ORIGINAL

0000063313

305

Brian Brumfield
Supervisor
Regulatory Affairs

Tel. 602-250-2708
Fax 602-250-3003
e-mail Brian.Brumfield@aps.com

Mail Station 9708
PO Box 53999
Phoenix, Arizona 85072-3999

November 3, 2006

Docket Control
Arizona Corporation Commission
1200 west Washington
Phoenix, Arizona 85007

RE: Arizona Public Service Company –Rate Case Docket Nos. E-01345A-05-0816, E-01345A-05-0826, & E-01345A-05-0827

Attached are the Rejoinder Testimonies of Arizona Public Service Company's witnesses James M. Levine, Peter M. Ewen, Roger J. Mattson, Robert E. Denton and George L. Fitzpatrick in the above referenced matter regarding the Palo Verde Prudence Audit.

Sincerely,

Brian Brumfield
Supervisor
Regulatory Affairs

Attachments

CC: Parties of Record

REJOINDER TESTIMONY OF JAMES LEVINE

On Behalf of Arizona Public Service Company

Docket No. E-01345A-05-0816
Docket No. E-01345A-05-0826
Docket No. E-01345A-05-0827

November 3, 2006

Table of Contents

REJOINDER TESTIMONY OF JAMES LEVINE
ON BEHALF OF ARIZONA PUBLIC SERVICE COMPANY
(Docket No. E-01345A-05-0816)
(Docket No. E-01345A-05-0826)
(Docket No. E-01345A-05-0827)

I. BACKGROUND

Q. PLEASE STATE YOUR NAME AND POSITION WITH APS.

A. My name is Jim Levine. I am the Executive Vice President Generation for Arizona Public Service Company ("APS" or "Company").

Q. DID YOU FILE REBUTTAL TESTIMONY ON BEHALF OF APS IN DOCKET NUMBER E-01345A-05-0816?

A. Yes. I filed Rebuttal Testimony on September 15, 2006.

Q. WHAT IS THE PURPOSE OF YOUR REJOINDER TESTIMONY IN THIS PROCEEDING?

A. The purpose of my Rejoinder Testimony is to respond to the October 13, 2006 Surrebuttal Testimony of William R. Jacobs, Jr., who provided testimony on behalf of the Utilities Division of the Arizona Corporation Commission ("ACC" or "Commission").

Q. ARE THERE OTHER WITNESSES TESTIFYING ON BEHALF OF APS IN RESPONSE TO DR. JACOBS' SURREBUTTAL TESTIMONY?

A. Yes. Robert Denton, the former President and Chief Executive Officer of Constellation Nuclear, which owned and operated the Calvert Cliffs and Nine Mile Point nuclear plants, will testify regarding the March Diesel Generator outage and use of Nuclear Regulatory Commission ("NRC") and Company

documents. Roger Mattson, a former senior official at the NRC, will testify regarding the RWT outage, Palo Verde performance, use of NRC and Company documents, and the proposed Nuclear Performance Standard. George Fitzpatrick, the chief executive of Harbourfront Group, Inc., with over 30 years experience in performing statistical analyses for electric and gas utilities, will testify regarding the proposed Nuclear Performance Standard. Finally, Peter Ewen, APS' Manager of the Revenue and Fuel Analysis and Forecasts Department, will testify regarding the quantification of outage costs.

II. SUMMARY OF TESTIMONY

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. My testimony begins by addressing Dr. Jacobs' rebuttal concerning the facts of outages at Palo Verde in 2005, whose prudence he challenges. Dr. Jacobs has not presented any evidence to counter my earlier conclusions in my Rebuttal Testimony that APS was prudent regarding those outages. First, the October RWT outage was directly caused by a new question from the NRC, and the NRC Regional Administrator stated that it was not a question that he would have expected APS to have addressed earlier. Dr. Jacobs' primary response is that this Commission should reject the statements of Dr. Mallett, the senior NRC official involved, which he made when he appeared before this Commission at the Commission's invitation. Second, although Dr. Jacobs has not established a basis for any disallowance, Palo Verde prudently performed maintenance during this outage that either shortened or prevented later outages or downpowers, which would significantly reduce any disallowance otherwise found. Third, the August reactor trip was caused by an individual's error in controlling the steam

generator water level, and such human error does not constitute management imprudence. Finally, the March diesel generator governor outage was not caused by imprudence because there was no indication that rust was in the governor, and Palo Verde properly stored and inspected the governor prior to installation.

Rather than focus on the facts of the 2005 outages in question, Dr. Jacobs devotes most of his Surrebuttal Testimony to *subsequent* correspondence between the Company and the NRC and to *subsequent* self-critical Company analyses. However, his testimony does not establish any causal connection between the matters discussed in those documents, e.g., cross-cutting issues and the yellow cornerstone, and the events that caused the outages at issue.

Finally, my Rejoinder Testimony addresses Palo Verde's overall performance. Palo Verde has performed very well over the last decade, and Dr. Jacobs' characterization of Palo Verde's 2005 performance is seriously flawed. For instance, there is no basis to describe Palo Verde's 2005 performance as "abysmal" when he challenges a total of only 23 days of outage time at the three units. We realize that the plant did not perform to the Company's high standards in 2005, but this does not change the fact that Palo Verde's high performance over the past decade has saved Arizona ratepayers a significant amount of money. We take seriously the improvement efforts that are in process. However, those improvement efforts have no bearing on the prudence of the four outages at issue.

III. PALO VERDE OUTAGES

A. October RWT Outage

Q. HAVE YOU REVIEWED DR. JACOBS' ANALYSIS OF THE OCTOBER RWT OUTAGE ON PAGES 23-34 OF HIS SURREBUTTAL TESTIMONY?

A. Yes.

Q. WHAT IS YOUR RESPONSE TO DR. JACOBS' CONCLUSION THAT PALO VERDE WAS IMPRUDENT?

A. Dr. Jacobs is unable to rebut the facts set forth on pages 14-17 of my September 15, 2006 Rebuttal Testimony regarding this outage. The October RWT outage was initiated because an NRC inspector asked a question about the possibility of air ingestion during certain scenarios involving the refueling water tanks, and the Company did not have an immediate answer. As stated by the NRC's Regional Administrator, Bruce Mallett, before the ACC on January 26, 2006, this was a new question. Furthermore, Dr. Mallett responded to Commissioner Mayes' specific question about whether Palo Verde should have anticipated the question by stating that "we didn't determine that they should have found it beforehand."

Q. DOES DR. JACOBS RESPOND TO THE STATEMENTS MADE BY DR. MALLETT?

A. Yes. Dr. Jacobs states on page 32 of his Surrebuttal Testimony that "Dr. Mallet's opinion on this is not supported by the facts" and on page 33 that "Dr. Mallet's oral statements . . . are not consistent with the NRC's various written materials." Dr. Mallett's statements to the ACC, that the NRC raised a new question and Palo Verde should not have recognized the issue earlier, do not conflict with the

NRC's inspection report -- a report that Dr. Mallett, the senior NRC official involved, approved.

Q. PLEASE RESPOND TO DR. JACOBS' COMMENTS ON PAGE 33 OF HIS SURREBUTTAL TESTIMONY REGARDING NRC RESIDENT INSPECTOR WARNICK.

A. First, Dr. Jacobs fails to respond to the substance of the points I made on page 17 of my Rebuttal Testimony regarding Mr. Warnick's reported conversation with Dr. Jacobs. APS in no way disagrees with Dr. Jacobs' statement that "NRC resident inspectors [are] a valuable and credible source of information," but this is not responsive to my testimony. As I pointed out, Mr. Warnick was not a member of the inspection team, and unlike Dr. Mallett, did not sign off on the inspection report. Finally, any statement by Mr. Warnick that the outage was avoidable does not equate to evidence, let alone proof of imprudence. As Dr. Mattson explains, the NRC does not use a prudence standard, and an NRC employee's statement that an outage was avoidable would be made taking full advantage of hindsight. Obviously, many events are "avoidable" in hindsight that could not have been reasonably foreseen.

Q. DO YOU AGREE WITH DR. JACOBS' STATEMENT ON PAGE 40 OF HIS SURREBUTTAL TESTIMONY THAT "MR. EWEN'S CLAIM THAT THE WORK PERFORMED DURING THE RWT OUTAGE WOULD REDUCE THE REPLACEMENT POWER COSTS ATTRIBUTED TO THE RWT OUTAGE IS FLAWED"?

A. No. As addressed in my Rebuttal Testimony on pages 18-20, Palo Verde performed a significant amount of work during the October RWT outage, including some work that prevented or reduced the length of a later outage or downpower. To clarify, we are not claiming that all maintenance performed

during this outage offsets the replacement power costs associated with the RWT outage. Rather, we are stating that had certain work not been performed during the outage, the equipment in question would have caused later unplanned outages or downpowers that would have resulted in separate replacement power costs. Some of this work, such as the work to repair Reactor Coolant Pump ("RCP") oil seals, already has been determined by GDS and Dr. Jacobs to be prudent when it occurred during other outages.

If this Commission determines, as the facts surrounding the outage support, that Palo Verde was not imprudent with the RWT outage, then an evaluation of this other work is unnecessary. If the Commission determines that part or all of the RWT outage was imprudent, any disallowance of associated replacement power costs should be offset by the replacement power costs that were avoided because of the performance of this other work during the outage in question. The amount of these avoided costs is set forth in Peter Ewen's September 15, 2006 Rebuttal Testimony.

Contrary to Dr. Jacobs' assertion that there is no evidence to support APS' claims, the Company's response to data request WRJ 21-8 (provided as Attachment JML-1RJ) demonstrates that had this work not been performed during the RWT outage, it would have resulted in later outages that would have resulted in separate replacement power costs.

As discussed in the data request response, had Unit 2 not been shut down for the RWT outage, it would have had to have been shut down shortly thereafter to

repair the RCP 2A oil seal. As stated in the response to WRJ 21-8(b), Palo Verde initiated unplanned outages to repair RCP oil seals when the "pump-up" rate for the oil, which directly corresponds to oil leakage rate, was between 3-12 hours. The Unit 2 RCP 2A oil leakage had worsened to the point that it was well within this range. As shown by an attachment to WRJ 21-8(c) (document APS08334), the pump-up rate for Unit 2 RCP 2A was approximately every 9 hours during the last days prior to the October RWT outage. This 9 hour pump-up rate was worse than the pump-up rate in Unit 3 RCP 1A when Unit 3 was shut down on October 2, 2005 to make necessary repairs to the RCP oil seals to correct the oil leakage. As shown in Attachment JML-2RJ, the oil leakage for Unit 3 RCP 1A had decreased to approximately 12 hours during the days before the October 2 outage. Palo Verde prevented later replacement power costs by repairing the Unit 2 RCP 2A oil seals during the October RWT outage, and this amount should be subtracted from any costs that the Commission determines should be disallowed for the RWT outage.

B. August Reactor Trip Outage

Q. HAVE YOU REVIEWED DR. JACOBS' ANALYSIS OF THE AUGUST REACTOR TRIP OUTAGE ON PAGES 20-23 OF HIS SURREBUTTAL TESTIMONY?

A. Yes.

Q. WHAT IS YOUR RESPONSE TO DR. JACOBS' TESTIMONY ON THE REACTOR TRIP?

A. On pages 21-22 of his Surrebuttal Testimony, Dr. Jacobs attempts to combine the cause of the reactor trip with other problems that had occurred at Palo Verde,

such as NRC-identified cross-cutting issues. However, his testimony establishes no connection between these other issues and the reactor trip. Dr. Jacobs has also provided no direct evidence that Palo Verde management was imprudent regarding this reactor trip. The reactor trip was primarily the result of improper actions of an individual operator. Dr. Jacobs incorrectly states on page 21 of his Surrebuttal Testimony that "[p]roblems with the Digital Feedwater Controls System (DFWCS) were not identified in a timely manner and effectively resolved." This is inaccurate because the problem was not with the DFWCS, but with the perception of the system by operators. This perception problem is illustrated by Root Cause #2 for the outage, quoted on page 21 of Dr. Jacobs' Surrebuttal Testimony, which discusses "operational strategies to cope with perceived system instability at low power levels." (Emphasis added) Had the operator that overfilled the steam generator simply left the system in automatic control, the reactor would not have tripped.

Q. PLEASE EXPLAIN WHY YOU BELIEVE THIS INCIDENT WAS NOT "REFLECTIVE OF THE CROSS-CUTTING ISSUES IN HUMAN PERFORMANCE AND PROBLEM IDENTIFICATION AND RESOLUTION" AS DR. JACOBS ASSERTS AT PAGES 21-23 OF HIS SURREBUTTAL TESTIMONY.

A. First, let me reiterate my understanding that human error does not equate to imprudence. As this Commission has previously pointed out, Palo Verde was built and is now operated "by human beings, not mistake – proof automata" (Decision No. 54204 at p. 15), and APS is not charged with achieving "unobtainable goals of absolute perfection." (Decision No. 55118 at p. 20). As I also pointed out in my Rebuttal Testimony (p. 22), Palo Verde has performed well in comparison to other plants with respect to unplanned reactor trips.

Consistent with our goal to continuously improve performance, we made certain procedural changes and increased training following the reactor trip. However, those improvements do not detract from the fact that the reactor trip was an isolated event caused primarily by the failure of an individual operator to follow procedures, and was not the result of imprudence by Palo Verde management. Dr. Jacobs' quotation from various passages of the root cause report does not alter this conclusion. In fact, the Company's "CRDR" regarding problem identification and resolution from which Dr. Jacobs also quotes extensively criticizes the CRDR/root cause process, stating that the "[p]ropensity to create procedure revisions or formal training as a corrective action to isolated occurrences reduces ownership and accountability," page 14 of CRDR 2780286 (GDS Report, Attachment 7). Prudence does not require avoidance of all such isolated occurrences, and human errors will occur even under the most prudent circumstances.

C. March Diesel Generator Governor Outage

Q. HAVE YOU REVIEWED DR. JACOBS' ANALYSIS OF THE MARCH DIESEL GENERATOR OUTAGE ON PAGES 17-20 OF HIS SURREBUTTAL TESTIMONY?

A. Yes.

Q. WHAT IS YOUR RESPONSE TO THIS TESTIMONY ON THE DIESEL GENERATOR OUTAGE?

A. Although I agree with some statements made by Dr. Jacobs, I disagree with much of his analysis and with his conclusion that Palo Verde was imprudent.

I agree with Dr. Jacobs that because this outage occurred prior to implementation of the PSA, it is not subject to a disallowance. Apparently, Dr. Jacobs has withdrawn his earlier recommendation that the costs associated with this outage not be included in establishing base fuel costs.

Additionally, I agree with Dr. Jacobs that diesel generators are important pieces of equipment. However, Palo Verde has many important pieces of equipment, in addition to the diesel generators, and we treat each piece of equipment accordingly. As with most pieces of important equipment, the diesel generators are part of an extensive redundant system. As Dr. Jacobs acknowledges on page 18 of his Surrebuttal Testimony, the diesel generators are only necessary if there is a loss of all offsite power simultaneous with certain major plant accidents. This combination of events is extremely rare. Additionally, if one diesel generator fails to start during this scenario, it is still backed up by an identical redundant system that would supply all necessary electrical power. By pointing out these facts, I do not intend to minimize the role of the diesel generators. However, they are one of literally hundreds of important pieces of equipment that we inspect and maintain pursuant to manufacturer recommendations and governing plant procedures.

Q. ON PAGE 20 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS STATES THAT "THE COMPANY DID NOT USE A STANDARD OF CARE COMMENSURATE WITH THE IMPORTANCE OF THE DIESEL GENERATOR." DO YOU AGREE WITH THIS STATEMENT?

A. No. As discussed above, although the diesel generators are important, a malfunction does not mean that Palo Verde was imprudent. Dr. Jacobs does not

identify what he believes the standard of care should be for this equipment. As I described in my Rebuttal Testimony on pages 26-28, Palo Verde stored the diesel generator governor in accordance with the manufacturer's recommendations. Additionally, Palo Verde reasonably inspected the governor prior to installation, and as supported by the failure analysis for the diesel generator, which is provided as Attachment JML-2RB to my Rebuttal Testimony, any rust could only be identified through disassembly of the governor. These actions provided the appropriate standard of care for the diesel generator governor.

Q. DO YOU AGREE WITH DR. JACOBS' CONCLUSIONS THAT PALO VERDE COULD HAVE PREVENTED THIS PROBLEM BY SAMPLING THE OIL DIFFERENTLY?

