

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 8512020472 DOC. DATE: 85/11/20 NOTARIZED: NO DOCKET #
 FACIL: STN-50-528 Palo Verde Nuclear Station, Unit 1, Arizona Public 05000528
 STN-50-529 Palo Verde Nuclear Station, Unit 2, Arizona Public 05000529
 AUTH. NAME AUTHOR AFFILIATION
 VAN BRUNT, E.E. Arizona Nuclear Power Project (formerly Arizona Public Serv
 RECIP. NAME RECIPIENT AFFILIATION
 KNIGHTON, G.W. Office of Nuclear Reactor Regulation, Director (pre-851125)

SUBJECT: Forwards summary & anticipated schedule for remaining
 Chapter 14 power ascension testing & applicability of 851003
 loss of power event to testing requirements for loss of
 offsite power, per 851104 meeting.

DISTRIBUTION CODE: A001D COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 5
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NOTES: Standardized plant. 05000528
 OL: 12/31/84
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Arizona Nuclear Power Project

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November 20, 1985
ANPP-34062-EEVB/BJA

Director of Nuclear Reactor Regulation
Attention: Mr. George W. Knighton, Project Director
PWR Project Directorate #7
Division of Pressurized Water Reactor Licensing - B
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1 and 2
Docket Nos. STN 50-528 (License No. NPF-41)/529
Unit 1 Power Ascension Testing
File: 85-056-026; G.1.01.10

Reference: Meeting Between E. A. Licitra and M. Ley of the NRC Staff, and
J. G. Haynes, R. M. Butler, and T. F. Quan of ANPP; dated
November 4, 1985 in Bethesda, MD

Dear Mr. Knighton:

The attachments to this letter contain the following information which was requested by the NRC staff during the referenced meeting.

- i) Attachment 1 - Summary and anticipated schedule for the remaining Chapter 14 Power Ascension Testing on PVNGS Unit 1.
(This schedule also includes other major transient tests.)
- ii) Attachment 2 - Applicability of the October 3, 1985, Loss of Power Event to the Testing Requirements for Loss of Offsite Power.
- iii) Attachment 3 - Administrative Controls for Initial Concurrent Operation of Units 1 and 2.

The dates which are given in the testing schedule of Attachment 1 are projected dates for achievement of the various tests and milestones. These dates are subject to change as the testing program develops. Additionally, all required power ascension testing for PVNGS Unit 1 with the exception of the Natural Circulation Cooldown Test, is scheduled to be performed prior to initial criticality of PVNGS Unit 2. Should the testing schedule change such that additional PVNGS Unit 1 tests extend beyond initial criticality of PVNGS Unit 2, these tests will be reviewed with the NRC staff prior to initial criticality of PVNGS Unit 2.

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Mr. George W. Knighton
Unit 1 Power Ascension Testing
ANPP- 34062
Page Two

If you have any questions on this matter, please contact Mr. W. F. Quinn of my staff.

