Commission made eight Bench Requests:

1. PGE states that it relied exclusively on Siemens, the original equipment manufacturer, for the installation and maintenance of the upgraded LP1 turbine. *See, e.g.*, PGE/300, Quennoz/13.

    a. What is standard industry practice for turbine installation and maintenance?

    b. Provide examples of other utilities that have relied on an original equipment manufacturer to provide such services.

c. Provide examples of other instances in which Siemens has provided such services to PGE and other utilities.

2. Provide copies of the Siemens reports provided in response to the Industrial Customers of Northwest Utilities (ICNU) Data Request Nos. 009, 010, 016, and 018. See ICNU/105, Martin/1.

3. Other than Siemens, what entities provide turbine installation or maintenance?

4. Is it standard industry practice for a utility to rely exclusively on an outside entity's (including an original equipment manufacturer) quality assurance/quality control (QA/QC) program for the installation and maintenance of a turbine rotor instead of having its own QA/QC program? *See, e.g.*, ICNU/105, Martin/1.

   a. Describe the key elements of Siemens's QA/QC program.

   b. Provide examples of other instances where PGE and other utilities have relied exclusively on an outside entity's QA/QC program for installation and maintenance services.

5. Describe in detail the actions PGE personnel took to oversee the installation and maintenance work performed by Siemens on the LP1 turbine. *See, e.g.*, PGE/400, Quennoz/10.

   a. Identify the PGE personnel responsible for overseeing Siemens's installation and maintenance of the LP1 turbine and describe their experience, training, education, and specialized knowledge.

   b. How could PGE provide effective oversight if much of the information about the installation of the new rotors in the LP1 turbine was considered proprietary and not shared with PGE? *See, e.g.*, PGE/105C-A, Quennoz/4-5.

6. Did PGE hire any outside consultants to oversee, monitor, or examine Siemens's installation and maintenance? If so, provide any reports or other similar materials prepared by these outside consultants.

7. Provide any reports or other similar materials prepared by the contractor hired in 2006 to perform the "frame foot loading test" referenced in ICNU/3I2C at 4.

8. Provide any reports or other similar materials prepared by the consultant(s) hired to conduct alignment checks and measure turbine component movement. See PGE/300, Quennoz/3, lines 14-15.

ICNU and CUB moved for reconsideration of the Commission's Order reopening the record, arguing on various grounds that the Order was improper. The Commission denied reconsideration by Order on February 5, 2009. ICNU and CUB have now appealed the Commission's Order to the Oregon Court of Appeals.

In the meantime, PGE filed testimony in response to the Commission's Bench Requests. Staff, CUB and ICNU filed responsive testimony. Staff concluded that "the Commission should allow the amortization to proceed and the company to recover the excess power costs plus interest on the unpaid balance as requested." Staff/300; Durrenberger/6. CUB and ICNU argues that PGE should recover nothing. CUB/300; Feighner 3; ICNU/300; Martin 21. ICNU, CUB and Staff also served additional data requests on PGE. Following a hearing on April 20, 2009, the ALJ again closed the record in this docket.

III. DISCUSSION

The Commission reopened this record to address specific Bench Requests. As a general matter, the requests ask for information about PGE's dealings with Siemens and other outside experts involved in the LP turbine upgrade.

A. Legal Standard

In their testimony, CUB and ICNU attack various aspects of PGE's upgrade of the LP turbines through the testimony of their experts, Gordon Feighner and John Martin. We will address their individual arguments below. As an initial matter,

however, it is important to remember that the focus of this proceeding is on PGE's prudence. With the benefit of hindsight, CUB and ICNU have implied that because the LP1 turbine cracked after only five years, PGE should not be allowed to recover costs of replacement power. But the proper question is not simply whether this rotor lasted as long as it should have but, rather, whether PGE's decisions in connection with the LP turbine upgrade were prudent at the time they were made.

In a prudence review, the Commission reviews "the objective reasonableness of a decision at the time the decision was made." *See* UM 995, Order No. 02-469 at 5. The Commission does not focus on the outcome of the utility's decision, but rather on the reasonableness of the actions "based on information that was available (or could reasonably have been available) at the time." *See In Re PGE*, UE 102, Order No. 99-033 at 36-37. *See also In Re Transition Costs*, UM 934, Order No. 98-353 at 9 ("[when utilities mitigate transition costs], they must behave prudently, meaning that their decisions were reasonable, based on information that was available (or could reasonably have been available) at the time"); *In Re Northwest Natural Gas*, UG 132, Order No. 99-697 at 53 ("in this review, therefore, we must determine whether the NW Natural's actions and decisions, based on what it knew or should have known at the time, were prudent in light of existing circumstances").

B. Responses to Individual Bench Requests

1. Requests for Documentation

Several of the Commission's Bench Requests – numbers 2, 3, and 6-8 -- call for PGE to provide specific documents or lists of information. PGE provided that

information in connection with its initial testimony in the reopened docket. PGE/500; Quennoz/7-8, 21-23.

The remaining requests called for information and explanation. PGE addresses those individual requests below.

2. **Request No. 1: PGE states that it relied exclusively on Siemens, the original equipment manufacturer, for the installation and maintenance of the upgraded LP1 turbine. See, e.g., PGE/300, Quennoz/13.**

PGE hired Siemens to manufacture and install the upgraded Boardman turbines. However, PGE did not rely exclusively on Siemens for installation and maintenance of the LP1 turbine. PGE took an active role. PGE designated one of its engineers, Janet Kahl, to act as PGE's Quality Control Representative (PQCR) to oversee the manufacturing and installation of the turbines. April 20 Transcript at 255:15-17. Numerous experienced PGE employees participated with Ms. Kahl in monitoring Siemens' manufacture and installation. PGE/600; Kahl/6. During the installation, qualified PGE employees were on site day and night, closely monitoring the installation process.

Further, it is not accurate to say that PGE relied exclusively on Siemens for maintenance of the upgraded LP turbines. PGE used Siemens for turbine alignment and some major maintenance tasks, with appropriate oversight by PGE, but did not use Siemens for routine annual maintenance. PGE/700; Quennoz/14. Even ICNU's expert agrees that this is consistent with common and desirable industry practice. April 20 Transcript at 349:22 – 351:20.