A. No. As stated on page 9 of the root cause investigation (Attachment 10 to the GDS Report), a sample of the lube oil on April 19, 2004 showed only 104 ppm of water, well within the upper limit of 1500 ppm. Palo Verde had no reason to believe water was an issue. Additionally, as discussed on page 16 of the root cause investigation, following the outage, Palo Verde personnel performed a careful review of the process used for changing and sampling oil and could not determine any potential source of water addition.

IV. PALO VERDE PERFORMANCE

Q. HAVE YOU REVIEWED PAGES 2-14 OF DR. JACOBS' SURREBUTTAL TESTIMONY REGARDING PALO VERDE'S PERFORMANCE?

A. Yes.

Q. WHAT IS YOUR RESPONSE TO DR. JACOBS' CONCLUSIONS IN THIS SECTION OF HIS SURREBUTTAL TESTIMONY?

A. Dr. Jacobs' arguments in this section are unconvincing, and in some areas are even contradictory. For example, Dr. Jacobs argues both ways, first focusing on a small portion of Palo Verde's past performance and then later stating that the past is irrelevant. On page 3 he states that "when considering any individual specific outage, it is neither necessary nor appropriate to consider prior performance and, in fact, the issue of prior performance is irrelevant when determining the responsibility for additional costs incurred due to any individual imprudent event." Therefore, although Dr. Jacobs states that past performance is "irrelevant" and not "appropriate," significant parts of the GDS Report and of his testimony focus on past Palo Verde performance.

Dr. Jacobs takes an inappropriately limited view of performance at Palo Verde. He takes issue with looking at performance over the past decade, and instead compares performance from the 2000-2002 timeframe to performance during the 2003-2005 timeframe. Palo Verde's performance during 2000-2002 was one of the best periods of performance since the operation of the plant began. Performance during 2003-2005 was lower, not only due to the higher number of unplanned outages in 2005, but also due to two steam generator replacements. The steam generator replacements involved lengthy outages that directly affected measured performance, but not due to any fault of Palo Verde. Similarly, with respect to the 2005 unplanned outages, Dr. Jacobs only challenges four of these outages totaling 23 days. As Dr. Mattson quantifies in his Rejoinder Testimony, this contributes a very small reduction in Palo Verde's capacity factor during 2005. When one considers these facts, it is clear that both

GDS' initial claims in its report that 2005 Palo Verde performance was "poor," as well as Dr. Jacobs' more extreme assertions in his Surrebuttal Testimony that Palo Verde performance was "abysmal" are incorrect.

Q. DR. JACOBS STATES ON PAGE 4 OF HIS SURREBUTTAL TESTIMONY THAT MANAGEMENT ALLOWED PERFORMANCE AT PALO VERDE TO DECLINE "FOR SEVERAL YEARS WITHOUT CORRECTIVE ACTION." IS THIS STATEMENT ACCURATE?

A. No. Dr. Jacobs' statement that APS did not take any corrective action for years while performance declined is incorrect. Palo Verde conducted a number of assessments and instituted a number of programs prior to 2005 that were appropriate given the available performance indicators. The current Performance Improvement Program is, in significant part, an effort to unify and address the earlier improvement efforts in a more programmatic manner. APS provided a number of documents evidencing these efforts to ACC Staff in response to data requests. See responses to PB 1.14, 1.21, 1.22. For example, PB 1.22 sought a description of "performance improvement program or initiatives planned or implemented in 2004 or 2005." Included in the response to this request was a program description of the Palo Verde Prevent Event Strategies 2004 which was directed at reducing significant human performance events across all departments. See JML – WP1RJ.

Q. ON PAGES 4-5 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS STATES THAT YOUR REBUTTAL TESTIMONY DOES NOT AGREE WITH EARLIER STATEMENTS THAT YOU MADE REGARDING PERFORMANCE IN 2005. DO YOU AGREE THAT YOUR STATEMENTS WERE INCONSISTENT?

A. No. Dr. Jacobs takes statements from my testimony and the Performance Improvement Plan out of context. On page 10 of my Rebuttal Testimony I state

that "the decrease in performance is directly related to the greater than typical number and duration of plant outages that we experienced in 2005." Here, I was talking about the 2005 capacity factor at Palo Verde in response to a follow-up question to my discussion about capacity factor in the previous answer. On the other hand, the discussion of performance in the Performance Improvement Plan is not focused on economic performance. In fact, the same page from which Dr. Jacobs quotes expressly states that "while the economic performance at Palo Verde continues to be at or near the top industry quartile there is a need for improvement in implementing programs and processes."

Q. DOES THIS CONCLUDE YOUR REJOINDER TESTIMONY?

A. Yes.

Attachment JML-1RJ

ARIZONA CORPORATION COMMISSION
STAFF'S TWENTY-FIRST SET OF DATA REQUESTS TO
ARIZONA PUBLIC SERVICE COMPANY
Docket No. E-01345A-05-0816; E-01345A-05-0826 and E-01345A-05-0827
SEPTEMBER 28, 2006

WRJ 21-8 Referring to Mr. Ewen's discussion of the Unit 2 RWT outage beginning on page 21 of his rebuttal testimony, please provide:

a. Any documents that demonstrate that Unit 2 was scheduled for an outage for the period from October 11, 2005 to the next planned refueling outage.
b. The criteria used by APS to decide when RCP seal oil leakage is excessive and it is necessary to shut a unit down to repair the RCP oil seals.
c. The Unit 2 RCP seal oil leakage measured daily for each day, or as often as it is available, from January 1, 2005 to October 11, 2005.
d. The Unit 3 RCP seal oil leakage rate prior to the Unit 3 shutdowns in May 2005 and July 2005.
e. Any documents that demonstrate that Unit 2 power reduction to perform main feedwater pump repair work and heater steam drain repair work would have been required during the period between October 11, 2005 and the next scheduled Unit 2 refueling outage. Include the criteria that would apply to determine the need for the power reduction and equipment operating data that demonstrate the need for the power reduction.

Response:

a. Unit 2 was not scheduled for an outage during the October 2005 timeframe, however, the criteria provided in response to parts b and c of this request indicate that an unplanned outage in Unit 2 was probable based on previous experience.

Palo Verde constantly monitors the status of equipment to determine when an outage will be necessary and the team is prepared to perform maintenance when a short notice outage is initiated so that equipment reliability issues are addressed before conditions deteriorate further and possibly result in a longer or less advantageously timed outage.

b. The decision of when to shut down a unit to repair RCP oil seals because of excessive RCP oil seal leakage is based on management and engineering judgment. Numerous criteria are analyzed to determine the best time to shut down for these repairs. These criteria include time until the next shutdown, other maintenance that must be performed, status of the other units, and the extent of the oil leakage.

The extent of the oil leakage is determined by how frequently oil must be added to the RCP thrust bearing reservoir. As oil leaks from the RCP oil seals, the level of oil in the RCP thrust bearing reservoir decreases. The leaked oil is collected in an external Hydraulic Power Unit ("HPU") reservoir. When the RCP thrust bearing reservoir oil level indicates low alarm, the HPU lift pump is manually started to "pump up" oil from the HPU reservoir to the RCP thrust bearing reservoir to return the oil level to the normal range. A pump-up is required when the reservoir level is at approximately 64%. The pump-up frequency is used to determine the extent of oil leakage and whether a unit should be shut down to repair or replace oil seals. Palo Verde has shut down to replace RCP oil seals when the time between pump-ups occurs in the range of 3 - 12 hours.

c. When Palo Verde shut down Unit 2 in October 2005 to respond to questions regarding air entrainment, a separate shutdown to replace various Unit 2 RCP oil seals, based on previous experience, was probable. At the time of the October outage, the time between pump-ups for Unit 2 RCP 2A was less than 12 hours and decreasing (as shown in yellow on attachments) and was approximately every 3 days and decreasing for Unit 2 RCP 1A (as shown in green on attachments.) Palo Verde engineering and management were closely watching these RCP oil seals to determine if a shutdown was necessary. As discussed above, RCP 2A had entered the range of time when Palo Verde has performed a shutdown to repair or replace RCP oil seals.

Documents showing the pump-up and leakage rates for the Unit 2 RCP oil seals from January 1 to April 2, 2005, and May 21 to October 11, 2005, are provided as APS08330 through APS08334.

- The first chart provides data from January 1 to April 2, 2005. See APS08330.
- On April 1, 2005, Unit 2 entered a planned refueling outage. The unit was returned to service on May 20.
- The next chart provides data from May 20 through July 1, 2005. See APS08331.
- The next chart provides data from July 1 through September 27, 2005. See APS08332.
- The final two charts (APS08333 and APS08334) provide weekly snapshots from September 27 - October 4 and October 4 - 11, 2005. These display in detail the information monitored by management during the days preceding the October shutdown.

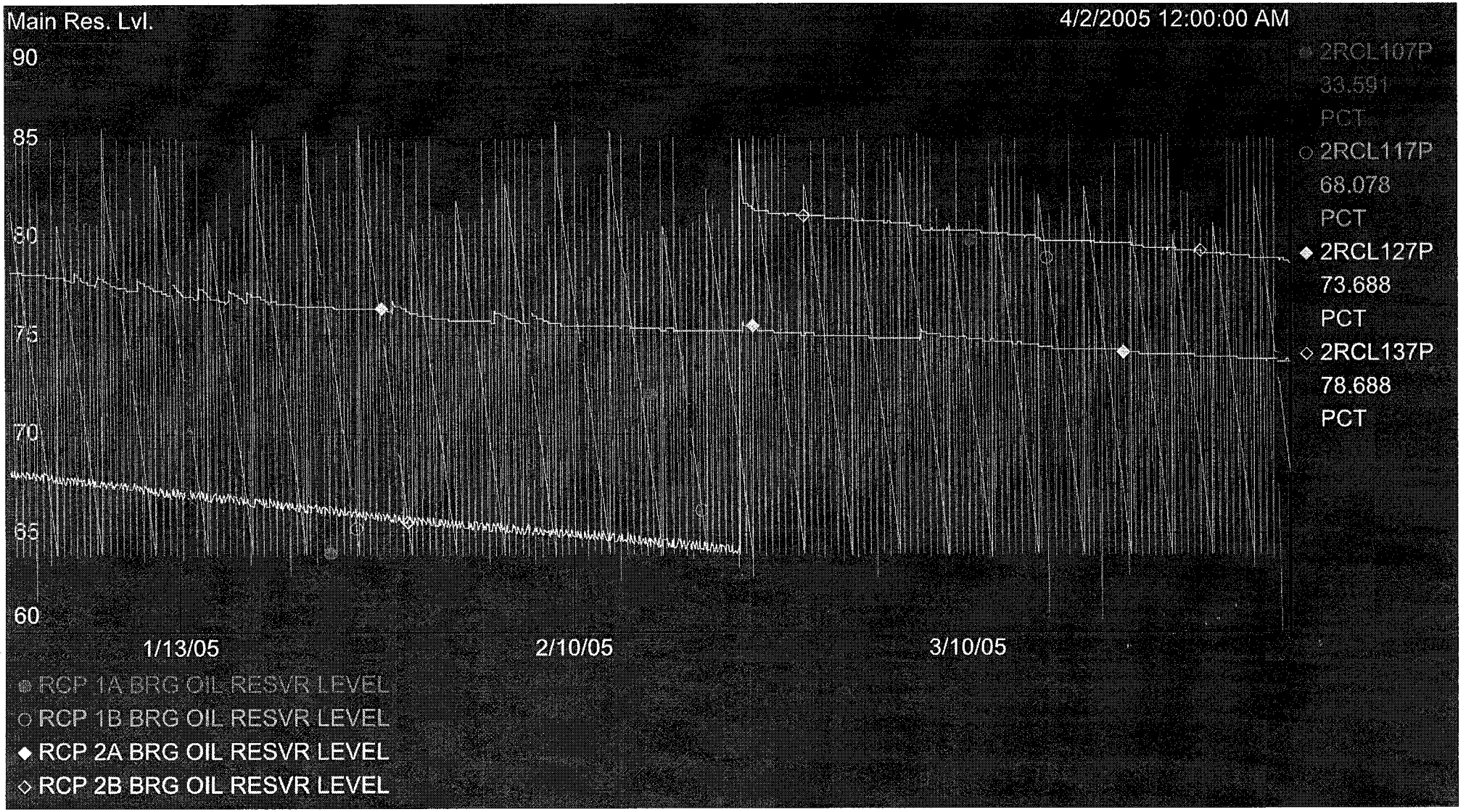
d. In May 2005, the time between pump-ups for the Unit 3 RCP 1A oil seal had decreased to about every 3 hours when Unit 3 was shut down to replace pressurizer heaters and to replace oil seals. In July 2005, the time between pump-ups for the Unit 3 RCP 1A oil seal had decreased to about every 4 hours when Unit 3 was shut down to replace the oil seal.

e. As noted above, Palo Verde constantly monitors the status of equipment and impacts to safety and operation to determine if and when an outage will be necessary.

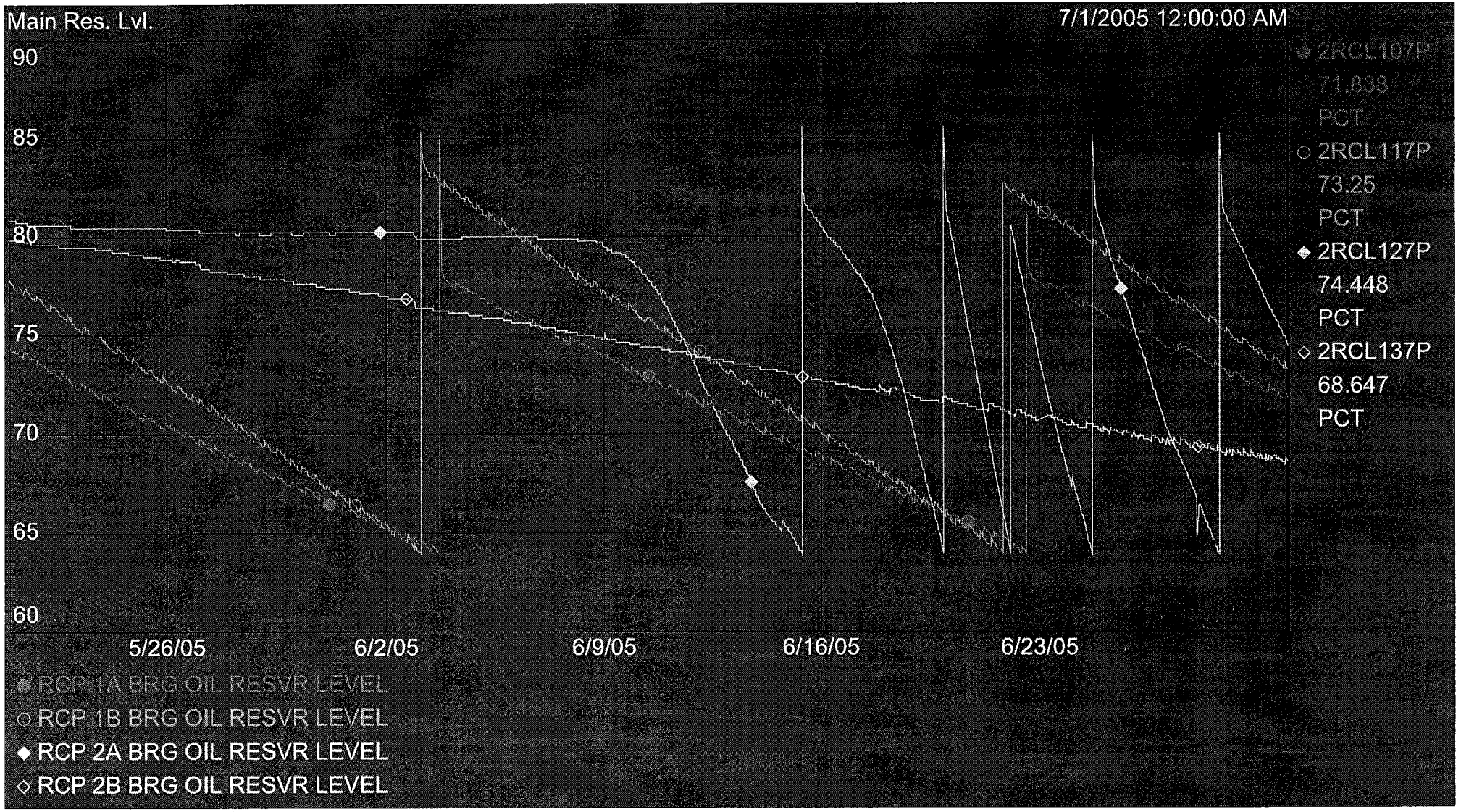
Down power of the unit and subsequent repairs are made based on potential impacts to personnel safety and equipment operation/reliability. The decision of when to make these repairs is based on management and engineering judgment.