Very truly yours,

EE Van Brunt / JSK

E. E. Van Brunt, Jr.
Executive Vice President
Project Director

EEVB/BJA/dlm
Attachments

cc: E. A. Licitra (all w/a)
R. P. Zimmerman
M. Ley
A. C. Gehr

ATTACHMENT 1

SCHEDULE FOR REMAINING PVNGS UNIT 1 POWER ASCENSION TESTING

<u>TEST DESCRIPTION</u>	<u>PROJECTED PERFORMANCE DATE</u>
- Control Systems Checkout at 80% Power (CESSAR 14.2.12.5.4)	December 1, 1985
- Load Rejection Test from 80% Power	December 1, 1985
- Initial Increase to 90% Power	December 2, 1985
- Initial Increase to 95% Power	December 3, 1985
- Initial Increase to 100% Power	December 3, 1985
- Fixed Incore Detector Test at 100% Power (CESSAR 14.2.12.5.20)	December 3, 1985
- RCS and Secondary Chemistry and Radiochemistry Test at 100% Power (CESSAR 14.2.12.5.5)	December 3, 1985
- Biological Shield Survey at 100% Power (CESSAR 14.2.12.5.10)	December 3, 1985
- Intercomparison of PPS, CPC, and PMS Inputs at 100% Power (CESSAR 14.2.12.5.15)	December 3, 1985
- Movable Incore Detector Test at 100% Power (CESSAR 14.2.12.5.20)	December 3, 1985
- Steady State Core Performance Record at 100% Power (CESSAR 14.2.12.5.14)	December 5, 1985
- COLSS/CPC Verification at 100% Power (CESSAR 14.2.12.5.18 and 14.2.12.5.21)	December 5, 1985
- Control Systems Checkout at 100% Power (CESSAR 14.2.12.5.4)	December 6, 1985
- Variable Tavg at 100% Power (CESSAR 14.2.12.5.2)	December 9, 1985
- Unit Load Transient Test at 100% Power (CESSAR 14.2.12.5.3)	December 12, 1985
- Reactor Power Cutback System Test at 100% Power	December 15, 1985
- Unit Load Rejection Test at 100% Power (CESSAR 14.2.12.5.7)	December 17, 1985
- Turbine Trip Test at 100% Power (CESSAR 14.2.12.5.6)	December 19, 1985

ATTACHMENT 2

LOSS OF OFFSITE POWER TESTING

Section 14.2.12.5.9 of CESSAR describes the Loss of Offsite Power Test for System 80 plants. This test is required by Regulatory Guide 1.68, Rev. 0 in order to demonstrate the acceptable response of the plant to a Loss of Offsite Power Occurrence. This test must be performed at a power level greater than 10% of rated power. In lieu of performing a loss of offsite power simulation test in accordance with CESSAR Section 14.2.12.5.9, PVNGS Unit 1 will use the data obtained during the actual Loss of Offsite Power Event which occurred on October 3, 1985.

On October 3, 1985, PVNGS Unit 1 experienced an actual loss of offsite power while the reactor was being operated at 52% of rated power. The reactor was automatically shutdown due to loss of the reactor coolant pumps and the plant was maintained in Hot Standby on emergency power sources for approximately 25 minutes at which time offsite power was restored. Vital auxiliaries were restored within the following 15 minutes, and RCS forced circulation was restored approximately 3.5 hours after initiation of the event.

The results of the actual loss of offsite power event give a much better indication of the plant's ability to perform acceptably during a Loss of Offsite Power than the results that could be obtained during a test simulation. Additionally, even though the 30 minute time duration which is specified in CESSAR 14.2.12.5.9 was not met during the event, the functional equivalent of this commitment has been met since the plant was fully stabilized and verified to be in natural circulation prior to the restoration of offsite power. The performance of a specific Loss of Offsite Power Test is not justified in this case because the test would impose an additional severe transient on the plant, a significant challenge to plant safety systems, and the test would not result in any information which has not been previously collected. It should be noted that PVNGS Units 2 and 3 will perform Loss of Offsite Power Tests during the power ascension testing phases in accordance with CESSAR 14.2.12.5.9.

ATTACHMENT 3

OPERATION OF UNITS 1 AND 2

ANPP will implement the following measures during the performance of NRC required power ascension testing on PVNGS Unit 2 to assure the opportunity for management and staff attention to PVNGS Units 1 and 2.

- i) PVNGS Unit 2 activities will progress only when adequate resources are available to assure that these activities are conducted properly.
- ii) Ascending mode changes (e.g., Mode 2 to Mode 1) will not occur unless the other unit (either Unit 1 or Unit 2) is in a stable operating condition.



Earl McCartney/Republic

Lyn McKay heads a group from the Coalition for Responsible Energy Education in front of APS headquarters. McKay on Friday announced plans to monitor problems at the Palo Verde plant.

Group decries Palo Verde's record, urges delay of fuel loading at Unit 2

By JOHN STAGGS
Arizona Republic Staff

The Coalition for Responsible Energy Education said Friday it is planning a number of actions to combat what it calls poor quality control, training and safety conditions at the Palo Verde Nuclear Generating Station.

The coalition began by urging the U.S. Nuclear Regulatory Commission to delay fuel loading at Unit 2 of the plant.

Myron Scott, intervention coordinator for the coalition, said permission for fuel loading and low-power operation of Unit 2 should be withheld until the NRC "can assure the public that Arizona Public Service Company is competent to operate Unit 1 safely."

His urging came during a demonstration by the Tempe-based group at APS headquarters, 411 N. Central Ave., Phoenix.