3. Request No. 1(a): What is standard industry practice for turbine installation and maintenance?

a. Installation

Hiring the Original Equipment Manufacturer (or "OEM") – in this case, Siemens -- to install upgraded turbine components, particularly on large turbines like those at the Boardman plant, is standard industry practice. PGE/500; Quennoz/3. As Mr. Durrenberger of Staff testified, the OEM is often not only the best source but the only viable source for post-sales installation and servicing of turbines of this class. Staff/300; Durrenberger/2.

Long-term relationships with OEMs like Siemens ensure that the plant has ready access to specialized knowledge (*e.g.* tolerances, drawings, and fleet operating history), tools, and experience needed to operate and maintain the turbine with best practices and to efficiently perform repairs. Such relationships allow access to engineering talent and experience not otherwise available to a utility that only operates a single large steam plant turbine generator. PGE/500; Quennoz/3.

b. Maintenance

Using the OEM is also a common and accepted practice for some turbine maintenance. PGE/500; Quennoz/3; PGE/700; Quennoz/14. The scope of turbine maintenance work at Boardman varied from year to year. This depended on whether any major turbine modifications were made or a major inspection interval had been reached, or only minor maintenance was required (e.g., repairing valves and fixing steam leaks). A summary of turbine maintenance (including Siemens' involvement) performed between the years 2000 and 2005 is provided below.

- During the 2000 Boardman plant outage, Siemens performed the Low Pressure Turbine installation/upgrade. They installed the new low pressure rotors and performed modifications and maintenance necessary to accommodate the new rotors. The work was performed in accordance with Siemens' procedures and QA/QC program. PGE maintained careful oversight of the work.

- During the 2001 annual Boardman plant outage, PGE craftsmen performed maintenance on the turbine governor and intercept valves (e.g., fixing hydraulic control fluid leaks).

- During the 2002 annual Boardman plant outage, Siemens replaced the journal bearings on the low pressure turbines with new tilt-pad bearings. Similar to the 2000 installation work, PGE maintained careful oversight of this work. Apart from the Siemens work, PGE craftsmen and qualified inspectors inspected, cleaned, and repaired steam valves (governor, throttle, reheat stop, and intercept valves) on the turbine. Qualified PGE personnel performed Non-Destructive Examinations (NDE) as part of this work.

- During the 2003 outage, PGE craftsmen repaired steam and air leaks, checked piping, repaired valves, and changed the turbine rupture disks.

- During the 2004 outage, the HP/IP turbine upgrade work was performed by Siemens, similar to what was performed in 2000 for the low pressure turbine upgrade. PGE maintained careful oversight of the work. PGE craftsmen also inspected and repaired the governor, throttle, reheat stop valves, fixed air leaks and a broken support weld, fabricated supports for a new main steam pressure tap added during the HP/IP turbine upgrade, and fixed leaks.

- During the 2005 annual outage (Spring 2005), PGE craftsmen repaired oil leaks and worked on the turbine throttle valves.

PGE's practice was to use Siemens for alignment and major maintenance on the turbines. PGE/500; Quennoz 17-18. This is consistent with common and accepted industry practice. ICNU's expert John Martin agrees. He testified that "using the OEM for major maintenance is a common and desirable practice in the industry . . . ." ICNU/400; Martin/3.

Mr. Martin also testified that it is not standard to use the OEM for routine annual maintenance on a turbine. ICNU/400; Martin 3. Again, this is consistent with

PGE's practice. PGE performed routine maintenance on the turbines, and used Siemens during annual maintenance outages for specific tasks only, on an as-needed basis. PGE/500; Quennoz 17-18. At the April 20 hearing, Mr. Martin testified that PGE's use of Siemens for annual and major maintenance was appropriate and consistent with desirable industry practices. April 20 Transcript at 349:22-351:20.

4. **Request No. 1(b): Provide examples of other utilities that have relied on an original equipment manufacturer to provide such services.**

In response to this Bench Request, PGE conducted a survey of other fossil fueled generating plants in the United States and in Canada. PGE conducted this survey through Fossil Operations and Maintenance Information Service (FOMIS), an on-line utility information service based in Dunedin, Florida. The FOMIS service is sponsored by 77 utility companies that represent 156 plant sites and over 400 generating units. The survey was sent to all of the sponsor plant sites and responses were received from those who could reply on a short turn-around basis. Responses came from utilities in the United States and Canada.

FOMIS broadcast PGE's survey questions to its members, and responding utilities e-mailed their answers directly to PGE. The survey questions, together with a list of responding utilities and a summary of all responses, were provided to the Commission as PGE Exhibit 501.

Thirteen of the fourteen utilities that responded to PGE's FOMIS survey reported that they used the OEM for steam turbine installation. (The other respondent reported that he/she did not know.) Thirteen utilities also reported that they use the OEM for some or all of their steam turbine maintenance.

These responses demonstrate that it is a common and accepted practice for utilities to hire their OEMs for installation and maintenance services, subject to the utilities' monitoring and oversight.

CUB faults the survey because only 13 of the 77 FOMIS utilities responded. CUB/300; Feighner/5. This was a voluntary survey conducted with a short turnaround time. Whether or not this is a statistically significant sample, it is telling that every respondent reported using the OEM for some installation or maintenance services on its turbines. CUB may find fault with PGE's methods or response rate, but they have not attempted to put any evidence in this record to contradict PGE's testimony or the FOMIS survey. And the survey clearly "provide[s] examples of other utilities that have relied on the original equipment manufacturer to provide such services," which is what this Bench Request asks for.

CUB also criticizes the wording of one of PGE's FOMIS questions: "Did you have the original equipment manufacturer (OEM) install or verify proper installation of the steam turbines during original installation?" PGE/500; Quennoz/501A/1. CUB suggests that this question is somehow misleading because it does not reveal whether the OEM (1) actually physically performed the installation or (2) monitored and verified the installation. But again, the Commission's Bench Request did not ask whether all OEMs physically install their turbines but, rather, for examples of utilities that have used OEMs for installation or maintenance services. PGE's question was designed to discover whether it is common practice for the OEM to be involved in the installation and maintenance of turbines, either through actual installation or monitoring and verification. The FOMIS survey is consistent with PGE's prior testimony and experience in the

industry. PGE/700; Quennoz/8. It is the common practice to have the OEM significantly involved in the installation and maintenance of new turbines, which is what occurred at Boardman.