Documents describing component operations related to main feedwater pump oil seal repair and heater steam drain repair work are attached as APS08325 through APS08329, which are confidential and are being provided pursuant to an executed Protective Agreement.

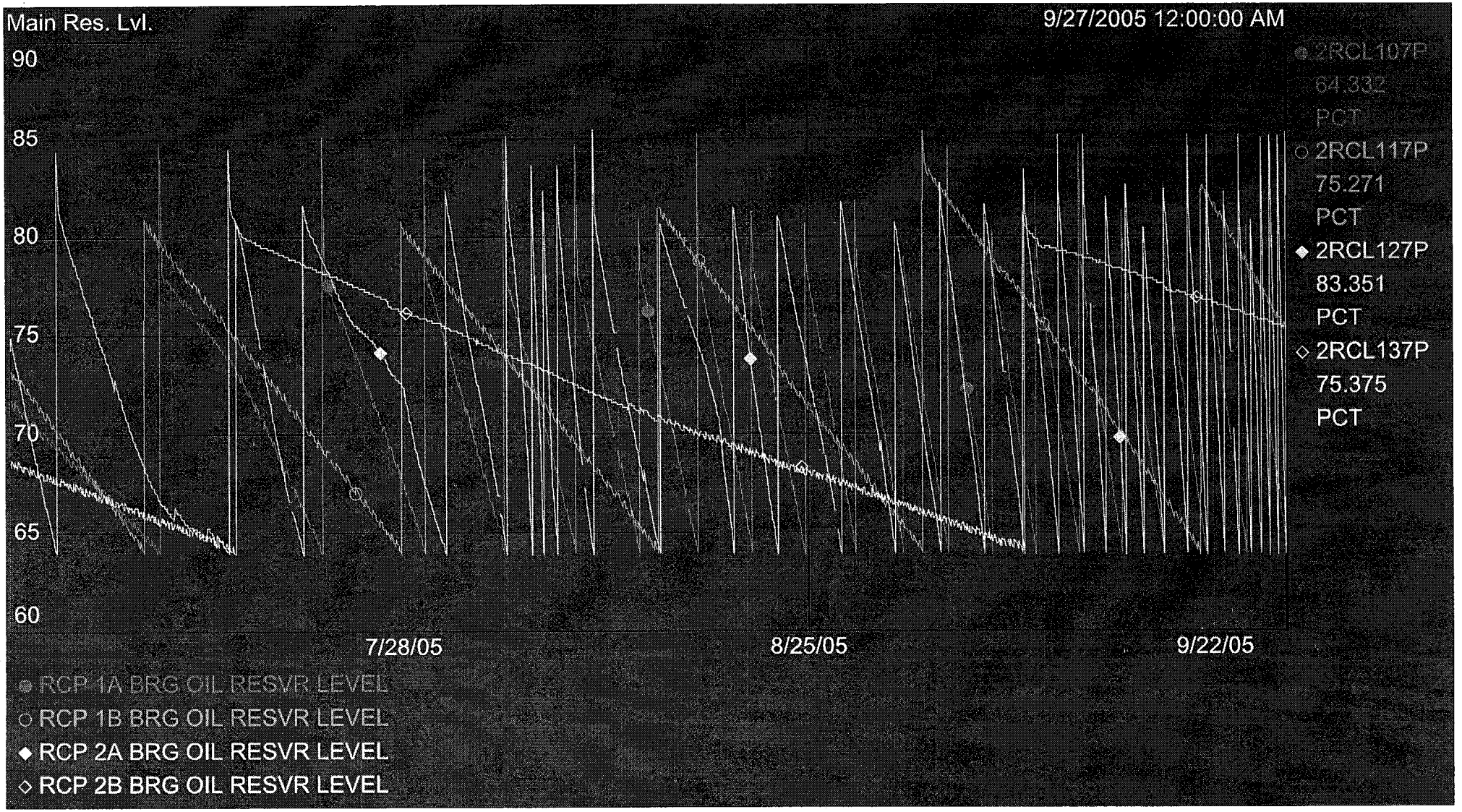
Witness: Jim Levine


Main Res. Lvl.
4/2/2005 12:00:00 AM
90
85
80
75
70
65
60
1/13/05
2/10/05
3/10/05
2RCL107P
33.591
PCT
2RCL117P
68.078
PCT
2RCL127P
73.688
PCT
2RCL137P
78.688
PCT
RCP 1A BRG OIL RESVR LEVEL
RCP 1B BRG OIL RESVR LEVEL
RCP 2A BRG OIL RESVR LEVEL
RCP 2B BRG OIL RESVR LEVEL

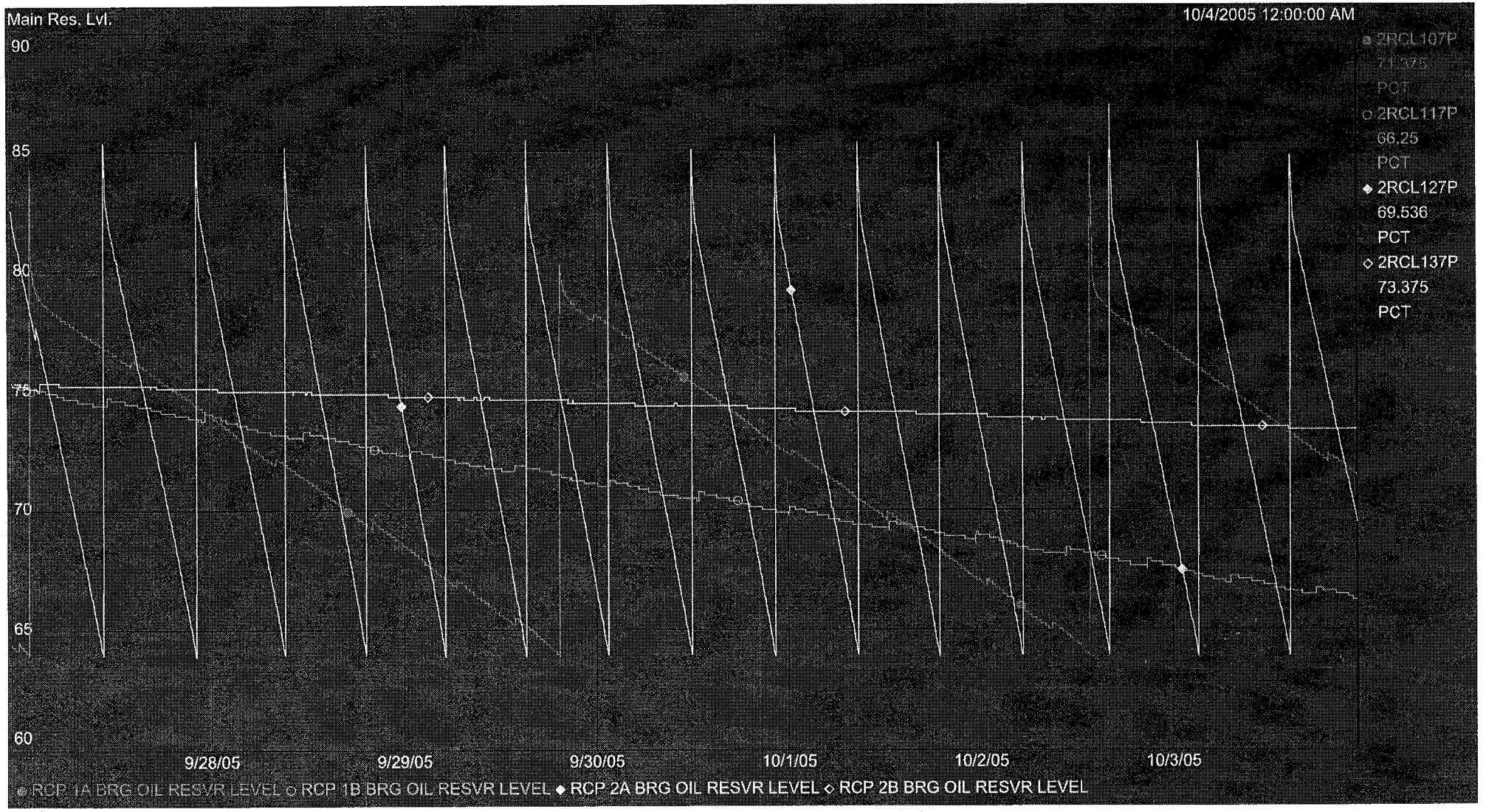
APS08330


Main Res. Lvl.
7/1/2005 12:00:00 AM
90
85
80
75
70
65
60
5/26/05
6/2/05
6/9/05
6/16/05
6/23/05
2RCL107P
71.838
PCT
2RCL117P
73.25
PCT
2RCL127P
74.448
PCT
2RCL137P
68.647
PCT
RCP 1A BRG OIL RESVR LEVEL
RCP 1B BRG OIL RESVR LEVEL
RCP 2A BRG OIL RESVR LEVEL
RCP 2B BRG OIL RESVR LEVEL

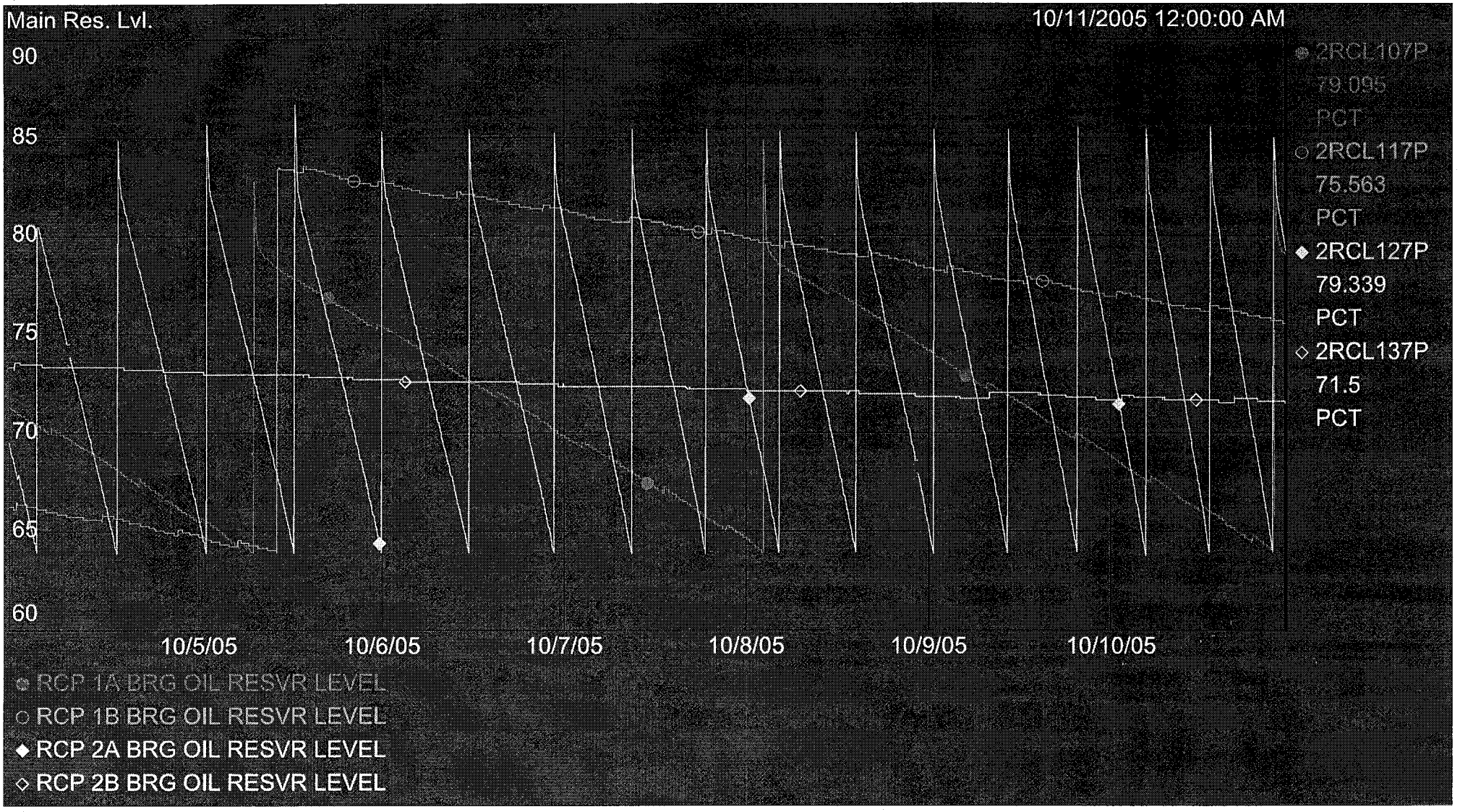
APS08331


Main Res. Lvl.
9/27/2005 12:00:00 AM
90
85
80
75
70
65
60
7/28/05
8/25/05
9/22/05
2RCL107P
64.332
PCT
2RCL117P
75.271
PCT
2RCL127P
83.351
PCT
2RCL137P
75.375
PCT
RCP 1A BRG OIL RESVR LEVEL
RCP 1B BRG OIL RESVR LEVEL
RCP 2A BRG OIL RESVR LEVEL
RCP 2B BRG OIL RESVR LEVEL

APS08332

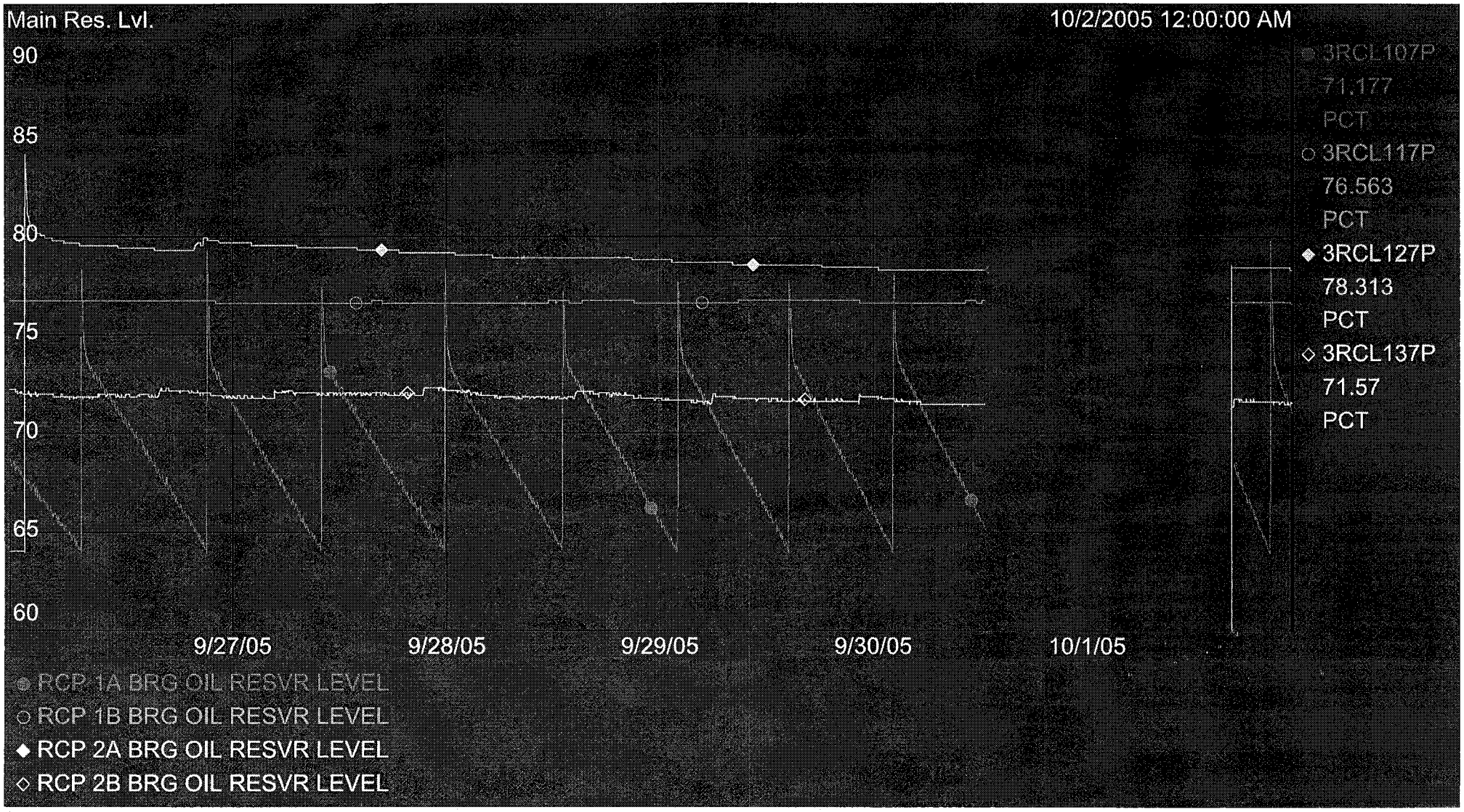

Main Res. Lvl.
10/4/2005 12:00:00 AM
90
85
80
75
70
65
60
9/28/05
9/29/05
9/30/05
10/1/05
10/2/05
10/3/05
2RCL107P
71.375
PCT
2RCL117P
66.25
PCT
2RCL127P
69.536
PCT
2RCL137P
73.375
PCT
RCP 1A BRG OIL RESVR LEVEL
RCP 1B BRG OIL RESVR LEVEL
RCP 2A BRG OIL RESVR LEVEL
RCP 2B BRG OIL RESVR LEVEL