Claiming faulty quality assurance, training, equipment testing, security and fire safety at Unit 1, Scott asked, "If APS doesn't have a handle on Unit 1, how can it be trusted to operate Unit 2?"

Scott was referring in part to a recent NRC report citing officials for failure to follow fire-safety procedures at Palo Verde, which is located 50 miles west of downtown Phoenix.

In addition, the federal agency criticized the plant's management for allowing a worker to take safety-related measurements in the reactor core while working for 20 continuous hours.

The coalition based its other charges on previous problems and NRC reports about Unit 1.

Dan Canady, spokesman for Palo Verde, said that NRC Commissioner Lando Zech inspected Unit 2 this week and indicated that "management is on top of things."

"He's one of the five top men in the NRC. On a daily basis, we're in contact with the NRC inspectors" at the plant, Canady said.

Lyn McKay, coalition president, also announced plans to monitor problems at the plant, investigate worker allegations and file formal petitions on problems with the NRC.

Contending it is difficult to obtain a coherent picture of "what is going on" at Palo Verde, she said the coalition will try to closely monitor and publicize plant activities.

In addition, McKay said the group will ask television and radio stations for "equal time" to answer a recent \$60,000 APS ad campaign, featuring former astronaut Wally Schirra, that promoted the plant.

Barbara Bush, the coalition's executive director, said the demonstration was planned for Friday because that was the date Palo Verde officials had targeted for fuel loading at Unit 2.

However, Canady denied that a specific date had been set.

"We've always been referencing fuel loading for Unit 2 for the last quarter of the year," he said.

Later, another Palo Verde spokesman amended

Unit 2, F6

THE ARIZONA REPUBLIC

The Economy

Unit 2

Continued from F1

Canady's statement, saying that "about a year ago, we told the NRC" that fuel loading could take place sometime in November but that a firm date never was set.

However, an NRC report from a Sept. 20 meeting with Palo Verde officials addressed to Ed Van Brunt, APS vice president for nuclear production, gives the target loading date as Nov. 1. The final report is dated Oct. 9 and confirms the understanding of the Nov. 1 date.

Greg Cook, an NRC spokesman in Walnut Creek, Calif., said that "November 1 is not the official docketed date" but was an estimate. "Now we're looking at the late part of November" for low-power licensing and fuel loading, Cook said.

Canady later admitted that Palo Verde officials had advised the NRC that their estimated date for fuel loading was Nov. 1.

"If everything had gone exactly right," fuel loading would have begun Friday, he said.

MAX JENNINGS
EXECUTIVE EDITOR

120 West First Avenue
Post Office Box 1547
Mesa, Arizona 85201

(602) 898-6545

C2 MT/Sunday, December 15, 1985

The Mesa Tribune

ROGER S. KINTZEL Publisher
MAX JENNINGS Executive Editor
SANDY SCHWARTZ Managing Editor
BOB SCHUSTER Editorial Page Editor

OPINION

ROGER S.
DENNIS
PETER F.
MAR

EDITORIAL

Banning of books no way to ensure critical thinking

Casa Grande school board members deserve praise for resisting pressure from a group demanding that the Pulitzer Prize-winning novel *To Kill a Mockingbird* be banned from the eighth grade reading list.

Those who would ban books and teaching materials from classrooms are on the march in virtually every state. One anti-censorship group cites a 37 percent increase in censorship activity from 1984 to 1985. Most of the demands have come from right-wing groups opposing the teaching of evolution and human sexuality.

In Casa Grande, the demand came from a different quarter — the local chapter of the National Association for the Advancement of Colored People after a girl complained that some characters' use of derogatory terms in reference to blacks made her "uncomfortable."

Written in 1960 by Harper Lee, the novel is a powerful condemnation of racism.

Casa Grande isn't the only place Lee's book has come under fire. Parents of junior high school students in Missouri recently urged removal of the book because it "explores bigotry and prejudice." The school board stood firm and kept the book in the school library.

In Kansas, a parent demanded the book be removed from a required-reading list because it is "offensive to blacks." The school board voted unanimously to keep it on the list.

Other attempts to ban books or teaching materials from schools have been more successful. Last year the Lake Havasu City School Board banned Robert Cormier's *The Chocolate Wars* because it "fosters disrespect in the classroom."