5. Request No. 1(c): Provide examples of other instances in which Siemens has provided such services to PGE and other utilities.

PGE's Exhibit 502C is a 19-page list of facilities at which Siemens has provided installation or maintenance services for turbines. After receiving this list, Janet Kahl contacted Siemens and confirmed that Siemens had installed the turbines at the listed facilities. April 20 Transcript at 327:15-328:9.

ICNU criticizes this list because it does not specify exactly what installation services Siemens provided at these facilities. Mr. Martin states "it is doubtful that Siemens provided the complete plant design and construction services normally provided an Engineer/Constructor." ICNU/400; Martin/10. But that is not the question. The issue in this case is not whether Siemens has provided "complete plant design and construction services" at any facilities. PGE did not hire Siemens to perform complete plant design and construction services at Boardman. PGE hired Siemens to manufacture and install upgraded turbine components and then to align and perform major maintenance on the upgraded turbines. PGE/502C provides a list of facilities at which Siemens has provided installation and maintenance services, which is what the Bench Request asked for. Ms. Kahl confirmed the scope of the services provided. If ICNU had any legitimate question on this subject, it could simply have contacted Siemens to ask, or taken the additional step of issuing a subpoena. But neither ICNU nor its expert did

either. April 20 Transcript at 352:17-353:2. The only testimony on this issue is Ms. Kahl's, which confirms the scope of services Siemens provided.

6. **Request No. 4: Is it standard industry practice for a utility to rely exclusively on an outside entity's (including an original equipment manufacturer) quality assurance/quality control (QA/QC) program for the installation and maintenance of a turbine rotor instead of having its own QA/QC program?** ***See, e.g.,*** **ICNU/105, Martin/1.**

Yes. It is typical for a purchaser/user of a steam turbine, like PGE, to rely on the manufacturer's QA/QC programs, with adequate oversight and monitoring. PGE/500; Quennoz/10. As Mr. Durrenberger of Staff testified, the appropriate question in assessing QA/QC is not whether PGE created separate QA/QC programs to govern Siemens, but whether Siemens had "robust QA/QC program and demonstrated conformance to the program and does the product/service conform to the specifications, form and function required by the owner?" Staff/300; Durrenberger/5. Further, the responses to PGE's FOMIS survey confirm this industry practice. Almost all of the responding utilities reported that they relied on the QA/QC program of the OEM, with appropriate oversight. See PGE Ex. 501.

"A quality assurance (QA) program is prepared and implemented by an equipment supplier to achieve certain requirements or characteristics in the components produced within his or her facilities." William P. Sanders, *Turbine Steam Path Maintenance and Repair*, Vol. II at 677 (PenWell 2002). "The purchaser/user has an implied responsibility to monitor," but this monitoring "can normally be achieved by the monitoring of the supplier's quality program, and also by directing inspection or

surveillance attention to those critical characteristics that must be achieved if the unit is to perform as anticipated." *Id.* at 654. (Copies of the relevant pages of Sanders' book are included in PGE Exhibit 508). PGE fulfilled this responsibility by reviewing and accepting Siemens' QA/QC program and by monitoring Siemens' performance and compliance with its programs.

As the operator of the Boardman Plant, PGE recognized its responsibility to monitor the manufacture and assembly of the upgraded LP turbine components. PGE personnel reviewed the Siemens QA/QC program, examined material test reports, and made inspection visits to the manufacturing facilities during the manufacture of both LP turbine rotors and the HP/IP turbine rotor. During installation at the Boardman Plant, experienced PGE personnel reviewed Siemens QA/QC program and monitored Siemens' activities, including installation, interface problems, QA/QC program compliance and any material or program nonconformance.

Before purchasing the upgraded LP turbines from Siemens, PGE required Siemens to have a QA/QC program that met industry standards. In its contract with Siemens for manufacture and installation of the LP turbines, PGE required that Siemens' QA/QC program be ISO 9001 certified.[1] PGE Exhibit 511 is a description of the elements required for ISO 9001 certification. Exhibit 512 is a copy of Siemens' ISO 9001 certification. Mr. Durrenberger of Staff testified that Siemens' ISO 9001 certification supports the contention that Siemens had a robust QA/QC program. Staff/300; Durrenberger/5.

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[1] ISO 9001 certification is the industry standard for QA/QC programs. PGE Exhibit 510 contains a description of ISO 9001 Certification.

During the manufacture of the LP and HP/IP turbines, PGE employees conducted site visits to Siemens' facilities in North Carolina, Ohio, Mexico and Germany, where the turbine components were being manufactured. During those site visits, PGE employees reviewed and verified Siemens' QA/QC documentation. PGE/600; Kahl/2; PGE Exs. 603 and 604. PGE employees also monitored Siemens' testing and manufacturing to ensure that Siemens was following its QA/QC program. *Id.*

ICNU also alleges that PGE failed to ensure that Siemens had an adequate QA/QC program for the LP turbine installation in addition to its program for the turbine manufacture. This allegation is false. PGE's contract with Siemens required that Siemens have a QA/QC that governed installation. Siemens followed a QA/QC program that covered both manufacturing and installation of the LP turbines. PGE ensured that Siemens had that program in place during pre-installation meetings at Boardman. April 20 Transcript at 306:3-308:11; PGE/700; Quennoz/18. Siemens kept a copy of the QA/QC program on-site in its construction trailer and followed it during the installation. (*Id.*) Janet Kahl reviewed that program during the installation to ensure Siemens' compliance. April 20 Transcript at 291:12-292:2.

In sum, PGE ensured that Siemens had industry standard QA/QC programs in place for the manufacture and installation of the upgraded LP turbines. PGE personnel monitored Siemens' compliance with the QA/QC program during manufacture and installation. This is consistent with common industry practice.

7. **Request No. 4(a): Describe the key elements of Siemens' QA/QC program.**

In connection with the purchase, construction and installation of the upgraded LP turbines, PGE reviewed and accepted Siemens' QA/QC program. PGE's contract required Siemens to follow a QA/QC program that met ISO 9001 standards.