APS08333


Main Res. Lvl.
10/11/2005 12:00:00 AM
90
85
80
75
70
65
60
10/5/05
10/6/05
10/7/05
10/8/05
10/9/05
10/10/05
2RCL107P
79.095
PCT
2RCL117P
75.563
PCT
2RCL127P
79.339
PCT
2RCL137P
71.5
PCT
RCP 1A BRG OIL RESVR LEVEL
RCP 1B BRG OIL RESVR LEVEL
RCP 2A BRG OIL RESVR LEVEL
RCP 2B BRG OIL RESVR LEVEL

APS08334

Attachment JML-2RJ


Main Res. Lvl.
10/2/2005 12:00:00 AM
90
85
80
75
70
65
60
9/27/05
9/28/05
9/29/05
9/30/05
10/1/05
3RCL107P
71.177
PCT
3RCL117P
76.563
PCT
3RCL127P
78.313
PCT
3RCL137P
71.57
PCT
RCP 1A BRG OIL RESVR LEVEL
RCP 1B BRG OIL RESVR LEVEL
RCP 2A BRG OIL RESVR LEVEL
RCP 2B BRG OIL RESVR LEVEL

REJOINDER TESTIMONY OF PETER M. EWEN

On Behalf of Arizona Public Service Company

Docket No. E-01345A-05-0816
Docket No. E-01345A-05-0826
Docket No. E-01345A-05-0827

November 3, 2006

Table of Contents

REJOINDER TESTIMONY OF PETER M. EWEN
ON BEHALF OF ARIZONA PUBLIC SERVICE COMPANY
(Docket No. E-01345A-05-0816)
(Docket No. E-01345A-05-0826)
(Docket No. E-01345A-05-0827)

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Peter M. Ewen. My business address is 400 North Fifth Street, Phoenix, Arizona, 85004. I am Manager of the Revenue and Fuel Analysis and Forecasts Department for Arizona Public Service Company ("APS" or "Company"). In that role, I am responsible for preparing the Company's short-range and long-range forecasts of system peak demand and energy sales, and projecting the optimal dispatch of available resources to minimize the cost of meeting those energy requirements.

Q. DID YOU PREVIOUSLY FILE DIRECT, REBUTTAL AND REJOINDER TESTIMONY IN THIS PROCEEDING?

A. Yes.

Q. WHAT IS THE PURPOSE OF YOUR PALO VERDE REJOINDER TESTIMONY?

A. I am responding to the Surrebuttal Testimony of Staff Witness Dr. Jacobs. Dr. Jacobs disagreed with certain adjustments that I proposed in my Rebuttal Testimony to his recommended disallowance of replacement power costs related to alleged imprudent Palo Verde outages occurring in 2005.

Q. DOES YOUR SILENCE REGARDING ANY OF THE ISSUES DISCUSSED BY OTHER PARTIES INDICATE AN ACCEPTANCE OF THOSE POSITIONS?

A. No, it does not. An absence on my part of a response to a surrebuttal issue should not be taken as acceptance of any party's testimony; instead it is an indication that I maintain my position, as discussed in previous testimony.

II. SUMMARY OF REJOINDER TESTIMONY

Q. PLEASE SUMMARIZE YOUR REJOINDER TESTIMONY.

A. Although Dr. Jacobs accepted two of the Company's adjustments to his recommended disallowance of 2005 Palo Verde replacement power costs, he failed to adequately consider the remaining adjustments.

First, Dr. Jacobs provided no support for his conclusion that prudent maintenance work performed during the October 2005 Unit 2 refueling water tank ("RWT") outage did not allow the Company to avoid a later unplanned outage or downpower. Neither did he appear to disagree in principle with the Company's quantification of the avoided replacement power costs of $5.1 million (after 90/10 sharing). In his Rejoinder Testimony, APS Witness Jim Levine provides the detailed evidence that supports the conclusion that the Company did avoid such a future outage.

Second, with respect to the impact of Palo Verde outages on off-system sales margins, Dr. Jacobs offered a high-level critique of the analysis provided by the Company, but failed to provide any analysis to demonstrate that his original calculation was more accurate than the one provided by the Company. He also mischaracterized the manner in which the analysis was conducted and erroneously concluded that the Company's assessment was performed only during hours in which the Company was not purchasing power.

Finally, Dr. Jacobs continued to take an unbalanced approach to the Company's

unplanned outages. He made disallowances for poorer-than-planned performance at Palo Verde, yet ignored the better-than-planned performance at the Company's fossil units.

III. AVOIDED OUTAGE COSTS DUE TO MAINTENANCE DURING OCTOBER 2005 UNIT 2 RWT OUTAGE

Q. HAS DR. JACOBS DISAGREED WITH YOUR QUANTIFICATION OF THE AVOIDED OUTAGE COSTS RELATED TO THE MAINTENANCE WORK PERFORMED DURING UNIT 2'S RWT OUTAGE IN OCTOBER 2005?

A. Dr. Jacobs offered no specific disagreement with the quantification of the outage costs that were avoided due to the maintenance work undertaken during the Unit 2 RWT outage during October 2005. Apparently he did disagree with the Company's conclusion that additional future outage costs were avoided, calling such a conclusion "speculative." (Surrebuttal Testimony of William R. Jacobs, p. 40) In his Rejoinder Testimony, Mr. Levine provides detailed evidence associated with the extent of leakage in the RCP oil seals, which conclusively demonstrates that such an outage was imminent. The Company's best estimate of the avoided costs resulting from this maintenance work is the $5.6 million I described in my Rebuttal Testimony in this docket.

IV. OFF-SYSTEM MARGIN IMPACTS

Q. DID DR. JACOBS CORRECTLY CHARACTERIZE YOUR METHODOLOGY FOR CALCULATING THE OFF-SYSTEM SALES IMPACTS FROM THE PALO VERDE OUTAGES?

A. No. At page 41 of his Surrebuttal Testimony, Dr. Jacobs stated that the Company:

> [P]rovided for an adjustment to margins for lost off-system opportunity sales in those hours when both (1) Palo Verde was shut down due to an imprudent outage and (2) APS was not buying power in the wholesale market.

He was correct that the analysis of lost margins I provided in my Rebuttal Testimony covered only the hours during which he has recommended a disallowance, but he was not correct in his assertion that I further limited the analysis to only hours in which the Company was not purchasing power. My analysis covered all outage hours at issue in Dr. Jacobs's recommendation.

Q. ARE THERE OTHER CHARACTERIZATIONS OF YOUR ANALYSIS BY DR. JACOBS THAT ARE NOT CORRECT?

A. Yes. Dr. Jacobs observed that there were three days out of fourteen where the actual realized off-system margins during a Palo Verde outage exceeded the expected margins without a Palo Verde outage. As a result, he concluded that the analysis must be wrong and totally disregarded it. Unfortunately, he did not take into account that other factors, such as better than expected coal plant performance, could help alleviate the reduction in margins related to Palo Verde being out of service. Another significant factor that helped improve off-system margins was the use of certain generating units at low incremental heat rates. This occurred in instances when, for example, a 2x1 combined cycle unit would not normally be run on a particular day (and therefore did not contribute to off-system sales on that day), but was turned on to replace the unplanned Palo Verde outage. These units were not always needed during the Fall and Spring because they compete with other similar units on the margin and have significant start-up costs. However, once they are started and ramped up to minimum load, their incremental heat rates are much lower than their average heat rates, which can make them economic enough to make off-system sales. The replacement costs already reflected the start-up and higher heat rate costs related to these units, so the additional sales margins helped defray those costs.

Q. DOES THE PRESENCE OF THESE DAYS MAKE A DIFFERENCE IN YOUR CONCLUSIONS ABOUT THE LOSS OF OFF-SYSTEM SALES MARGINS?

A. No. Even if each of these days were ignored for purposes of establishing the impact of the Palo Verde outages on off-system sales margins, the impact increased by only $200,000 to a total of just over $500,000. This is significantly different from the more than $2 million calculated by Dr. Jacobs.

Q. WHY IS YOUR METHOD A MORE ACCURATE REPRESENTATION OF OFF-SYSTEM SALES COMPARED TO THE METHOD EMPLOYED BY DR. JACOBS?

A. The method I propose is based on an analysis of hourly data that relied on actual system conditions to the largest extent possible. Dr. Jacobs has based his calculation on a set of assumptions that are far too general to rely on when confronted by a difference of almost $2 million. In particular, he has assumed that every megawatt-hour (MWh) of lost Palo Verde generation leads to a reduction in off-system sales. This is simply impossible when the Company typically makes annual aggregate off-system sales on the order of 1,500 gigawatt-hours (GWh) and Palo Verde generation can be as high as 9,000 GWh. Additionally, Dr. Jacobs assumed that every lost off-system sale can be priced at the average across all sales during 2005. This gross simplification failed to take into account the specific time periods and corresponding market conditions during the outages that are in question. Taken together, it is clear that the analysis of hourly data yielded a more realistic and accurate result: that the off-system sales impact can be quantified at $0.3 million.

V. EXEMPLARY PERFORMANCE

Q. DO YOU AGREE WITH DR. JACOBS'S STATEMENT THAT THERE SHOULD BE NO OFFSET DUE TO COAL PLANT PERFORMANCE?

A. No. Dr. Jacobs has taken a one-sided approach to the Palo Verde outage costs and chose to focus only on higher outage costs, despite the fact that significant mitigation of those

costs has already occurred through the superior performance of the Company's coal plants. As I previously indicated in my Rebuttal Testimony, the coal plants outperformed their expected unplanned outages by $10 million.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

REJOINDER TESTIMONY OF ROGER J. MATTSON, PH.D.

On Behalf of Arizona Public Service Company

DOCKET NO. E-01345A-05-0816
DOCKET NO. E-01345A-05-0826
DOCKET NO. E-01345A-05-0827

November 3, 2006

TABLE OF CONTENTS

1. PURPOSE AND SUMMARY

Q. PLEASE STATE YOUR NAME, EMPLOYMENT AND BUSINESS ADDRESS.

A. My name is Roger J. Mattson and my business address is 2511 Fossil Trace Court, Golden, CO 80401. I am self-employed.

Q. DID YOU FILE REBUTTAL TESTIMONY IN THIS CASE?

A. Yes.

Q. WHAT IS THE PURPOSE OF THIS REJOINDER TESTIMONY?

A. The purpose of this Rejoinder Testimony is to respond to the Surrebuttal Testimony of witness Dr. William R. Jacobs, Jr.

Q. HOW IS YOUR REJOINDER TESTIMONY ORGANIZED?

A. I will first address Dr. Jacobs' testimony on the outages of Units 2 and 3 in October 2005 relating to the new question raised by the Nuclear Regulatory Commission (NRC) regarding the dynamic aspects of air entrainment in the suction line from the refueling water tank (RWT), and then I will address his testimony on the performance of the Palo Verde station. (A list of Acronyms is provided in Attachment RJM-1RJ.)

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS FOR THIS REJOINDER TESTIMONY.

A. The October 2005 outages at Units 2 and 3 were not the result of APS imprudence. Palo Verde personnel responded reasonably to a new question the NRC raised – a question that the Company should not have anticipated. Once APS answered the NRC's new question, the units restarted without any change to the equipment, training or procedures related to the systems in question.

Palo Verde's performance has been within industry norms over the decade from 1995 to 2005. Palo Verde has performed better than the average nuclear plant and better than the average of plants in its peer group in almost all of the indicators that

the NRC tracks. On its own initiative, APS has recently undertaken a Performance Improvement Program that involves close oversight by the NRC. Self-critical reports and assessments are always a part of such improvement efforts and are not an indicia of imprudence. The fact that APS and NRC are engaged in this way has no bearing on the prudence of the outages experienced in 2005. Given Palo Verde's long term good performance, a nuclear performance standard is unnecessary.

Dr. Jacobs' Surrebuttal Testimony is insufficient to counter these conclusions. Furthermore, his testimony is flawed because of its serious misunderstandings of the federal regulatory process. His most significant errors occur in the following areas:

- the distinction between a question involving air entrainment in water coming from the RWT that was asked in the original licensing of Palo Verde and the new question that was asked by an NRC contract inspector in October 2005;
- the reliance NRC places on the design basis in regulating operating nuclear power plants;
- the interpretation of statements reportedly made by the senior resident inspector at Palo Verde and his rejection of statements made by the inspector's superior, Regional Administrator Mallett, during his appearance before this Arizona Corporation Commission (ACC or Commission);
- the distinction NRC makes between a degraded cornerstone of safety and other, all-green, noncited violations that exhibit cross-cutting aspects;
- the occurrence of hindsight bias in all retrospective analyses and how the ACC might account for such bias in NRC and company reports; and
- the importance of NRC 's concerns with economic performance standards.

Dr. Jacobs' fundamental contention with respect to the refueling water tank (RWT) outages – that APS should have anticipated the NRC's new question – even if

correct, should not result in any disallowance. As I explain below, the outages would still have occurred and the resulting replacement power costs would still have been incurred.

Finally, Dr. Jacobs' attempted dismissal of NRC's concern about the potentially negative effects of a nuclear performance standard as a "red herring" is unpersuasive. The NRC remains concerned about the potential disincentives to safety of such a standard.

2. RWT OUTAGES

Q. PLEASE REMIND US OF THE CIRCUMSTANCES SURROUNDING THESE OUTAGES.

A. The RWT outages occurred to Units 2 and 3 in October 2005 when NRC was onsite for a followup inspection to the one it conducted in 2004 concerning the voided sump suction line. The general purpose of this followup inspection was for NRC to determine if APS had implemented the corrective actions for the root causes that APS had determined to be responsible for that earlier condition. APS had undertaken an extensive design basis implementation review to determine the extent of condition related to the voided pump suction pipe discovered in 2004 in advance of the arrival of the second NRC inspection team to demonstrate what APS had done to correct the root causes and to examine the generic implications (or extent of condition) of the prior discovery. In advance of the arrival of the inspection team, APS was informed that questions would be asked about the possibility of air entrainment in the RWT suction line that leads to some emergency cooling pumps.

Then, early in that followup inspection, a contractor to the NRC who was on the inspection team asked if the possibility of air entrainment had been considered in the design of the suction line from the RWT to the emergency pumps. The APS staff responded that air entrainment had been considered in the design and that the design measures proposed by APS and approved by NRC to preclude this

possibility had been implemented in the construction of the plant and remained in existence to the present time. Plant records from the original licensing review in 1976 were provided to demonstrate this claim.

The contract inspector challenged the response provided by APS, saying in effect that the calculation provided from the plant records was based on static principles. It did not include the possibility of air entrainment by a back-and-forth movement of the water/air interface in the suction line. APS could not provide a quick answer to that question because no such calculation had ever been performed for Palo Verde or, for that matter, any other plant of its type.

The technical specifications for Palo Verde, like every other nuclear power plant, require that when the operability of a safety system is called into question it must be answered in a short time (a time related to the risk associated with the safety equipment being out of service) or the reactor must be de-powered and placed in an inherently safe shutdown condition (that condition is called cold shutdown).

APS determined that the RWTs for Units 2 and 3 were inoperable on October 11, 2005 and took the two units offline and placed them in cold shutdown. Unit 1 had the same issue but was already shut down for refueling. APS engaged a leading expert in the field of dynamic, two-component flow phenomena to develop an answer to the contract inspector's question. The expert's answer was provided to the inspection team shortly after it was finished, on October 17. The answer was reviewed and accepted by the NRC and the two units were returned to power on October 20. The RWT and associated systems and procedures were not changed before the return to power and remain today the same as they were in all three units before the new question was asked. That is, the original design basis of the plant remains acceptable for current operations.