Palo Verde shutdowns open queries

Eight times in the last year, something has gone wrong at Palo Verde. Eight times, the nuclear reaction has been stopped because of accidents and malfunctions. Eight times, there was trouble.

Eight times... eight times... Intellectually, I know the Palo Verde nuclear plant must be safe. But something's still there, eating away at my guts. There's no rational explanation for it. My uneasiness no doubt is similar to that of tens of thousands of other Arizona residents.

A cold analysis of the facts indicates Palo Verde is, indeed, safe. But who needs a cold analysis? Maybe an emotional one has its merits, too.

It was last Jan. 7 when control rods were gradually lifted to begin the controlled nuclear reaction, the first in Arizona. Last Tuesday, at 5:43 p.m., Palo Verde was kicked up to 100 percent output, producing 1,270 megawatts of power, enough to take care of the needs of a major metropolitan area.

That triumphant moment of last Tuesday lasted only 14 hours. A leak was discovered in a condenser tube which turns the steam back into water, and the Unit 1 was cut back to zero. The nuclear reaction was not halted, but the production was stopped.

At the same time work was under way to repair this latest problem, workers were loading fuel into Unit 2, which soon will begin the same kind of shakedown that Unit 1 has had for the last year.

If you listen to Arizona Public Service, operator of Arizona's first and only nuclear power facility, the shakedown of Unit 1 is right on target. It was supposed to take 50 weeks to get the plant up to 100 percent production, and that's almost exactly what it took.

Problems were expected and they have been dealt with successfully. Or so we've been told.

APS spokesman Dan Canady says what he is supposed to say, and that is that the "industry average" for startup of new nuclear plants is 15 to 20 unplanned shutdowns in the first year. That makes Palo Verde look good.

And, Canady reminds us, "Coal-fired power plants go through the same type of systems checkout process, and coal fired plants I'm aware of during

LETTER FROM THE EDITOR



Max Jennings

Commentary

their first year of operation, it's not uncommon to have 100 unplanned trips (shutdowns)."

That's the official line. What else? Things are swell. Why this feeling in the my gut?

Here's the 1985 chronology of the shutdowns:

• Jan. 7 — The first nuclear reaction begins and first tests get under way.

• June 14 — An automatic shutdown occurred when an electrical circuit breaker opened and shut off a condensate pump.

• July 1 — The main feedwater pump supplying water to generators malfunctioned.

• July 11 — The reactor was shut down when a one-gallon per minute water leak was detected. The cause was not determined at that time.

• July 17 — Another shutdown triggered by a signal from a faulty circuit board which indicated trouble in the core protector calculator system.

• July 23 — A shutdown was ordered when the one-gallon-per minute leakage began again. A charging pump seal was the problem.

• Sept. 12 — During a load rejection test to simulate what would happen if the electricity production suddenly had no place to go, the plant was shut down because of an incorrect testing procedure.

• Sept. 16 — A scheduled shutdown to

demonstrate ability to shut down the reactor from outside the control room.

• Oct. 3 — Another unscheduled shutdown caused by interruption in delivery of electricity to the plant from the switch yard.

• Oct. 7 — An accident while working on the electronic switching system recreated the Oct. 3 type of problem.

• Oct. 24 — While running at 81 percent power, Unit 1 shut itself down during a load reduction test because of an erroneous low water level signal from one of the steam generators.

• Dec. 4 — A faulty control rod breaker switch allowed rods to drop down into the core accidentally, shutting down the system.

• Dec. 11 — The unit, which had been operating at peak power, was shut down because of a leak discovered in condenser tubes.

• Dec. 13 — While operating just above zero power, a minor chemistry imbalance which showed too much ammonia in the water required the plant to be shut down again.

Little things, all, I guess. How can I tell? How can you? Basically, we take the company's word for it that none of these problems was all that serious. And we hope the Nuclear Regulatory Commission is doing its job.

But there are design problems at Palo Verde. There have been and will continue to be equipment problems. There have been and will continue to be human errors at Palo Verde.

The idea is to detect the problems and fix them before they become catastrophic.

That will be done, I hope. I pray. But still, I guess I'm like a lot of people who Canady, the APS spokesman, talks to.

"I think unfortunately people's perception of the plant is it's not reliable," he says. "They don't really understand the process we've been going through this year."