A robust QA/QC program should include procedures or processes for controlling all aspects of a component's quality. Key elements include:

- procedures for controlling the purchase of materials,
- inspection and test methods and plans,
- personnel responsibilities and authorities,
- control and calibration of measuring and test equipment,
- control of special processes,
- methods for reporting, evaluating and dispositioning non-conforming items,
- instructions for storage, packaging and shipping, and
- plans for controlling documents and records.

PGE/500; Quennoz/13-14.

PGE reviewed Siemens' QA/QC program and found that it addressed the key program elements and had received ISO 9001 certification. Janet Kahl and other PGE employees reviewed the QA/QC program at Siemens' facility before manufacturing began. Later, after Siemens delivered the upgraded LP turbines to Boardman, Ms. Kahl and other PGE representatives reviewed the QA/QC program during the pre-installation meeting at Boardman. The QA/QC documents remained on-site at Boardman during the installation, in a construction trailer. Ms. Kahl reviewed them during the installation.

April 20 Transcript at 291:12-292:2. PGE did not retain a copy of Siemens' QA/QC program after installation in 2000, but reviewed the program at the time to ensure that it met industry standards and had the necessary components.

8. **Request No. 4(b): Provide examples of other instances where PGE and other utilities have relied exclusively on an outside entity's QA/QC program for installation and maintenance services.**

PGE did not use its own separate QA/QC program to direct Siemens' operations. PGE verified that Siemens had ISO 9001 certified QA/QC programs and then closely monitored Siemens' work in the manufacturing, installation and maintenance of the upgraded turbines. Reliance on a vendor's certified QA/QC program, together with appropriate monitoring, is accepted industry practice. PGE has successfully used – and continues to use – the same approach in the construction of Coyote Springs, Port Westward, and Biglow Canyon Phases I and II, and in other large non-power-production projects. PGE/500; Quennoz/16.

The responses to PGE's FOMIS survey confirm this industry practice. Nearly every responding utility reported that it relied on the QA/QC program of its OEM for steam turbine work, with appropriate oversight. None of the responding utilities reported that they have their own QA/QC programs governing the OEM for steam turbine work. *Id.*

PGE also contracts with the OEM, with PGE oversight, for maintenance at some of its other thermal plants. The Coyote Springs plant is a combined cycle unit with General Electric gas and steam turbines. PGE has a long term service agreement with General Electric to provide planned maintenance services on both the gas and steam

turbines. The Port Westward plant is a combined cycle unit with Mitsubishi gas and steam turbines. PGE has a long term service agreement with Mitsubishi to provide planned maintenance services on the gas turbine. Consistent with PGE's practice at Boardman, and with the practices of other utilities that responded to the FOMIS survey, PGE has not attempted to impose its own QA/QC program on GE or Mitsubishi. PGE/500; Quennoz/16-17.

9. **Request No. 5: Describe in detail the actions PGE personnel took to oversee the installation and maintenance work performed by Siemens on the LP1 turbine. *See, e.g.*, PGE/400, Quennoz/10.**

PGE actively monitored Siemens' manufacture, installation, and maintenance of the upgraded turbines. Beginning in 1998, Janet Kahl and other PGE representatives participated in negotiations with Siemens on the turbine upgrade purchase. April 20 Transcript at 254:24 - 255:5. PGE's right to monitor Siemens' QA/QC programs and performance was explicitly addressed during those negotiations. PGE negotiated the right to establish "witness points" during the manufacture of the turbine. See PGE Exhibit 513, Contract, at 73 and 83. These "witness points" were specific events during manufacturing that PGE's Quality Control Representative (PQCR) oversaw to ensure compliance with the requirements of the specifications, codes and drawings.

The contract also required that Siemens maintain a QA/QC program that was certified under ISO 9001 standards. Siemens' QA/QC program met that standard. See PGE Exhibit 511. PGE had the contractual right "to witnessing of tests and inspections by the PQCR to ensure compliance with the specifications, codes, and

drawings" of its QA/QC program and turbine design. See PGE Exhibit 512, Contract, at 83.

As part of this oversight, PGE employees visited Siemens' facilities to review their QA/QC programs and to witness specific events related to the manufacture of the turbines. Ms. Kahl made multiple visits to Siemens' design and manufacturing facilities, in Florida, North Carolina, Ohio, and Mexico. PGE/600; Kahl/3, and Exhibits 601, 602. PGE's contract with Siemens included rights to review the results of tests that Siemens performed on the LP turbines. See PGE Exhibit 512, Contract, at 10-14. For example, PGE reviewed the Forging Ladle Analysis, which tests the rotor's metallurgical composition, to ensure that the composition met contract specifications. PGE Exhibit 603 is a copy of the Forging Ladle Analysis. PGE also reviewed Siemens' Tensile Test data related to the turbines. PGE Exhibit 604 contains copies of these test results.

PGE's "witness points" and QA/QC reviews allowed PGE to monitor production of the turbines. These events were milestones under PGE's contract with Siemens, which meant that PGE's periodic payments to Siemens were tied to successful completion of these steps during the production process. The contract also required that PGE be informed of deviations or non-conformances and approve disposition of those items. When Siemens deviated from design requirements during production, Siemens was required to inform PGE and to obtain PGE's agreement that the deviation did not affect the form, fit, or function of the turbine. Siemens informed PGE through its Material Disposition Reporting system, as shown in PGE Exhibit 605.

After completion of the manufacturing process, Siemens shipped the LP1 and LP2 turbine rotors to Boardman for installation. When the turbine rotors arrived at

Boardman, an American Society for Nondestructive Testing (ASNT) Level II qualified PGE employee conducted visual receipt inspections of the rotors to check for damage. PGE Exhibit 606 contains reports from these inspections, with photographs.

After PGE's receipt, inspection and acceptance, Siemens installed the upgraded turbines. PGE employees actively monitored the installation. As part of PGE's monitoring, Janet Kahl kept a daily log of Job Notes, which is contained in PGE Exhibit 607, and took hundreds of photographs of the installation, which are provided on a CD as PGE Exhibit 608. PGE/600; Kahl/3. PGE employees were present during the installation; photographed and recorded installation steps; consulted with Siemens personnel about the installation; physically inspected turbine components during installation; and ultimately approved the progress and completeness of the installation.