Three months later, on January 26, 2006, NRC Region IV Administrator Bruce Mallett appeared before this Arizona Commission. He said (transcript pages 42-44)

> In the October [2005] time frame, when we raised this issue about the design flaw, it was a new question, okay, one that we hadn't

come across before, nor had they [APS] to the best of my recollection. And so they did what we expected. They searched that out and said we can't answer the question – I am over simplifying – so that would put us in a condition we don't believe is within our design. If you can't answer [the] NRC, and we [APS] can't answer it within this certain time frame, we have to shut the plant down by our technical specifications until we get it resolved. And that's what they did....***All I can say in this case is that it was a question we raised and they did the right thing when they couldn't answer the question....In this instance we didn't determine that they should have found it beforehand....*** But the issue, I think, was it was a new question that was asked. If they were investigating and looking at that system, you would expect them to find out, but I am not sure we would expect them to go in and look at that system at the time we were looking at it....We have an inspection we are conducting at the time and we have a report that is coming out....we will probably issue it tomorrow....And that report will make our conclusions final in that instance that we looked at. [emphasis added]

Dr. Mallett also gave this event as an example of APS actions that "have been in compliance with our requirements and timely and thorough in response to events and emergent issues." (Transcript pages 19-20) In the inspection report that Mallett signed on the following day, NRC did not issue a violation for APS not asking itself the new question in advance of it being asked by the contract inspector.

I concluded in my Rebuttal Testimony that APS was prudent in its handling of the RWT air entrainment issue because it could not reasonably have anticipated the emergence of the new question that NRC raised, and, once the question was asked, APS followed its only available course of action.

Q. DOES DR. JACOBS ACCEPT YOUR DESCRIPTION OF THESE RWT OUTAGES AND YOUR DETERMINATION THAT APS WAS PRUDENT?

A. Dr. Jacobs seems to agree with me on how the outage came about, but he claims APS should have anticipated the new question asked by the contract inspector and thereby avoided the outage. From this he concludes APS was imprudent. However, he does not say how he thinks the outage could have been avoided if the question had been raised by APS in advance of NRC. Although I do not agree with Dr. Jacobs that APS should have anticipated the NRC's new question, even if APS had

done so, the outages would still have occurred, the replacement power costs would still have been incurred, and there would be no imprudent costs.

Q. WOULD THE OUTAGES STILL HAVE OCCURRED IF, RATHER THAN THE NRC RAISING THE QUESTION, APS HAD DONE SO?

A. Yes. Let's consider a hypothetical situation along the lines implied by Dr. Jacobs. Say APS engineer Smith comes to one of the Palo Verde control rooms one day in the summer of 2005, during the examination of the generic implications of the voided sump suction line, and tells the on-duty senior reactor operator that he doubts that the original licensing basis of the RWT is adequate because the dynamic behavior of the air/water mixture in the RWT suction pipe might entrain more air than the design can accommodate. If the SRO is convinced, then the technical specifications require a SRO in the control room of each operating unit to declare the RWTs inoperable and shut the operating units down, just like APS did for the question raised by the NRC contract inspector.

In summary, the RWT outages would not have been avoided if APS had asked the question in advance in the summer of 2005 during the examination that was performed by APS that was required by the yellow cornerstone determination by the NRC. Once this basic fact is recognized, any remaining differences between Dr. Jacobs and me on the RWT outages are moot.

Q. AT PAGE 9 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS CITES THE QUESTION LEADING TO THE RWT OUTAGES AS AN EXAMPLE OF WHERE NRC IS FINDING PROBLEMS AND NOT APS. DO YOU AGREE?

A. No. As I explain at length in Section 6 of my Rebuttal Testimony, the issue arose when the contract inspector, without advance notice, went beyond the questions originally asked about possible air entrainment in the RWT suction line during the licensing of Palo Verde nearly 30 years before this imposition of a new requirement, i.e., the requirement to perform a new type of analysis that went beyond the analysis required by the NRC when it gave its approval for the plant operating license is called a backfit. (The term "backfit" is defined in 10 CFR

50.109 as the modification of equipment, approvals or procedures at a plant required by a change in NRC requirements or in NRC staff interpretations of NRC requirements, imposed after a plant was originally constructed.)

The actions by the NRC inspectors to raise the dynamic aspects of the switchover of ECCS suction in PWRs from the RWT to the sump constitute a backfit because such effects were not considered in the original licensing basis for these plants. Additionally, this backfit was not done in accord with NRC procedures, which would have required it to be technically justified as being required for assurance of adequate protection of public health and safety. It also would have had to be approved by senior management in NRC's Office of Nuclear Reactor Regulation. There is no reasonable way APS or any other NRC licensee can anticipate spontaneous backfits of this type, conducted outside of NRC's rules and procedures.

Q. AT PAGE 25 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS SAYS THAT "APS' FAILURE TO ADEQUATELY EVALUATE THE SCOPE OF THE YELLOW FINDING OUTAGE IN 2004 [VOIDED SUMP SUCTION LINE] RESULTED IN THE FAILURE TO IDENTIFY THE RWT PROBLEM PRIOR TO 2005." DO YOU AGREE?

A. No. First, Dr. Jacobs offers no proof of this statement, and I know of none. Second, as I noted above, NRC did not issue a violation to APS for not anticipating this issue. Third, Regional Administrator Mallett told this Commission that, "In this instance we didn't determine that they should have found it beforehand..."

Q. AT THAT SAME PAGE 25, DR. JACOBS SAYS THAT ONCE THE CONTRACT INSPECTOR RAISED THE QUESTION, "APS WAS NOT ABLE TO DEMONSTRATE THAT AIR ENTRAINMENT FROM THE RWT WOULD NOT RENDER THE ECCS PUMPS INOPERABLE." IS THIS REALLY WHAT HAPPENED?

A. No. As I demonstrated in my Rebuttal Testimony (pages 54-55), the designers of the plant and NRC were aware, back in the 1970s, of the potential for air entrainment in the RWT suction line, and requirements had been established in the design that were met by the plant construction to foreclose this possibility. Proof of this fact was provided to the contract inspector who raised the question. In my

Rebuttal Testimony, I provided a copy of the proof of this fact that was given to NRC (Attachment RJM_WP11RB. CESSAR Review Matter Number 38, January 19, 1976). That document reads, in part, as follows:

> Under present design...the closing of the RWT discharge valves during the switchover from injection to recirculation is the result of operator action. The consequence of the operator failing to close the valves at the proper time, assuming the combination of (1) low containment pressure relative to refueling water ambient pressure and (2) an insufficient elevation of the sump water level above the piping junction (the TEE) between the RWT, sump, and safeguards pumps...could be the following. With safeguards pump suction being taken from the sump, the water level in the RWT and then in the RWT [suction] lines continues to drop until it reaches the TEE. This exposes the sump-to-pumps flow to dry lines and pump cavitation results from air in the suction lines. The calculation which follows will define an elevation for a suitable pressure differential which will preclude the above described system dysfunction [i.e., air entrainment into the pumps].

There follows in this CE document a calculation to prove that 16 feet of elevation difference between the sump water level and the top of the piping junction between the RWT and the sump (see figure at page 50 of my Rebuttal Testimony) is sufficient to preclude air entrainment. The Palo Verde units in actuality have 40 feet of elevation difference between these two points, much more than enough to satisfy the design requirement.

It is incorrect for Dr. Jacobs to say that APS could not demonstrate that air entrainment would not render the ECCS pumps inoperable because that is what the above quotation from the original licensing basis for Palo Verde does, using static analysis. It shows that air entrainment will not occur if the required elevation difference is met, which it is at Palo Verde, with margin. And the contract inspector was told so.

What happened next, which Dr. Jacobs apparently does not understand, was the contract inspector said that the original calculation (i.e., the original licensing basis) was not good enough. He wanted another level of proof, namely, a dynamic calculation that showed how the air/water mixture would move in the RWT

suction pipe to assure that it would not lead to a damaging level of air entrainment into the pumps.

The contract inspector could have asked APS to investigate the adequacy of the design basis of some other part of the plant that, like the RWT, had never proven inadequate in service. If he had done so, like the case of the RWT, it would have been just as much of a surprise to APS. Adherence to the design basis of nuclear power plants is strenuously enforced by the NRC. The design basis can only be changed by formal processes that conform with requirements in the NRC regulations. They are not changed thoughtlessly. When brought into doubt by some operating event in the industry, they are often reexamined, but no such thing had happened with RWT lines in the industry. Furthermore, when the unforeseeable question of dynamic movement of the air/water mixture in the RWT suction line was addressed by APS to the NRC's satisfaction, no change in the Palo Verde design resulted.

Q. AT PAGES 26 AND 27 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS QUOTES AT LENGTH FROM THE 95002 INSPECTION REPORT. DO ANY OF THOSE PARTICULAR QUOTATIONS HAVE ANYTHING TO DO WITH THE CAUSE OR THE DURATION OF THE OUTAGES?

A. None at all. These particular quotations have to do with opportunities for improvement observed by NRC in the course of APS' decision making to enter the RWT outage. The cause and the duration of the outages owed to a separate matter, i.e., the new question about the dynamic aspects of air entrainment in the RWT suction line.

In discussing the peripheral matters that he quotes, Dr. Jacobs says at page 27 that "...the NRC found many deficiencies in APS'...management of the design basis information that led to the RWT outage." If you go back to page 26 and read the only quotation he cites from the NRC inspection report relating to management of design basis information, you find the following: "The licensee also noted, ***in other ongoing programs*** at the facility, that design basis information was not handled

with appropriate attention to detail." (emphasis added) Thus, the only issue relating to management of design basis information had nothing to do with the RWT outage.

The preceding paragraph on page 26 (top bullet) of his Surrebuttal Testimony (page 26) may hold the key to what Dr. Jacobs is missing. That paragraph is quoted from the NRC inspection report. In it NRC faults APS for not expending "...a thorough enough effort to validate the design criteria." (lines 11 and 12) At the time of this inspection, there was no requirement for licensees to validate the adequacy of their design bases unless they had some operating experience that called the design into question or unless NRC issued some new question about the design derived from its broader view of the nuclear industry. Basically, that is what the contract inspector did – he asked a new question (as Dr. Mallett described it to this Commission), one that could not be anticipated and that tested the validity of the existing design basis. Such disregard for the original licensing basis is one of the complaints that the nuclear industry has voiced about NRC implementation of the Reactor Oversight Process, as I described in my Rebuttal Testimony.

Q. ON PAGE 27 OF HIS SURREBUTTAL TESTIMONY DR. JACOBS CITES AN "INVESTIGATION CHARTER" WRITTEN BY APS CONCERNING THE RWT OUTAGES. HE QUOTES A STATEMENT FROM THAT DOCUMENT TO THE EFFECT THAT IT WAS APS' "INABILITY TO PROVIDE A TIMELY RESPONSE TO THE NRC QUESTION" THAT RESULTED IN THE OUTAGES. DO YOU AGREE WITH THE MANNER IN WHICH HE OFFERS THIS QUOTATION?

A. No, he is misinterpreting the timeliness issue. This document is simply saying APS could not provide a response within the short time limits of the Technical Specifications for the reasons I have elaborated above and that Dr. Mallett addressed – it was a new question – so the units had to be shut down pursuant to those Technical Specifications while an answer was developed. As Dr. Mallett told this Commission, "This shutdown was what was expected, in fact, it is required by [their] Technical Specifications."

APS supplied the answer to the question from the contract inspector almost

immediately. The fact that he judged the answer to be inadequate for his purposes has nothing to do with its timeliness.

Administrator Mallett also stated that the APS response was timely. He said, "I should also note there are some areas where their performance is not degraded and their actions have been in compliance with our requirements ***and timely and thorough in response to events and emergent issues***. I will give you some examples....Most recently, and I know you are interested in this event, in October 2005 the licensee did shut down Units 2 and 3 in response to a potential design deficiency, that the NRC raised, until that design deficiency was addressed." (transcript pages 18-19, emphasis added)

Q. AT PAGES 28 TO 30 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS QUOTES FROM SEVERAL APS REPORTS ABOUT ITS INTERNAL INVESTIGATIONS AFTER THE RWT OUTAGES. ON PAGE 30 AT LINE 14 HE CONCLUDES THOSE QUOTATIONS BY NOTING THAT THERE WERE "...MANY OPPORTUNITIES FOR APS TO HAVE IDENTIFIED THE RWT ISSUE EARLIER." DOES THIS CONCLUSION SUPPORT HIS CONTENTION THAT THE OUTAGE WAS IMPRUDENT?

A. No. Dr. Jacobs does not distinguish between what could have been done and what should have been done. The root cause assessments he quotes do not make that distinction because they were performed by APS according to NRC and industry expectations – in nuclear power plant operations you have to learn from hindsight so the future is always safer than the past, you don't have to distinguish between could and should. In a prudence review such as this one, the difference between could and should is essential.

Dr. Jacobs does not address this distinction. However, for the specific reasons that I have articulated, it is unreasonable to expect that APS should have anticipated the question in advance. Dr. Mallett's statements are consistent with that judgment. Furthermore, even if APS had anticipated the question, it would not have changed the duration of the outage that resulted while the new question was being answered.

It is also important to note that prior to October 2005 many people had looked at

the RWT suction piping and the possibility of air entrainment and had not thought the static design basis at Palo Verde might be inadequate. Those people included the original NRC license reviewers, the original plant designers from Combustion Engineering and Bechtel Corporations, several decades of plant engineering and operations personnel at APS, similarly qualified professionals at other plants having the same design (such as San Onofre and Waterford), and the NRC headquarters thermal-hydraulic experts who have remained cognizant of this system down through the years. After decades of acceptance that air entrainment from the RWT was adequately addressed by static design methods, the new question was raised by a contract inspector and the end result of his question has been no design change.

Q. DID DR. JACOBS ADDRESS YOUR CONTENTION THAT A NEW ISSUE BROUGHT UP BY NRC LED TO THE RWT OUTAGES?

A. Yes, he did so at page 31 of his Surrebuttal Testimony. In essence he says he disagrees because air entrainment is not a new issue and there were lots of earlier opportunities to bring it up. I agree that air entrainment is not a new issue. It was addressed in the original licensing review of every nuclear power plant in the country. I know; I was there. What he misses is the fact that no one prior to the contract inspector at Palo Verde in October 2005 said the dynamic nature of the physical processes invalidated the original designs of all those prior plants. It is not the case that the dynamic nature of the processes involved was not understood all along – I can tell you it was understood. Rather, it was that scores of engineers in and out of government had judged that the static approach to this design, when applied with sufficient conservatism, would accommodate the dynamic effects. The contract inspector said "show me." APS showed him. The show cost 9 days of down time for two large power plants. The plants returned to power with no design change. It was not imprudence on the part of APS that led to these consequences.

Dr. Jacobs goes on to belittle APS' efforts to explain this situation ("Gee, we never thought of that."). The ACC should not be distracted by flippant comments. It is a fact of regulation of nuclear power in the United States that NRC personnel are

allowed and indeed encouraged to think outside the box. The fact that a licensee does not anticipate such creative thinking is not an indicator of imprudence..

Q. DR. JACOBS REJECTS ADMINISTRATOR MALLETT'S CONCLUSIONS THAT THE RWT QUESTION WAS A NEW ISSUE AND NOT ONE THAT APS SHOULD HAVE ANTICIPATED. IS THIS APPROPRIATE?

A. No. He addresses Dr. Mallett's statements to this Commission at page 31-33 of his Surrebuttal Testimony. He says that "The idea that this was a new question appears to be an attempt to shift responsibility for the design of Palo Verde to the NRC." Why Administrator Mallett would want to do such a thing is a mystery to me. It certainly would be counter to every statement ever made by the NRC, of which I am aware, on the question of where such responsibility lies, namely with the licensees. Dr. Mallett would not be so foolish as to say what Dr. Jacobs says. I take Dr. Mallett at his word, it was a new question. He could not have said it more succinctly or simply.

Dr. Jacobs goes on to say "Dr. Mallett's opinion on this [whether the RWT issue should have been seen by APS in advance] is not supported by the facts or NRC's findings." Of course, it is Dr. Mallett who signed the inspection report upon which Dr. Jacobs relies. It seems much more plausible to me that, rather than Dr. Mallett's statements and report being contradictory, it is Dr. Jacobs' interpretation of the inspection report that is wrong.

Administrator Mallett's language and message were stated in clear, simple terms. They help to explain a very complex situation involving two important regimes of regulation, economic performance and safety performance. His statements should be taken at face value. He is the most senior official of the NRC that has been involved in matters important to this case. Dismissing his opinions on those matters would be wrong.

Q. DR. JACOBS SEEMS TO PLACE HIGHER CREDENCE ON THE STATEMENTS ABOUT THE RWT OUTAGES THAT HE SAYS SENIOR RESIDENT INSPECTOR WARNICK MADE DURING A GDS INTERVIEW. WHAT DO YOU THINK OF THAT?