PGE also employed a third-party consultant, Stone & Webster, to review and validate Siemens' performance test procedures and results for the upgraded turbines. Because performance guarantees were easily exceeded, no written report was required or prepared. PGE/600; Kahl/4.

PGE also closely monitored Siemens during turbine maintenance. When PGE scheduled a maintenance outage at Boardman, plant representatives listed tasks to be performed on an outage schedule. PGE/500; Quennoz/18-20. During a maintenance outage, one or more PGE employees are assigned to oversee service providers hired to perform maintenance tasks. The assigned PGE employees must verify the completion of the maintenance tasks, and then report the tasks as complete to the Boardman Plant Manager, who was in charge of the plant during operation and during outages. *Id.* This is the protocol that PGE followed for turbine maintenance performed by Siemens. At

least one PGE employee was assigned to monitor each scheduled turbine maintenance task. Those employees would observe Siemens' maintenance activities, consult or ask questions where necessary, and report on progress at regular progress meetings with the Boardman Plant Manager and staff. When Siemens completed a task, the assigned employee was responsible for verifying that the task was completed satisfactorily and reporting to plant management. *Id.*

After the upgraded LP turbines were on-line, PGE continuously monitored vibration and temperature readings at the turbine bearings to detect changes that might indicate problems with the turbines. PGE/100; Quennoz/3, 6-7, 9. PGE's monitoring of temperatures uncovered issues that led Siemens to replace Bearing Nos. 3-6 on the turbines in 2002. PGE's monitoring also detected increased vibrations that led to discovery of the LP1 rotor crack in 2005, and PGE removed the turbine from service before a catastrophic failure occurred. PGE Exhibit 609 contains copies of PGE vibration data that were included in the Alstom root cause analysis (provided in PGE Exhibit 105C-B). PGE also monitored Siemens' maintenance of the upgraded LP turbines.

In sum, PGE employees oversaw and monitored Siemens' construction, installation, and maintenance of the upgraded LP turbines. Siemens was required to obtain PGE's approval before manufacturing, installation, and maintenance tasks were considered complete. Although PGE contracted with Siemens to perform these tasks, they were performed under PGE's monitoring and subject to PGE's approval.

ICNU argues in the reopened docket that PGE should have hired an engineer/constructor to monitor the LP turbine upgrade. ICNU/400; Martin 4. This is the first time that ICNU has made this argument in this proceeding. Mr. Martin has

previously testified that this monitoring could properly have been performed either by PGE or an outside expert. April 20 Transcript at 379:25-380:8. It is not PGE's practice to hire a separate or independent engineer/constructor for an upgrade of existing components like the LP turbine rotors, nor is it a standard practice in the industry. PGE/700; Quennoz/10.

PGE typically uses engineer/constructors to oversee the construction of new generating facilities, not for the upgrade of an existing component at an existing facility. PGE/700; Quennoz/10-12. It is industry practice to use an engineer/constructor when constructing a new facility, which will encompass many disparate components manufactured by many different OEMs. In those circumstances with multiple construction contractors and OEMs and multiple new components, it is not prudent to have a single OEM oversee the entire project. PGE used an engineer/constructor, Bechtel, during the initial construction of the Boardman facility, just as PGE used Black and Veatch at Port Westward. This was not the case in the LP turbine upgrade, where PGE had a single OEM, Siemens. PGE/700; Quennoz/12.

When a new turbine is installed in a new facility, it is only one part of a complicated, integrated construction project. By contrast, the upgrade of the LP turbines involved replacement of a few components of the existing steam turbine and integrating those new components with the existing components. The upgrade took six weeks to complete and was far less complex than the construction of a new generating facility, which usually takes years to complete. *Id.*

More to the point, it is a single project, with a single OEM. In a circumstance like this, no outside engineer/constructor will be able to duplicate the

knowledge and experience of the OEM. PGE would typically hire an engineer/constructor for a large construction project with multiple OEMs (like the construction of Port Westward or Boardman), because the engineer/constructor can oversee the entire construction and work with multiple OEMs and with PGE. But in this case, PGE worked directly with Siemens, the OEM who manufactured the only components PGE was replacing.

It is also important to point out that Mr. Martin does not identify any aspect of Siemens' installation that he believes was performed incorrectly, or could have been done better with the services of an engineer/constructor. Neither he nor any of the root cause analyses have pointed to any shortfall or deficiency in Siemens' installation of the LP turbines that they believe, (1) caused the rotor crack, and (2) and would likely have been caught by an engineer/constructor.

ICNU's criticisms of PGE's monitoring are also inaccurate. According to Mr. Martin, PGE's internal QA/QC and monitoring programs are based on PGE's desire to "absolve itself of responsibility if something goes wrong." He also describes PGE's monitoring of plant operation as "unofficial, passive and hands-off." ICNU/400; Martin/12. These characterizations are inaccurate and unfair. They are also contradicted by the facts of this case.

As an initial point, none of the root cause analyses of this outage has ever identified PGE's monitoring or operation of the Boardman plant as a cause of the rotor crack. Mr. Martin himself previously testified that he did not believe that PGE's operation of the Boardman plant was a major cause of the crack. PGE/301 at 1.

Further, Mr. Martin ignores the fact that it was PGE's monitoring that led to the discovery of this crack in the first place. PGE continuously monitors bearing vibration and temperature along the length of the turbine, with assistance from outside experts as needed. PGE detected temperature anomalies through its monitoring and insisted that Siemens make improvements. This resulted in the replacement of bearings 3-6 in 2002.

When PGE discovered changes in vibrations at bearing 3 in 2005, PGE enlisted the support of Siemens and other outside experts to determine the cause of the increased vibrations. PGE's monitoring of vibrations and our decision to take the turbine offline led plant employees to discover the crack before it became worse. This is not passive, hands-off monitoring. PGE did not sit back and rely on Siemens, with the idea that PGE could "absolve itself of responsibility if something goes wrong." When something went wrong, it was PGE who discovered it and PGE who took action. ICNU's allegation that PGE fails to actively protect its facilities is simply false and is not borne out by any of the events in this case.