A. At pages 26 and 27 of my Rebuttal Testimony I gave six reasons to suspect that Senior Resident Inspector Warnick's reported statement that the RWT outages could have been avoided should not be interpreted in the way Dr. Jacobs has. They were as follows:

- The senior resident inspector in question was not a member of the inspection team that dealt with the RWT issue nor did he write the January 27, 2006 report of that inspection (Attachment 3 to GDS report of August 17, 2006),
- As noted above, NRC inspectors are not trained or qualified to make such judgments,
- Region IV Administrator Mallett told the ACC on January 26, 2006 that NRC did not determine that APS should have found the new question beforehand,
- The inspection report of January 27, 2006 that dealt with this matter did not contain an NRC finding or a violation for APS's failure to find the new question beforehand,
- The NRC's approval of the GDS interview of the senior resident inspector was approved by the NRC in a letter dated March 15, 2006 from Troy W. Pruett of NRC to Janet Wagner of ACC (RJM_WP2RB) and did not include solicitation of the inspector's opinion on the reasonableness of APS actions in connection with the outages in 2005, and
- There is an alternate interpretation of the senior resident's statement, i.e., he was speaking from his NRC perspective of continuous improvement using hindsight, not from the ACC perspective of judging prudent performance according to information reasonably available at the time.

Dr. Jacobs implies that I was impugning the value and credibility of NRC inspectors by my statement that "... NRC inspectors are not trained or qualified to make such judgments." To the contrary, I was referring to a statement made by a

senior regional manager of the NRC regarding a prudence question at the Indian Point nuclear power station, i.e., "...the NRC does not have the 'role to review or judge that [prudence], nor do I endeavor to have the expertise to decide such matters; NRC inspections are not designed to obtain the necessary information or perspectives to judge such matters.' (A. Randolph Blough, NRC Region I Division Director, July 26, 2000 E-mail to Region I staff. RJM_WP1RB)" Again, I prefer this written statement of the NRC official at face value, and my own experience as a senior NRC manager, rather than the interpretations provided by Dr. Jacobs of statements attributed to Inspector Warnick.

Finally, the reported statement of Inspector Warnick is irrelevant to this proceeding where the ACC is examining what APS should have done to avoid the outages, not what APS could have done. If the NRC had asked for a dynamic, two-component flow calculation before the plants were licensed, or asked for it in a generic communication that allowed the question to be answered while the plants continued to operate, the outages could have been avoided. Besides those alternatives, if either NRC or APS had raised the question while the units were operating, the outages would not have been avoided.

3. PALO VERDE PERFORMANCE

Q. ASIDE FROM THE RWT OUTAGES, DOES DR. JACOBS ADDRESS OTHER PALO VERDE PERFORMANCE ISSUES USING NRC DOCUMENTS AND STATEMENTS?

A. He does, and his interpretations of NRC reports and operating data are flawed in many respects and have nothing to do with the outages experienced in 2005.

Q. AT PAGE 6 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS SAYS HE AGREES WITH YOU THAT THERE HAS BEEN A DECLINE IN REGULATORY PERFORMANCE AT APS. DO YOU THINK THAT THE TWO OF YOU ARE REALLY IN AGREEMENT ON THIS POINT?

A. No. I think his statements gloss over the difference we have on this point. First, the decline in regulatory performance as indicated by the number of noncited violations, cross-cutting issues and the yellow degraded cornerstone have no

bearing on the outages in 2005. He says the yellow cornerstone has a nexus with the RWT outage. I have shown that not to be the case. Second, his testimony muddies the water concerning the difference between power production efficiency (as measured by capacity factors, for example) and regulatory performance. When NRC finally removes the degraded yellow cornerstone has no bearing whatsoever on the cause and length of the outages in 2005. When and how cross-cutting issues are ultimately resolved by APS and NRC also have nothing to do with the cause and length of those outages. He opines at length about the current difficulty of resolving those issues, but he cannot show how they caused or lengthened outages that occurred a year or more ago. So, we may agree that there has been a decline in regulatory performance, but we certainly do not agree on how that matters to the outages being examined in this case.

Q. AT PAGES 2-3 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS ADDRESSES THE RECENT CAPACITY FACTORS OF PALO VERDE IN COMPARISON TO THE REST OF THE INDUSTRY. WHAT IS YOUR REACTION TO THIS TESTIMONY?

A. As he did in his Direct Testimony, Dr. Jacobs relies on an article in the *Nuclear News* of May 2006 for his analysis of capacity factors. A complicating factor for the data presented in that article is that they are averaged over three year periods and are detailed by individual units only for two periods, 2000-2002 and 2003-2005.

Relying on data from that article, Dr. Jacobs says that "...Palo Verde generation and capacity factor have been declining since 2002..." (Surrebuttal Testimony, p. 2, line 19) He does not mention that 2002 was Palo Verde's best year for generation, and that although productivity declined in the years 2003 and 2004, they were still the sixth and seventh highest years of production in Palo Verde's lifetime. From the NRC data summarized in my Rebuttal Testimony (Attachment RJM-3RB), I can tell you that instead of being worst in the industry as Dr. Jacobs portrays its performance, Palo Verde's average availability for the years 2002-2004 was 89.1% compared to an average of 89.8% for all PWRs, placing Palo Verde in

the middle of the pack for the period – the period in which APS also accomplished steam generator replacements in Unit 2.

Another conclusion that Dr. Jacobs derives from the data in the *Nuclear News* article is that Palo Verde's productivity declined more than other plants between the period 2000-2002 and the period 2003-2005. He fails to mention that Palo Verde accomplished steam generator replacements in both Units 2 and 3 in the latter time period. These steam generator replacements required approximately 70 extra days of outage time, compared to about 175 days of non-refueling outage days due to unanticipated events in that same three-year period. Dr. Jacobs would have the ACC believe that the decrease in productivity compared to the prior three years owed entirely to unplanned outages. The fact is that nearly 30% of the down time in the years he addresses was for planned steam generator replacements.

There is no doubt that the average availability of the Palo Verde units of 78% in 2005 was lower compared to other years of operation and compared to industry averages. However, there is a need to keep perspective on this performance indicator. Such perspective is provided in the same *Nuclear News* article on which Dr. Jacobs relies,

> As has been noted in this annual series of surveys, the most remarkable development in the U.S. power reactor community in the past quarter century is not that some reactors had managed to get their three-year capacity factors above 90 percent (which no reactor had done until the early 1990s), but that every one of the operating reactors has improved to the point where a factor well over 80 percent is expected. When these reactors were being planned and built, utilities would routinely make their case to state-level rate-making commissions for the recovery of plant costs in electricity rates by basing the reactor's performance on a capacity factor of about 65%.

I recommended in my Rebuttal Testimony that nuclear power plant performance should be viewed over a long enough period of time to avoid misperceptions created by the vagaries of statistics and sufficient to average out the effects of

refueling and other unavoidable outages. Seeing how the three year averages used by *Nuclear News* are susceptible to misunderstanding suggests to me that a somewhat longer period and a rolling average are more appropriate. Apropos this same point, I reiterate something I said in my Rebuttal Testimony (page 16): It is my understanding that the ACC in a previous decision (Decision No. 55118, page 20) has stated that "a realistic analysis of operating performance must look at both the 'successes' and the 'failures' if it is to avoid setting unobtainable goals of absolute perfection." This is one of the reasons why my analysis examines whether Palo Verde has been operating within industry norms over the past decade, a period over which any company could be expected to have some "successes" and "failures."

Q. AT PAGE 4 OF HIS SURREBUTTAL TESTIMONY DR. JACOBS OPINES THAT "IF THE DECLINE IN PERFORMANCE HAD BEEN RECOGNIZED IN 2003, MANAGEMENT COULD HAVE IMPLEMENTED MEASURES TO ADDRESS THE PROBLEM WITHOUT PALO VERDE SINKING TO THE BOTTOM OF THE INDUSTRY." DO YOU AGREE?

A. No, for several reasons. First of all Palo Verde has not "sunk to the bottom of the industry" as I have shown above. Second, in 2003, but for the outage for the steam generator replacements in Unit 2, the three units were having outstanding operating runs. (Unit 1 had only 7 outage days in 2003, Unit 2 had one day besides the steam generator/refueling outage, and Unit 3 had only 8 days in addition to its normal refueling outage.) Third, in 2003, APS was receiving high marks from NRC and INPO. It is hard to recognize a "decline" in the midst of that kind of performance.

I note that Dr. Jacobs only opines here that management could have done something, he does not say management should have done something nor does he say what management could have done. Also, it is important to recognize that Dr. Jacobs' conclusion, whether right or wrong, had nothing to do with the outages experienced in 2005. He has not shown how the time of detection of a decline in performance has anything to do with any of the outages that occurred in 2005.

Q. AT PAGES 5 AND 6 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS DISCUSSES THE EFFECT OF OUTAGES IN 2005 ON THE CAPACITY FACTOR OF PALO VERDE THAT YEAR. DR. JACOBS SAYS PALO VERDE'S PERFORMANCE WAS ABYSMAL. YET HE ONLY CHALLENGES 23 DAYS AS BEING IMPRUDENT. HOW MUCH CHANGE IN THE AVAILABILITY OF THE STATION OWES TO THOSE 23 DAYS?

A. The three unit station has the potential to produce a maximum of 1,095 full power days in a year. Losing 23 such days reduces the average availability of the units by 2.1% each. That is, the lost production owing to the outages he contests is very small. In sum, Dr. Jacobs' capacity factor arguments are off the mark for reasons I have discussed above and, in any event, bear no relationship to the outages that are in question in this case.

Q. FROM PAGES 7 TO 14 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS CITES VARIOUS NRC DOCUMENTS TO MAKE THE POINT THAT HE DISAGREES WITH YOUR TESTIMONY THAT THERE ARE RECENT INDICATIONS THAT THE STATION WILL BE SUCCESSFULLY RETURNED TO THE LOWEST LEVEL OF NRC SCRUTINY. DO YOU STAND BY YOUR EARLIER TESTIMONY TO THAT EFFECT OR HAS HE CHANGED YOUR MIND?

A. I stand by my earlier testimony. All the documents he now cites were available at the time I filed my Rebuttal Testimony in this case, and, with the exception of one document that summarizes the others, all were available at the time Dr. Jacobs filed his Direct Testimony. That is, I reached my earlier conclusion about there being recent indications of returning to a normal level of scrutiny by the NRC fully aware of the documents he cites. One of the indications identified in my Rebuttal Testimony was Administrator Mallett's statement to the ACC on January 26, 2006 (transcript page 24),

> They [APS] are in what we call the third column or yellow column [i.e., the second column of increased oversight] of our action matrix because they had a finding with this voiding issue in their emergency core cooling pipe system late 2004 that was risk significant. And we felt that needed to be corrected. So that's what put them into that column. Once they correct [accomplish] the actions they need to take for that specific issue and complete it, they will go back to the first column, or green column of

performance where we don't have increased oversight of them.

In addition to that action matrix, however, these other problems I listed, we issued them based on their performance, these two cross-cutting issues [of] problem identification and resolution and human performance. These have to be corrected by them [APS]. They have to address those issues. But they will still be in the green column with those issues.

The reason we identified them [cross-cutting issues] is those are indicators that we believe lead you to getting into one of the columns to the right of the matrix... the yellow or red column. So we identify those issues early and hope to turn them around so...their performance doesn't get worse.

At pages 11 to 13 of his Surrebuttal Testimony, Dr. Jacobs discusses the substantive crosscutting issues that NRC has identified for Palo Verde. He again fails to mention that these issues all concern non-cited violations (green ones in the NRC parlance, i.e., low safety significance) and are all addressed by the normal levels of NRC scrutiny. They are not the cause of increased scrutiny, as explained by Mallett in the quotation provided above. Dr. Jacobs also ignores the perspective I provided in my Rebuttal Testimony (pages 10 and 35) that these cross-cutting issues recently have been growing in number around the industry. Since the performance of the industry is known to be rising in this same time period, there must be something about these cross-cutting issues that doesn't directly correlate with performance. I offered a number of insights to this phenomenon in my Rebuttal Testimony, and Dr. Jacobs did not counter the points I made there.

In any case, I do not read the recent letters from NRC to APS to be as dire as Dr. Jacobs apparently does. The difference may be discerning a glass that is half empty from one that is half full. Let me explain. Performance improvement programs of the type now underway at Palo Verde are not expected to produce results overnight. The NRC letters that Dr. Jacobs cites are chronicling the improvement process at Palo Verde as it progresses under the direction of the PIP. While this theorizing on how things will go with the NRC in the future is interesting, it has nothing to do with the outages experienced in 2005.

Q. AT PAGES 14 AND 15, DR. JACOBS SAYS THAT "ROOT CAUSE EVALUATIONS AND OTHER OUTAGE REVIEWS CONDUCTED BY THE COMPANY DO NOT RELY ON HINDSIGHT...[AND] THE NRC DOES NOT RELY ON HINDSIGHT..." DO YOU AGREE?

A. No. Root cause assessments are only conducted after the fact, i.e., after the outcome of some set of circumstances is known. They are not contemporaneous to the occurrence of the preceding circumstances that led to the outcome. By definition, they are retrospective. They are fully informed of the outcome of the preceding factors. That is what hindsight means. My *American Heritage Dictionary* says hindsight is the "perception of the significance and nature of events after they occur."

This is very important to understand when one relies on information in root cause assessments performed by NRC or its licensees because those assessments are full of hindsight, and they do not attempt to distinguish between what could have been known and what should have been known at the time prior events occurred. It is important that people using these reports understand that distinction because any judgment about the reasonableness of what other people did in real time to control those prior events must make such a distinction.

Q. AT PAGE 15 OF HIS SURREBUTTAL TESTIMONY DR. JACOBS SAYS THAT NRC DOCUMENTS AND COMPANY SELF ASSESSMENTS "PROVIDE A CONTEMPORANEOUS ASSESSMENT" OF PLANT PERFORMANCE AND THAT "THE USE OF COMPANY ASSESSMENTS AND NRC DOCUMENTS HAS BEEN ALLOWED IN EVERY ONE OF THE MANY JURISDICTIONS IN WHICH I HAVE TESTIFIED ON NUCLEAR PLANT OUTAGES." IS THAT CORRECT?

A. No. Moreover, the more important question is whether those jurisdictions accepted his claim that such documents provide a contemporaneous assessment of plant performance, not based on hindsight. In my Rebuttal Testimony I quoted a decision from one of the jurisdictions in which Dr. Jacobs has appeared. I used the quote to show that backfitting at the Kewaunee Nuclear Power Plant (KNPP) by the same NRC contract inspector involved in this Arizona case had been found by the Wisconsin PUC not to be the source of imprudent action, contrary to testimony

offered there by Dr. Jacobs. Here is what that same Commission had to say about Dr. Jacobs' use of KNPP's root cause analysis in that case (page 24 of RJM_WP14RB):

> Dr. Jacobs primarily relied upon the Root Cause Analysis and other reports regarding the 2005 outage as the basis for his opinion that past NMC [Nuclear Management Corporation, the licensee] management was careless and, therefore, imprudent. These reports were prepared by NMC for the NRC in the course of the 2005 outage. The documents include a summary of prior KNPP conduct regarding the AFW [Auxiliary Feedwater] and other systems and observations of past opportunities to have made improvements. Dr. Jacobs primarily relies upon these documents as the basis for his opinion that KNPP failure to make repairs in the past was the result of imprudent management.
>
> ***These documents and their assessments***, however, were prepared for the NRC in 2005 and ***do not provide definitive evidence of past imprudent management. The record does not include documents contemporaneous with these past opportunities that show KNPP failed to exercise reasonable management*** with respect to the AFW system or other repairs made during the 2005 outage. Furthermore, the record does not include specific evidence that these repairs should have been made consistent with industry standards prevalent in the past when these opportunities occurred. As a consequence, the record does not present sufficient evidence to demonstrate that imprudent past management practices lead to the 2005 outage. (emphasis added)

So, a root cause assessment by the licensee and similar documents were allowed into the record in the Wisconsin case, but they were found to be inappropriate for the purpose for which they were offered by Dr. Jacobs. A similar finding is warranted in this case for the uses that Dr. Jacobs has made of APS' and NRC's retrospective analyses and reports because of his failure to account for hindsight bias contained in those documents.

Q. DO OTHER TECHNOLOGICAL ENDEAVORS RECOGNIZE THAT THERE IS HINDSIGHT IN RETROSPECTIVE ANALYSES?

A. Yes. The inherent nature of hindsight in root cause assessments is not unique to the nuclear industry. The following is a brief description of the phenomenon (called Hindsight Bias in the literature) as it is observed in the practice of medicine:

> There are a variety of factors that block or inhibit the learning processes central to a high reliability culture. One is the hindsight bias (Fischhoff, 1975; Woods et al., 1994; Woods and Cook, 1999). The hindsight bias is one of the most reproduced research findings relevant to accident analysis and reactions to failure. Knowledge of outcome biases our judgment about the processes that led up to that outcome.
>
> In the typical study, two groups of judges are asked to evaluate the performance of an individual or team. Both groups are shown the same behavior; the only difference is that one group of judges are told the episode ended in a poor outcome; while other groups of judges are told that the outcome was successful or neutral. Judges in the group told of the negative outcome consistently assess the performance of humans in the story as being flawed in contrast with the group told that the outcome was successful. Surprisingly, this hindsight bias is present even if the judges are told beforehand that the outcome knowledge may influence their judgment.
>
> (From a paper "Behind Human Error: Human Factors Research to Improve Patient Safety," David Woods, Past President, Human Factors and Ergonomics Society, published by American Psychological Association, 2006, RJM_WP1RJ)

The NRC makes no effort to remove hindsight bias from its retrospective assessments or those of its licensees. Rather, NRC values hindsight because it provides insight to what might be done in the future to foster continuous improvement. NRC does not make judgments about the reasonableness of past actions – the outcomes of those actions either meet the regulations or they do not meet the regulations, as far as NRC is concerned. But many other organizations do need to correct for hindsight bias because those organizations deal with the reasonableness of past actions, just as does this Commission. A recent, brief exploration on the Internet showed the range of organizations that acknowledge or correct for Hindsight Bias in their retrospective analyses of events. Documents illustrating this are provided as RJM_WP2RJ.

In sum, hindsight bias exists, it is human nature when looking back. NRC takes advantage of the bias to strengthen the assurances it provides of future nuclear safety. So does APS. Others correct for it, as should this Commission in reading

retrospective reports by NRC and its licensees.

Q. AT PAGES 15 AND 16 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS REFERS TO A DECISION BY FERC JUDGE COWAN IN 1998 INVOLVING PERMANENT SHUTDOWN OF THE CONNECTICUT YANKEE ATOMIC POWER PLANT. HE SAYS THAT COWAN'S DECISION TO USE INFORMATION FROM NRC AND COMPANY ASSESSMENTS TO REACH AN ECONOMIC REGULATORY JUDGMENT SHOULD BE FOLLOWED IN THIS CASE. DO YOU AGREE?

A. No. Judge Cowan was dealing with a very different situation than we are here, as he said in the paragraphs just preceding the ones quoted by Dr. Jacobs.

> In the instant case, the prudence inquiry, while broad-ranging, is not so much to determine whether certain costs sought to be recovered in rates were prudently incurred as it is to determine whether a pattern of utility managerial conduct was unreasonable and imprudent, compelling the closure of a plant with, arguably, some remaining economic life. The distinction between the prudence inquiry here and the more typical analysis of the prudence of certain incurred costs is not so much one of principle as one of approach.
>
> In the more typical prudence case, an inquiry into the reasonableness of management conduct surrounding a certain set of costs can follow an auditable trail more readily than the more complex prudence issue in the instant case. In both types of cases, the object is similar, to wit, to determine whether a reasonable utility management would have performed similarly under the same circumstances at the relevant point in time. ***But, given the broad nature of the inquiry here, encompassing a pattern of managerial conduct involving a wide range of issues over a span of time, the proof of imprudence will be more difficult to come by and will, of necessity, take a different form.*** (emphasis added)

Accordingly, the FERC ALJ decided to make use of NRC and Company documents due to "the absence of more traditional analysis and evidence." Judge Cowan pointed out that there are significant differences between a normal prudence case like this case and the one involving Connecticut Yankee. In the Yankee case, the plant allegedly had been operated and maintained in such a manner that its useful life for producing power was far shorter than originally intended. The FERC case had to do with the

recovery of decommissioning and other costs associated with the premature, permanent shutdown of that plant. Clearly, the Connecticut Yankee situation was not the same as this Palo Verde case where only a few short outages are in question. Thus, the unusual course chosen by Judge Cowan should not be followed here. This Commission's decision should be based on what it was reasonable for APS to have done in the various circumstances it faced where reasonableness is judged free of hindsight bias.

It bears repeating that, if one is careful to differentiate what could have been known from what should have been known, NRC and Company documents generated with hindsight bias can be used in cases such as this one. However, I have seen no effort by Dr. Jacobs to point out such distinctions in the testimony he has offered in this case, testimony that is nearly all based on retrospective NRC and APS documents.

Q. AT PAGE 17 OF HIS SURREBUTTAL TESTIMONY, DR. JACOBS DISAGREES WITH YOUR STATEMENT THAT HE HAS TAKEN SOME OF THE COMPANY'S ANALYSES OUT OF CONTEXT. IS HE CORRECT?

A. No, the reasons he cites for disagreeing with me have nothing to do with the point I was making at page 11 of my Rebuttal Testimony where I said, " Although I agree with the GDS report at pages 2 and 11 that the PIP should be successful in improving performance at Palo Verde, I strongly disagree with the manner in which GDS has taken out of context the harsh self criticism of the APS analyses connected with the PIP and incorrectly portrayed them as self condemnation."

My criticism about his use of NRC and APS documents has nothing to do with the length of his quotations or of the documents he has provided, as he asserts.

Rather, my criticism relates to what I have stressed in the preceding answers. That is, Dr. Jacobs makes no attempt in his testimony to put the harsh self-criticism found in APS documents in context. Had he done so he would have pointed out that they were written after the fact. He would have shown in specific details

where they contained hindsight bias. Also, he would have acknowledged that they were written in a style that is the established norm in this industry – all licensees use harsh self-criticism in their retrospective analyses of operating events or other unusual conditions.

Q. IN YOUR REBUTTAL TESTIMONY AT PAGES 45 TO 47 YOU PROVIDED INFORMATION ABOUT NRC'S CONCERN FOR ECONOMIC PERFORMANCE STANDARDS THAT MIGHT BE SET BY OTHERS FOR THE NUCLEAR POWER PLANTS NRC REGULATES. DR. JACOBS CALLS THIS CONCERN "SOMETHING OF A RED HERRING" AT PAGE 38 OF HIS SURREBUTTAL TESTIMONY. DO YOU AGREE WITH THE REASONING HE PRESENTS THERE?

A. I do not. As I discussed above, Dr. Jacobs would have this Commission disregard the words of an NRC Regional Administrator, the senior-most NRC official who has reviewed the RWT outages. Now, Dr. Jacobs would have this Commission ignore the statements of the NRC Commissioners themselves on another important topic, as those statements are found in the *Federal Register* and in a statement the NRC presented to Congress.

As I pointed out in my Rebuttal Testimony, NRC is concerned about economic performance standards because they can provide disincentives to safety. The importance of not creating such incentives was stressed by the President's Commission on the Accident at Three Mile Island. The avoidance of safety disincentives has attracted the attention of every NRC Commission since then. Because they are of concern at the highest levels of our government, I wouldn't call safety disincentives a red herring. Speaking frankly, the NRC does not like economic performance standards because of its concern for disincentives to safety. The NRC has offered some detailed advice on how to structure such standards if a state decides it has to have them. But NRC does not favor or encourage them.

4. SUMMARY OF CONCLUSIONS

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS ABOUT THE RWT OUTAGES IN LIGHT OF DR. JACOBS' SURREBUTTAL TESTIMONY.

A. My conclusions about the RWT outages are unchanged from those stated in my

Rebuttal Testimony. I reiterate them here for convenience.

- APS responded reasonably to the line of inquiry about air entrainment in the suction piping from the RWT by showing proof that air entrainment had been considered in a static calculation recorded in the original licensing basis of the plant.
- APS could not have anticipated that the contract inspector would then have questioned the adequacy of the original design by asking if there was a dynamic analysis, because static analysis was the basis for design and licensing of ECCS suction lines for all pressurized water reactors in the U.S., not just Palo Verde.
- Thus, the question was typical of one of the problems that have been identified to the NRC by the industry in its annual feedback associated with the reactor oversight process, namely, the inspection part of the reactor oversight process has begun to address the adequacy of the original licensing process wherein the safety basis was established;
- However, once NRC raised the question, APS was required to address it. When APS could not answer the question in the time prescribed by the plant's Technical Specifications, the two operating units had to be shut down until the answer could be developed. The answer required extending the state of the art for such analysis.
- As Region IV Administrator Mallett told the Arizona Corporation Commission on January 26, 2006, the issue was a new question, one that NRC and APS had not come across before, APS did what NRC expected, and NRC did not determine that APS should have found the issue beforehand.
- The units restarted and continue to run today without any changes in the equipment, training or procedures associated with the systems in question.

I disagree with much of what Dr. Jacobs has said in rebuttal of these conclusions, specifically,

- Dr. Jacobs argues that APS should have asked the new question about RWT air ingestion before the NRC asked it. I disagree because that question went beyond the design basis of the plant and there was no operating or other experience that called that design basis into question. However, even if APS had asked the new question in advance of the NRC, it would not have avoided the RWT outages.

- Dr. Jacobs says the RWT issue arose because NRC, not APS, was finding problems. I disagree. The air entrainment connection between the voided sump suction line and the RWT was addressed by APS in the expected and reasonable manner, i.e., by recourse to how the original design basis accommodated this concern. It was not reasonable for APS to have anticipated NRC's rejection of that answer and its raising of the new question about dynamic effects. In the end, no design changes have been required to answer the new question.

- Dr. Jacobs says APS was not able to demonstrate that air entrainment in the lines coming from the RWT would not disable the emergency pumps. I disagree. APS did make such a demonstration, and it was provided to NRC almost immediately after APS was asked to do so. The demonstration came form the original licensing records for the plant. That was a reasonable approach for APS to have taken. The contract inspector then asked the new question that had not been asked before and it took some time and one of the leading experts in the field to develop an answer.

- Dr. Jacobs offers no proof for his claim that APS should have known of the new question in advance. NRC did not cite APS for failure to anticipate the new question, and NRC Regional Administrator Mallett told the ACC that, "In this instance we didn't determine that they should have found it beforehand..." Dr. Jacobs dismisses the statements by Administrator Mallett on the RWT outages. I find Dr. Mallett's statements to be consistent with the inspection report he signed and conclude that it is Dr.

Jacobs' reading of the documents that is incorrect.

- Dr. Jacobs did not respond in his Surrebuttal Testimony to the interpretation that I have suggested the ACC should apply to senior resident inspector Warnick's reported statement to Dr. Jacobs about the avoidance of the RWT outages, i.e., Warnick was making a "could have avoided" statement not a "should have avoided" statement. Even if Inspector Warnick really meant that the outages should have been avoided, he was wrong and is in conflict with his superior Dr, Mallett.

- If APS had raised the new question before the contract inspector raised it, the RWT outages would still have occurred because technical specifications on the timing of operability determinations would have applied without regard to the source of the question that brought RWT operability into doubt.

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS ABOUT THE PERFORMANCE OF PALO VERDE IN LIGHT OF DR. JACOBS SURREBUTTAL TESTIMONY.

A. My conclusions about Palo Verde's power production and regulatory performance are unchanged from my Rebuttal Testimony. I reiterate some of the key conclusions here for convenience.

- Palo Verde's performance has been within industry norms over the decade from 1995 to 2005. Although it has experienced a decline recently, as most plants do at some point, APS is addressing this decline through its Performance Improvement Program. Self-critical reports and assessments are always a part of such improvement efforts and are not an indicia of imprudence.

- The new reactor oversight process that NRC implemented in 2000 provides four levels of increasing scrutiny of licensees above the normal level of NRC oversight. Palo Verde is now at the second level of increased oversight (yellow cornerstone), and there are indications that it will

successfully return to the lowest level of NRC scrutiny. In the meantime, NRC has not interfered with its continued operations.

- NRC has raised concerns with cross-cutting aspects of Palo Verde operations (human performance and problem identification and resolution). These issues did not cause the yellow cornerstone or the outages experienced in 2005, and they have been controversial within the industry. In response to general industry criticism of the cross-cutting issues, NRC has recently acknowledged it has its own difficulty in understanding and dealing with cross-cutting findings and in early 2006 proposed new ways of dealing with them.

- The Performance Improvement Process underway since October 2005 is beyond NRC's expectations for a station at Palo Verde's current level of performance. The PIP is typical of improvement programs that have been implemented at many operating plants, usually when they were experiencing worse performance problems than Palo Verde. Such processes always involve self-assessments that use hindsight to identify opportunities for improvement, and they often do so in harsh terms that are expected by NRC and the industry.

I disagree with much of what Dr. Jacobs has said in rebuttal of these conclusions, specifically,

- Although APS' recent performance has not been as high as prior levels of excellence, over the six year period that Dr. Jacobs purports to analyze, Palo Verde's performance is somewhat below average and nowhere near as bleak as depicted by Dr. Jacobs in his Surrebuttal Testimony.

- Dr. Jacobs opines that if the decline in performance had been detected in 2003 it could have been corrected earlier. I note that he did not say it should have been detected earlier, and I have listed some reasons why it was not reasonable for a decline in performance to have been detected in

2003.

- Dr. Jacobs and I agree that there was a decline in regulatory performance at Palo Verde, but I conclude there is no connection between that decline and the outages that occurred in 2005.

- Dr. Jacobs disagrees with my conclusion that there are signs that Palo Verde will return to a normal level of NRC oversight. His citation of recent statements by NRC about the yellow cornerstone and the cross-cutting issues fails to account for the inherently negative tone of NRC inspection reports, and he has not countered the indicators I cite, including statements to this Commission by Administrator Mallett that once the yellow cornerstone is cleared up the plant will return to normal oversight.

- Dr. Jacobs says that NRC and APS do not use hindsight in their retrospective analyses. He is wrong. NRC has stressed this aspect of accident analysis since the accident at Three Mile Island and the emphasis it placed on the value of retrospective, "What If" analyses of operating experience. Hindsight bias has been shown to be an inherent human psychological phenomenon that has been examined in the scientific literature. Some agencies and organizations intentionally discount the effects of hindsight bias in their retrospective analyses. NRC does not. The ACC should take care to identify and discount hindsight bias in its prudence determinations, certainly when using NRC documents, but also when asked to rely on the testimony of experts such as Dr. Jacobs who deny its existence.

- Dr. Jacobs claims in his testimony before this Commission that NRC documents and company root cause assessments have been allowed in every jurisdiction in which he has testified. However, although he was able to cite such documents in the Kewaunee case, the Wisconsin Commission easily detected the hindsight bias they contained and expressly ruled against the use for which he cited the documents.

- Dr. Jacobs persists in this case in making no effort to differentiate what could have been known from what should have been known when he relies on NRC and company documents generated with hindsight bias.
- Dr. Jacobs dismisses NRC's concern for economic performance standards. The subject deserves more serious consideration than he has given it because of the NRC-perceived potential of such standards to create disincentives to safety. Although the NRC has offered some detailed advice on how to structure such standards if a state decides it has to have them, NRC does not favor or encourage them.

Q. DOES THIS CONCLUDE YOUR REJOINDER TESTIMONY?

A. Yes.

ATTACHMENT RJM-1RJ. ACRONYMS

ACC	Arizona Corporation Commission
AEC	Atomic Energy Commission
AFW	Auxiliary Feedwater (System)
AIT	Augmented Inspection Team (from NRC)
APS	Arizona Public Service Company
BNL	Brookhaven National Laboratory
BWR	Boiling Water Reactor
CAP	Corrective Action Program
CE	Combustion Engineering
CFR	Code of Federal Regulations
CRDR	Condition Report/Disposition Request
CSS	Containment Spray System
ECCS	Emergency Core Cooling System
EPA	Environmental Protection Agency
FSAR	Final Safety Analysis Report
HPCI	High Pressure Coolant Injection (part of ECCS on BWR)
HPSI	High Pressure Safety Injection (a subsystem of the ECCS on a PWR)
I&C	Instrumentation and Control (Systems)
IEAL	International Energy Associates Limited
KNPP	Kewaunee Nuclear Power Plant
NCV	Non Cited Violation
NMC	Nuclear Management Corporation
NRC	Nuclear Regulatory Commission
OCS	Operations Computer Systems
ORR	Operational Readiness Review
PI&R	Problem Identification and Resolution
PVNGS	Palo Verde Nuclear Generating Station
PWR	Pressurized Water Reactor
RAS	Recirculation Actuation Signal
RHR	Residual Heat Removal
ROP	Reactor Oversight Process (of the NRC)
RWT	Refueling Water Tank
SIS	Safety Injection System (part of ECCS, another name for HPSI)
UFSAR	Updated Final Safety Analysis Report

REJOINDER TESTIMONY OF ROBERT E. DENTON
ON BEHALF OF ARIZONA PUBLIC SERVICE COMPANY

Docket No. E-01345A-05-0816
Docket No. E-01345A-05-0826
Docket No. E-01345A-05-0827

November 3, 2006

REJOINDER TESTIMONY OF ROBERT E. DENTON
ON BEHALF OF ARIZONA PUBLIC SERVICE COMPANY
(Docket No. E-01345A-05-0816)
(Docket No. E-01345A-05-0826)
(Docket No. E-01345A-05-0827)

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Robert Elmo Denton. My business address is 79 Redwood Lane, Weems, Virginia 22576.