ICNU is also incorrect in suggesting that PGE did not take an active role in the design and installation of the upgraded LP turbines. ICNU/400; Martin/14. PGE worked actively with Siemens over the course of three years to finalize the design of the upgraded LP turbines. July 23 Hearing Transcript at 104. PGE also actively participated in the installation of the upgraded turbines, as can be seen from Janet Kahl's testimony in this docket, PGE/600; Kahl/5, as well as her detailed job notes and several hundred photographs from the installation. PGE Ex. 602.

Finally, ICNU's criticisms of PGE's recordkeeping are also unfounded. Mr. Martin claims that PGE was unable to provide any job notes, diaries or other references from the turbine installations. ICNU/400; Martin/14. But Mr. Martin fails to acknowledge the detailed job notes and hundreds of photographs from the LP installation provided by Janet Kahl in connection with her testimony in this docket. PGE Ex. 607.

10. Request 5(a): Identify the PGE personnel responsible for overseeing Siemens' installation and maintenance of the LP1 turbine and describe their experience, training, education and specialized knowledge.

PGE has provided a list of personnel and their qualifications with the testimony of Janet Kahl. PGE/600; Kahl/6.

In addition to Janet Kahl, more than 30 qualified PGE employees participated in monitoring Siemens installation and maintenance of the LP turbines. In addition, PGE used outside consultants like RK Ltd. and Stone & Webster to assist with monitoring, and analysis, as described above.

ICNU argues that PGE's employees were not experienced enough to effectively monitor Siemens' activities. But PGE employees had significant experience in the installation and maintenance of the LP turbines. After Boardman came online in 1980, Siemens and PGE staff inspected and overhauled the turbines every five years as part of major scheduled maintenance. During those outages, PGE staff would pull the rotors from the LP turbines for internal bore inspections, examine turbine components for wear, and reinstall them. Loren Mayer, Bryan Timms and Tom Kingston, among others, assisted in those removals and replacements of the LP turbine components. PGE/700;

Quennoz/13. Mr. Mayer, Mr. Timms and Mr. Kingston also participated in PGE's monitoring of the LP turbine upgrade. ICNU's criticisms are simply unfounded.

11. Request No. 5(b): How could PGE provide effective oversight if much of the information about the installation of the new rotors in the LP1 turbine was considered proprietary and not shared with PGE? *See, e.g.*, PGE/105C-A, Quennoz/4-5.

The only information that was described as proprietary in Mr. Quennoz's referenced testimony were certain specific calculations that Siemens used in aligning the Boardman turbines. The installation was not proprietary: PGE personnel monitored every step of the installation. The same is true of Siemens' maintenance work for PGE, as described above.

Further, although certain of Siemens' alignment equations are proprietary, PGE employees and consultants still monitored the alignment of the LP turbines. PGE personnel were present for turbine alignments and measurements and verified the placement of turbine bearings and components during the alignment. April 20 Transcript at 272:3 – 275:21. PGE also continually monitored vibration and temperature readings along the turbine train during and after alignment to ensure that the readings were in acceptable tolerances while the turbines were operating. RK Ltd., monitored vibrations during every restart of the LP1 turbine between its installation and the 2005 outage, to provide further assurance that vibrations remained within acceptable levels. PGE/600; Kahl/8.

At the April 20 hearing, Mr. Martin criticized PGE for not demanding that Siemens provide PGE the proprietary calculations it uses to determine safety margins

during alignment. This criticism is based on Mr. Martin's inexperience with turbine alignment. In response to a question from the ALJ, Mr. Martin testified that he did not believe that Siemens would withhold such information or keep it proprietary. April 20 Transcript at 359:22 – 360:21. This testimony contradicts the testimony Janet Kahl, who was actively involved in monitoring Siemens' alignment of the turbine. April 20 Transcript at 312:1 – 313:1; PGE/600; Kahl/8.

Mr. Martin acknowledged that neither he nor his company has any experience in aligning steam turbines. April 20 Transcript at 370:7-371:18. Nor has he ever worked with Siemens in any capacity on a turbine alignment. *Id.*. He acknowledges that his testimony about what Siemens would and would not keep proprietary in this circumstance is speculation. *Id.* Nor has Mr. Martin made any attempt to contact Siemens at any time during this proceeding to ask Siemens whether it considers these calculations proprietary. April 20 Transcript at 352:17-353:2.

Mr. Martin acknowledges that his testimony about alignment is not expert testimony, since he has no experience with turbine alignment. April 20 Transcript at 375:2-376:12. Nor can he testify as a fact witness about Siemens' practices, since he has neither worked with Siemens on turbine alignment nor asked Siemens any relevant questions. Nevertheless, however, he speculates that if PGE had asked to see Siemens' safety margin calculations, Siemens would have provided them. His speculation on this point is based on nothing and has no evidentiary value.

In fact, Siemens did not provide these calculations to PGE, but instead held them confidential. PGE/600; Kahl/8; April 20 Transcript at 312:1-313:1. The reason for this is simple. PGE's engineers can calculate every other part of the alignment

themselves; they verify the measurements and observe the physical alignment of the turbines. If they had access to Siemens' safety-margin calculations, they could learn to do the alignment without Siemens. Mr. Martin speculated that Siemens would happily provide these calculations to PGE because PGE is a customer, not a competitor. April 20 Transcript at 359:22-360:21. But if PGE had these calculations, it might cease to be a customer and instead become a competitor, because it could do the alignment itself.

To the extent that this limits PGE's ability to monitor Siemens' alignment of the turbines, it is unavoidable. PGE lacks the expertise to align these turbines itself, and neither Siemens nor any other entity that has the expertise is likely to share its proprietary calculations with PGE, for competitive reasons. These are the conditions under which utilities operate. The turbines must be aligned by qualified experts, and PGE should not be called imprudent for accepting the recommendations of the most qualified experts in this case.

C. Responses to Other Arguments

In their testimony in the re-opened docket, CUB and ICNU go beyond the scope of the Commission's Bench Requests and raise additional arguments. PGE addresses those additional arguments below.

1. CUB's Arguments

CUB argues that "PGE's response to the Bench Request does little to demonstrate that the company has operated prudently with regards to its decision to install experimental technology or with regards to its installation and maintenance practices thereafter." CUB/300; Feighner/8.