Q. DID YOU PROVIDE REBUTTAL TESTIMONY ON BEHALF OF APS IN THIS DOCKET?

A. Yes. I provided Rebuttal Testimony on behalf of APS on September 15, 2006.

Q. HAVE YOU READ THE SURREBUTTAL TESTIMONY SUBMITTED BY WILLIAM R. JACOBS, JR. FOR THIS CASE, SUBMITTED OCTOBER 13, 2006?

A. Yes, I have.

I. SUMMARY

Q. PLEASE SUMMARIZE YOUR REJOINDER TESTIMONY.

A. My Rejoinder Testimony addresses two issues: (1) The March Diesel Generator Outage, and (2) the use of NRC reports and Company self-critical documents. In both areas I disagree with Dr. Jacobs' conclusions. I believe Dr. Jacobs overemphasizes the role of the Diesel Generators to make his point. I also believe he incorrectly characterizes the nature of the content of NRC reports and Company self-critical documents.

II. MARCH DIESEL GENERATOR OUTAGE

Q. HAVE YOU REVIEWED THE SECTION BEGINNING ON PAGE 17 OF DR. JACOBS' SURREBUTTAL TESTIMONY TITLED "UNIT 1 EMERGENCY DIESEL A GOVERNOR FAILURE MARCH 18-21, 2005"?

A. Yes, I have.

Q. DO YOU AGREE WITH DR. JACOBS' CHARACTERIZATION OF THE EMERGENCY DIESEL GENERATORS?

A. To the extent that the Emergency Diesel Generators (EDG) are important to the safe operation of a nuclear plant, I agree. However, I believe Dr. Jacobs has overemphasized the role of the EDGs to make his point.

Q. IN WHAT WAY HAS DR. JACOBS OVEREMPHASIZED THE ROLE OF THE EDGS?

A. Dr. Jacobs overemphasizes the role of the equipment when he states that "Failure of a diesel generator to function when needed could result in a serious nuclear accident." In fact, the EDGs are 100% redundant, and the failure of one machine to start is fully backed up by another diesel and a completely redundant set of equipment. Furthermore, for the EDGs to be called upon in the first place, a precipitating accident event must have occurred simultaneous with a loss of offsite power. Yes, the EDGs are important, but not of the singular importance implied by Dr. Jacobs.

Q. HOW DOES THIS OVEREMPHASIS AFFECT DR. JACOBS' ARGUMENT FOR IMPRUDENCE?

A. When applied to his corollary that "the care given to operating and maintaining a piece of equipment must be commensurate with the importance and function of the equipment," Dr. Jacobs reaches the conclusion that extraordinary surveillance of the EDG governor is warranted, in the form of extra oil samples. There are literally hundreds of pieces of equipment in a nuclear plant equally as important as the EDGs. There was no reason for the Company to sample the new oil added to the governor at the time of installation or at the time of the 2004 oil change. The new oil added to the governor is carefully controlled. These controls were reviewed and

found to be effective, as described in CRDR 2782680. In fact, the oil removed and sampled on 4/19/04 contained only 104 ppm of water – well below the 1500 ppm limit. It would virtually be impossible, and certainly prohibitively costly, to provide extraordinary coverage for all this equipment, as suggested by Dr. Jacobs.

Q. DO YOU CONTINUE TO BELIEVE THAT THE OUTAGE IN QUESTION WAS NOT DUE TO ANY IMPRUDENCE ON THE PART OF THE COMPANY?

A. Yes. The Palo Verde staff fully implemented the surveillances of the EDGs required by the manufacturer and the plant's NRC-approved Technical Specifications. The shipping and storage of the governor was also in full accordance with Woodward (the manufacturer) instructions. The oil used was stored and transported with proper controls. There was no reason to go even further with extraordinary inspections. Thus, the Company did "use a standard of care commensurate with the importance of the diesel generator."

III. USE OF NRC REPORTS AND COMPANY SELF-CRITICAL DOCUMENTS

Q. HAVE YOU READ THE SECTION BEGINNING ON PAGE 14 OF DR. JACOBS' SURREBUTTAL TESTIMONY TITLED "USE OF NRC REPORTS AND SELF-ASSESSMENTS"?

A. Yes, I have.

Q. DO YOU AGREE WITH DR. JACOBS' CHARACTERIZATION OF SUCH REPORTS AS NOT RELYING ON HINDSIGHT?

A. I do not. Even though Dr. Jacobs has extensive experience as a consultant, he has little experience in operating or managing the operation of nuclear power plants. On the other hand, I operated and managed nuclear plants for 32 years and can state with full assurance that such reports do rely on hindsight.

In fact, the very purpose of these types of reports is to look back and suggest ways to improve operations based on knowledge of the outcome of what took place. For example, if a complex trouble shooting effort delayed an outage step past its predicted end point, an after- the- fact root cause analysis, with full benefit of the knowledge of the outcome, including paths taken that may have been fruitless, could point to a more effective trouble shooting plan to be used in the future.

If these reports were only a "contemporaneous assessment" as stated by Dr. Jacobs, they would be no more than a list of facts or a log document. Without the benefit of hindsight, such analyses and reports could not provide suggestions to promote continuous improvement in operations.

Q. SINCE THESE REPORTS ARE HEAVILY BASED ON HINDSIGHT, WHAT IS YOUR OPINION OF DR. JACOBS' "TORTURED LOGIC" ARGUMENT?

A. Since Dr. Jacobs portrays these reports as only presenting "...facts and circumstances...," his argument is very much oversimplified. It is my opinion that such reports must be read carefully to recognize "what was known when" in the context of reasonableness at the time management decisions were made. Additionally, as stated in my Rebuttal Testimony, the reader must be fully aware of the self-critical negative nature of these reports.

Q. WAS HINDSIGHT USED IN THE ROOT CAUSE EVALUATION FOR THE MARCH DIESEL GENERATOR GOVERNOR OUTAGE?

A. Yes. It was only determined after failure of the EDG that rust was present in the governor. This conclusion does not mean that the Company should have known at the time of the outage that there was rust in the governor. Until the failure of the governor was discovered, the Company had no reason to believe that there was any rust. This key finding in the root cause evaluation, rust in the governor, was only determined after the outage and after physical disassembly of the governor. A root

cause evaluation, such as the one performed here, typically does not focus on culpability, but focuses on the facts determinable after the event and on the improvements that can be made with the benefit of hindsight to prevent similar occurrences in the future.

Q. DOES THIS CONCLUDE YOUR REJOINDER TESTIMONY?

A. Yes.

REJOINDER TESTIMONY OF GEORGE L. FITZPATRICK

On Behalf of Arizona Public Service Company

Docket No. E-01345A-05-0816
Docket No. E-01345A-05-0826
Docket No. E-01345A-05-0827

November 3, 2006

REJOINDER TESTIMONY OF GEORGE L. FITZPATRICK
ON BEHALF OF ARIZONA PUBLIC SERVICE COMPANY
(Docket No. E-01345A-05-0816)
(Docket No. E-01345A-05-0826)
(Docket No. E-01345A-05-0827)

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. George L. Fitzpatrick, 898 Veterans Highway, Suite 430, Hauppauge, New York 11788.

Q. HAVE YOU PREVIOUSLY FILED REBUTTAL TESTIMONY IN THIS PROCEEDING?

A. Yes. I filed Rebuttal Testimony on September 15, 2006 on behalf of the Arizona Public Service Company ("APS" or "Company").

Q. WHAT IS THE PURPOSE OF THIS REJOINDER TESTIMONY?

A. The purpose of my Rejoinder Testimony is to respond to William R. Jacobs, Jr.'s Surrebuttal Testimony in this docket on behalf of the Utilities Division of the Arizona Corporation Commission.

Q. HAVE YOU REVIEWED PAGES 34-39 OF DR. JACOBS' SURREBUTTAL TESTIMONY REGARDING A NUCLEAR PERFORMANCE STANDARD?

A. Yes.

Q. DO YOU AGREE WITH DR. JACOBS' ARGUMENTS REGARDING A NUCLEAR PERFORMANCE STANDARD?

A. No. As I testified in my September 15, 2006 Rebuttal Testimony, I do not believe a performance standard should be imposed at Palo Verde. Nonetheless, if the Commission decides to institute a performance standard, I believe it must be much different than the standard proposed by Dr. Jacobs. Dr. Jacobs' Surrebuttal Testimony does not convince me otherwise, and contains a number of major flaws.

These flaws include his discussion of the Georgia Power Company's rate case, his conclusion that coal baseload generation should not be included in a performance standard, and his discussion of the uniqueness of Palo Verde.

Q. PLEASE DISCUSS THE FLAWS WITH DR. JACOBS' DISCUSSION OF THE GEORGIA POWER RATE CASE.

A. It is important to set the record straight concerning Dr. Jacobs' use of and reference to performance standard-related information from a recent Georgia Power Company (GPC) rate case as support for his contention that a penalty-only, not a symmetrical (i.e., reward and penalty), Nuclear Performance Standard will cause APS to achieve better Palo Verde performance. In his Surrebuttal Testimony, on page 35, lines 18-21, Dr. Jacobs states: "I asked Georgia Power what actions they had taken for improved performance that would not have been taken absent the incentive provided by the program. The answer was one word – 'none.'" (Emphasis added).

However, as the record in that case clearly shows, GPC was asked the following question, presumably by Dr. Jacobs, in Staff Data Request No. STF-GDS-1-42:

> Question: Please describe in detail any activities or programs conducted because of the existence of the Nuclear Performance Standard that would not have been conducted if the Nuclear Performance Standard did not exist.

GPC's response to this question was "None." There is nothing in this question that specifically asks about only the incentive or the penalty side of the standard. Thus, Dr. Jacobs has wrongly characterized this question as pertaining to "incentives only." GPC stated that neither a reward nor a penalty performance standard had any effect on the way they managed their nuclear plants. Rather, the economics of nuclear power and the overriding focus on safety are sufficient key motivators for any nuclear plant management.

Q. WHAT DID DR. JACOBS RECOMMEND TO THE GEORGIA COMMISSION CONCERNING A NUCLEAR PERFORMANCE STANDARD?

A. In the GPC rate case that Dr. Jacobs references, he testified that a Nuclear Performance Standard that was then in place for Georgia Power's Plant Vogtle and Plant Hatch should be terminated. He stated that: "The Nuclear Performance Standard should be terminated because it does not have any effect on the operation of the Company's nuclear plants." (Jacobs Direct Testimony, Docket No.18300-U, page 4). Dr. Jacobs did not recommend removing only the incentive portion of the performance standard, but recommended termination of the entire performance standard. Ultimately, the Georgia Public Service Commission agreed with Dr. Jacobs' recommendation regarding the Nuclear Performance Standard, and issued a December 21, 2004 Order in that docket approving a Stipulation that terminated the Nuclear Performance Standard. (Order, Docket No. 18300-U, page 7). Clearly, the position taken by Dr. Jacobs in the GPC case -- that the Nuclear Performance Standard should be terminated in its entirety -- is at odds with his position in this case that this Commission should adopt an asymmetrical "penalty-only" type of plan.

Q. PLEASE DISCUSS YOUR DISAGREEMENT WITH DR. JACOBS REGARDING THE INCLUSION OF COAL BASELOAD GENERATION IN ANY PERFORMANCE STANDARD.

A. I reiterate my conclusion on page 16 of my Rebuttal Testimony that APS Base Load Coal Units "should be included if a performance standard is adopted because they have a significant bearing on the ultimate cost of power to APS customers." Dr. Jacobs' arguments against the inclusion of baseload coal plants in a performance standard are the same arguments that would apply to the imposition of any Nuclear Performance Standard in the first place. On page 36, lines 5-13, Dr.

Jacobs attempts to develop reasons why APS' coal plants should not be included in a performance standard. Each of his arguments is addressed below.

First, Dr. Jacobs states: "Nuclear and coal-fired generation are fundamentally different." He points out that nuclear plants have higher capital costs but lower production costs than coal plants. That distinction does not support excluding coal plants from any standard this Commission might adopt. The fact remains that both plants serve the same baseload function, generate great value for customers, and are very important to any evaluation of APS' performance. These units should be included if a performance standard is adopted because they have a significant bearing on the ultimate cost of power to APS customers. As stated in my earlier Rebuttal Testimony, Palo Verde accounts for only 39% of APS baseload capacity and, thus, should not be the sole focus of a generation performance standard. APS coal units do enjoy a significant $/MWH economic advantage over purchased power and contribute significant benefit to APS customers.

Second, Dr. Jacobs states: "The issues and regulations affecting the operation of these plants are also very different." This statement in fact is a good argument why, because of the extensive regulatory scrutiny surrounding nuclear generation, nuclear plants should be *excluded* from any performance standard. Instead, Dr. Jacobs cites this element as a reason to exclude coal plants from a performance standard.

Third, Dr. Jacobs further states: "My proposed NPS offers a method to share the risk of nuclear operation between ratepayers and the Company." Further in that same answer, Dr. Jacobs concludes that "the Company is rewarded by means of its opportunity to earn a rate of return on rate base and does not need additional incentive." These statements contradict each other. The first statement discusses a

sharing of the risk between APS and the ratepayers, while the second statement does not allow for any sharing.

Finally, Dr. Jacobs' most telling statement is: "A company wide performance plan for all baseload plants would be vastly different and is beyond the scope of my testimony." My Rebuttal Testimony addressed this issue and provides detail on how such plants could be included. Dr. Jacobs has had a chance to critique my testimony on coal unit performance measurement and chose not to do so. Dr. Jacobs has passed on the issue of coal plant inclusion by his above statement and does not provide credible reasons why such plants cannot and should not be included if this Commission decides to impose a performance standard. My Rebuttal Testimony on this matter has provided a methodological template for the inclusion of baseload coal plants in a performance standard, and is consistent with the recognition by this Commission in its Decision No. 55118 (page 20), that it is appropriate to consider both a utility's "successes" and "failures" in order to perform "a realistic analysis of operating performance."

Q. PLEASE ADDRESS DR. JACOBS' DISCUSSION ON PAGES 36-37 OF HIS SURREBUTTAL TESTIMONY ABOUT THE UNIQUENESS OF PALO VERDE.

A. Dr. Jacobs takes issue with my statement in my Rebuttal Testimony that Palo Verde is a one-of-a-kind plant, but then goes on to state that "all nuclear plants are unique." He continues by stating that "[e]ven sister plants are not exactly the same." Such statements in fact demonstrate why any Nuclear Performance Standard, because it can be so difficult to properly develop, is ill-advised. At a minimum, these statements by Dr. Jacobs lend support to my recommendation for the imposition of a symmetrical deadband if the Commission decides to impose a performance standard. In my years of modeling PWR capacity factors, my models have, at best, only been able to explain about 64% of the year to year variation in

PWR capacity factors. Thus, 36% of the remaining yearly variation appears to occur due to factors that are random across all plants. Although using a three year average for both the target plant and the comparison group helps dampen some of this unexplained variation, a statistically derived deadband would be an important feature of any performance standard to be considered.

Q. PLEASE SUMMARIZE THE CONCLUSIONS OF YOUR REJOINDER TESTIMONY.

A. A Nuclear Performance Standard has not been proven necessary at Palo Verde, nor has Dr. Jacobs proposed a complete, workable, or fair plan. Nonetheless, if any performance standard is adopted, my earlier Rebuttal Testimony provides a number of characteristics, most importantly the inclusion of baseload coal plants, a reasonable deadband, and symmetrical rewards and penalties, which should be considered and included in any performance standard. Dr. Jacobs' Surrebuttal Testimony does not change any of these characteristics. In fact, Dr. Jacobs' earlier testimony before the Georgia Public Service Commission, which he raises in his recent Surrebuttal Testimony, supports not having a Nuclear Performance Standard, because, as he argued to that Commission, a performance standard does not change the way that a nuclear plant is operated by a utility. As Dr. Mattson pointed out in his Rebuttal Testimony, the NRC has expressed its concern on several occasions that a Nuclear Performance Standard could negatively impact safety. However, even assuming that Dr. Jacobs is correct, and that a performance standard does not affect the way that a plant is operated, this supports my conclusion that a performance standard should not be imposed on APS.

Q. DOES THIS CONCLUDE YOUR REJOINDER TESTIMONY?

A. Yes.