As it has throughout this docket, CUB argues that the upgraded LP turbines were untested, experimental technology that PGE installed without adequate guarantees. PGE has responded to this allegation in written and oral testimony and briefing in this docket. This issue was not raised in the Commission's Bench Requests or in PGE's responses to those Requests.

It is not accurate to say that the upgraded LP turbines were "experimental" or "untested" at the time of the upgrade. The only significant design changes in the upgraded LP turbines were that they had ruggedized (*i.e.*, solid) shafts and elongated and reshaped last-row blades. PGE/300; Quennoz/5. These were not new or experimental technologies. Ruggedized rotors and lengthened and redesigned last row blades have been in use in Siemens' turbines and in the industry generally for years. July 23 Hearing Transcript at 101:3-102:7.

PGE's purpose in upgrading the LP turbines was to generate more electricity for the same amount of fuel burned. July 23 Hearing Transcript at 101-104. The only thing that was "experimental" about the upgrade was whether it would really produce the gains in efficiency that Siemens had promised. To mitigate the risk that the changes might not in fact produce the promised gains in efficiency, PGE included performance guarantees and liquidated damages in its contract with Siemens. If the turbines had not performed as expected, Siemens would have been required to remedy the underperformance or compensate PGE. July 23 Hearing Transcript at 100-103.

CUB's argument about PGE installing experimental or risky new technology misses the point. The "risk" was not in the redesign itself, because ruggedized shafts and elongated last-row blades had been used successfully for years.

The risk was a business risk, that the upgraded turbines would not perform as efficiently as promised. PGE mitigated that risk through contractual performance guarantees and liquidated damages. It turned out, however, that those contractual remedies never came into play, because the upgraded LP turbines actually exceeded Siemens' performance guarantees.

Further, CUB has never argued that the redesign of the ruggedized shaft or longer last-row blades somehow caused or contributed to the crack in the LP1 rotor. The Root Cause Analyses did not identify the design as a cause of this crack. CUB's testimony faults PGE for adopting "experimental" technology, but does not even attempt to link any "experimental" feature of these upgraded turbines to this outage.

CUB also faults PGE for negotiating a contract with Siemens "that only covered power costs from a forced outage during the turbines' first year of operation." CUB/300; Feighner/2. Here, CUB appears to misunderstand the terms of PGE's contract with Siemens. The contract does not provide for PGE to recover replacement power costs in the event of an outage. The contract provides for liquidated damages in some circumstances during the first year of the turbines' operation, and also provides for a 10-year warranty.

CUB appears to fault PGE for not negotiating a contract with Siemens that would require Siemens to cover PGE's replacement costs in this case, where the outage occurred more than five years after the LP turbines were installed. PGE is not aware of any component manufacturer ever agreeing to cover replacement power costs in a contract for the sale of a component like a turbine. PGE/700; Quennoz/5-6. It would not be feasible for a manufacturer to offer such a guarantee, because the cost of replacement

power for an outage at a generating plant is likely to be much greater than the sale price of any particular component. Here, for example, the cost of replacement power during the LP outage was approximately $45.7 million, which is much greater than the total cost of the upgraded LP turbines, which PGE purchased from Siemens for approximately $12 million. *Id.* No component manufacturer would agree to take on the risk of paying replacement power costs after for any length of time (let alone five years), given that those costs would likely dwarf the entire value of the contract.

Nor is CUB correct that PGE failed to conduct its own "technical analysis" of the proposed turbine upgrade. CUB/300; Feighner/4. PGE worked actively with Siemens for three years to finalize the design for the upgraded turbines before manufacturing of the turbines even began. July 23 Hearing Transcript at pages 104:13-19. Again, the background of this design work was that the new components of the upgraded LP turbines – the ruggedized shaft and longer, reshaped blades – had been in use in the industry for years. PGE monitored Siemens' manufacturing of the upgraded turbines through site visits, contractual witness points, and review of metallurgy and other tests. PGE/600; Kahl/3-4.

CUB also suggests that PGE was unable to monitor the installation and maintenance of the LP turbines because of its supposed lack of diligence before purchasing the turbines. CUB/300; Feighner/4. But PGE personnel with experience in turbine installations and maintenance were present and monitored the installation and subsequent maintenance of the upgraded LP turbines. If Mr. Feighner is suggesting that PGE somehow lacked knowledge about the upgraded components of the new turbines – the ruggedized shaft and last-row blades – this assertion is simply incorrect. PGE

personnel were actively involved during the design phase of the upgraded LP turbines. PGE employees were also involved with major turbine maintenance at Boardman before the upgrade, including removing and reinstalling the turbine rotors and inspecting and repairing turbine blades. Further, there is nothing in the record or the various root cause analyses that links the upgraded design or upgraded components of the LP turbines to the LP1 rotor crack. So even if Mr. Feighner were right (which he is not) that PGE lacked the expertise to oversee the installation or maintenance of a turbine with a ruggedized shaft and longer last-row blades, there is nothing here to link those new components to this outage.

CUB is also incorrect that PGE "dismissed" the October 2006 report and recommendations prepared by Sensoplan, Inc. After the outage, PGE commissioned Sensoplan, Inc. to conduct an analysis of vibrations and performance of the turbines. CUB sent PGE a Data Request asking about PGE's responses to the conclusions and recommendations in the Sensoplan report. Mr. Feighner testified, "While it is beyond the expertise of any member of CUB's staff to assess the validity of these particular actions on an engineering basis, we are troubled by PGE's simple one page dismissal of these recommendations . . . ." CUB/300; Feighner/7. But PGE did not "dismiss" Sensoplan's recommendations in one page. PGE's response to CUB's data request is one page. PGE took Sensoplan's recommendations seriously, in conjunction with recommendations from other consultants hired to address this question, and made reasonable decisions about whether to implement those recommendations based on our expertise and knowledge of the situation at Boardman. PGE/700; Quennoz/9. Mr. Feighner's suggestion that PGE somehow dismissed or ignored these suggestions is simply wrong.

2. ICNU's Arguments

ICNU's expert John Martin claims that the LP turbine upgrade resulted in a 40% increase in the weight of the turbines. ICNU/400; Martin/6. From this he argues that PGE and Siemens were "extremely imprudent" in not performing a renewed analysis of the structural design, weight-bearing capacity, and underlying soil and geology of the pedestal on which the turbine-generator components rest.

But the LP turbine upgrade did not actually result in a 40% increase of the weight borne by the pedestal. It is true that the weight of the rotors in the upgraded LP turbines increased by 40% over the rotors in the original turbines. However, the rotors are only one component of the LP turbines, which in turn are only one component of the turbine-generator set that rests on the pedestal to which Mr. Martin refers. PGE/700; Quennoz/12-13.

Since the rotors compromise only a part of the LP turbines and an even smaller portion of the entire turbine-generator set, the total weight increase on the pedestal that resulted from the LP turbine upgrade was only approximately 3%, not the 40% that Mr. Martin claims. As required by the contract, Siemens evaluated the effect of this weight increase on the pedestal and concluded that no changes were required. This argument is entirely based on a simple misunderstanding on Mr. Martin's part. PGE/700/Quennoz/12-13.

At the April 20 hearing, Mr. Martin also speculated that PGE or Siemens should have analyzed harmonic vibrations along the LP turbines to ensure that there would be no resonance problems following the upgrade. This issue was considered before the upgrade as part of a modal analysis performed by Siemens and reviewed by

PGE's expert EME. Further, Siemens' post-crack investigative report concluded that this was not an issue. PGE/Ex. 105C. Mr. Martin admitted at the hearing that he had no basis to believe that harmonic vibrations were actually a cause of the LP1 rotor crack. April 20 Transcript at 344:1-8.

ICNU's focus on missing sole plate nuts is also misleading. The missing nuts were not easily visible from the operating deck at Boardman, either while the plant was in operation or during the LP upgrade. Further, the nuts were on a part of the turbine that was not disturbed during the upgrade. PGE/700; Quennoz/20-22.

During his site visit to Boardman, Mr. Martin photographed the area near the missing nuts by climbing up on platforms between the HP/IP and LP1 turbines and taking a photograph with a flash into a dark recess below the deck. To get to the area where Mr. Martin took the picture, it is necessary to first leave the turbine operating deck and climb a ladder to access the area between high pressure and LP1 turbines. PGE/700; Quennoz/20-22. It is then necessary to step down between the turbines onto an area next to the turbine shaft, look down past a gap in the steel, and peer into a recessed area where the nut was located. This location cannot be seen from the turbine operating deck.

Mr. Martin has speculated in this docket that the missing nuts may have been a contributing cause to increased vibration on the LP turbine, although the root cause analyses point to them as only one of several potential contributing causes. But the central focus of this docket is on whether PGE's actions in connection with the upgrade of the LP turbines were prudent. These nuts were not involved in any way in the upgrade, since they are not located in any area of the turbine that was disturbed during the installation. It is likely that this condition existed for years before the upgrade. If the

nuts were causing unusual vibration on the LP turbines, PGE's continual monitoring of vibration and temperature along the turbines would have detected it. But vibration remained within normal tolerances for more than five years after the upgrade, despite the missing fasteners.

Finally, Mr. Martin testified at the April 20 hearing that he believes that he the root cause of the LP1 rotor crack was "misalignment." Mr. Martin's testimony was not based on any examination of the cracked rotor but, rather, on an early draft of the Alstom root cause analysis. April 20 Transcript at 372:3-373:5. Mr. Martin's unsupported speculations, which appear nowhere in the written record of this docket, are not entitled to any weight. Further, they do not address the central question in this case, the question of PGE's prudence.

IV. CONCLUSION

The premature failure of the LP1 turbine was an unfortunate and unforeseen event. PGE has borne the cost of the investigation, removal, transport, repair, and reinstallation of the cracked rotor and is not seeking to recover any of those costs in this or any other docket. Further, the Commission has already ordered that PGE bear 38 percent of the cost of replacement power for this outage, based on business risk and other factors. And all parties agree that, as a result of the LP turbine upgrades, efficiency at Boardman has increased significantly, resulting in cost savings to customers.

For the reasons stated here and in PGE's previous briefing and testimony in this docket, applicant PGE respectfully requests that the Commission find that it has acted prudently and grant its application to amortize the full amount of the deferred expenses authorized in Order 07-049.

DATED this 12th day of June, 2009.

TONKON TORP LLP

By _____
Paul W. Conable, OSB No. 975368
Attorneys for
Portland General Electric Company

CERTIFICATE OF SERVICE

I hereby certify that on this day I served the foregoing **PORTLAND GENERAL ELECTRIC COMPANY'S OPENING BRIEF IN RE-OPENED DOCKET** by electronically mailing a copy thereof to each party listed below and by placing in a sealed envelope, first-class postage prepaid, addressed to those parties who have not waived paper service, deposited in the U.S. Mail at Portland, Oregon.

Carla Owings
Revenue Requirements Analyst
Oregon Public Utility Commission
PO Box 2148
Salem, OR 97308-2148
Carla.m.owings@state.or.us

Robert Jenks
Citizen's Utility Board of Oregon
Energy Program Director
bob@oregoncub.org
Waived Paper Service

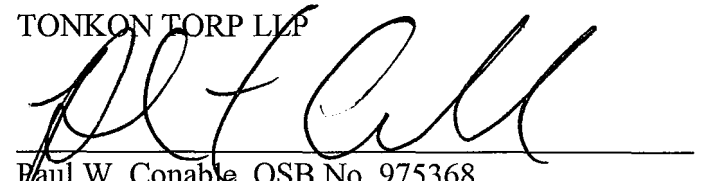
Stephanie S. Andrus
Assistant Attorney General
Department of Justice
Regulated Utility & Business Section
1162 NE Court Street NE
Salem, OR 97301-4096
stephanie.andrus@state.or.us

Melinda J. Davison
Davison Van Cleve, P.C.
333 SW Taylor, Suite 400
Portland, OR 97204
mail@dvclaw.com

John R. Martin
Pacific Energy Systems
15160 SW Laidlaw Road, Suite 110
Portland, OR 97229
Johnm@pacificenergysystems.com

DATED this 12th day of June, 2009.

TONKON TORP LLP



Paul W. Conable, OSB No. 975368
Of Attorneys for
Portland General Electric Company

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