You're right, Dan. We don't understand it, and we don't trust it.

Max Jennings is executive editor of The Mesa Tribune.

GARY MARKSTEIN

EDITORIAL CARTOONIST

WHERE TO WRITE

-SCOTTSDALE PROGRESS
DEC. 1985
p.1

Palo Verde to miss vow of 1985 service

WINTERSBURG (AP) — The latest shutdown of Palo Verde Nuclear Generating Station's Unit 1 reactor means the plant will not enter commercial service this year as operators had planned, a plant spokesman says.

"There's no way we can finish the testing program by the end of the year," Dan Canady of the Arizona Nuclear Power Project, the plant's operator, said Wednesday. "We've got too much work left, and not enough time between now and Dec. 31 in which to do it."

Wednesday night, technicians restarted the Unit 1 reactor, which shut itself down Monday night after detecting a low water level in a steam generator, Canady said.

"It currently is at 25 percent (of generating capacity) and climbing," Canady said today. "While there may be one or two pauses at certain power plateaus, we're looking at being up to full power probably over this weekend."

Palo Verde, located in the desert 50 miles west of downtown Phoenix, is owned by utilities in Arizona, California, New Mexico and Texas.

Arizona Public Service Co., 29.1 percent owner of the plant, will not lose any tax advantages by not

finishing Unit 1 testing by year's end because APS accountants already have taken advantage of all allowable deductions, said APS spokesman Brad Parker.

Tom Mumaw, chief hearing officer for the utility-regulating Arizona Corporation Commission, said documents filed by Palo Verde officials had promised to get Unit 1 into service by year's end.

"That's what they've always told us," Mumaw added. "We've said that's what's reasonable." Mumaw said March 1 "is the outer envelope. Beyond that date, we begin imposing economic penalties."

Because the plant cannot generate revenues for APS until a March 27 rate hearing, there are even some financial disincentives to putting the plant into the rate base between now and then, Mumaw said.

"They can't get money out and they will incur operating expenses," he said. "Once they are certified for commercial operation, they lose certain accounting advantages they now have. It all involves funny money on the books anyway, but it's a reality that provides a certain disincentive."

"We were assured by APS that the plant would be up and operating by now, so we never thought this would become an issue," Mumaw added.

Also Wednesday, APS proposed to the Arizona Corporation Commission two plans on how to bill its electric customers for the utility's share of the costs of building the Unit 2 reactor.

APS said it needs approximately \$193.9 million in additional annual revenue when Unit 2 begins commercial operations in mid-1986.

The first APS plan calls for a gradual phase-in of an 19.6 percent rate increase over three years, starting in 1987.

The other option provides for a 19.36 percent rate increase when the unit goes into commercial operations.

Loading of the Unit 2 reactor with nuclear fuel was completed earlier this week.

APS said the phase-in plan would increase the average residential customer's monthly bill from \$82.33 in 1985 to \$87.42 in 1987, \$92.75 in 1988 and \$98.50 in 1989. That doesn't count a request pending with the ACC for an 8.6 percent increase that would add \$7.08 to the average 1985 monthly bill to pay for Unit 1, APS said.

The one-step "traditional plan" would increase the average monthly residential bill from \$82.33 in 1985 to \$98.27 when Unit 2 begins commercial operations, scheduled for mid-1986, APS said.

Palo Verde will miss Jan. 1 power 'deadline'

By JOHN STAGGS
Arizona Republic Staff

Operators of the Palo Verde Nuclear Generating Station say their self-imposed Jan. 1 deadline for commercial operation of Unit 1 will be missed.

Despite that, a plant spokesman said, "We're extremely pleased with its operation."

But Arizona Public Service Co. spokesman Brad Parker said a March 1 deadline imposed by the state Corporation Commission "has put APS between a rock and a hard place."

The portion of a \$78.2 million rate increase specifically intended for Unit 1 won't be heard until March 27, and,

Parker said, "It's a lose-lose proposition" for APS. A decision on the request won't be made for several months.

On the one hand, "If you go commercial before the 27th, you can't put it in the rate base" because the rate base will not have been decided, and Palo Verde's power will be more expensive than APS coal-generated power, he said.

But "the longer you put it off, the more you impact the (\$2.86 billion) cost ceiling (of Unit 1)," Parker said.

The commission has said that money spent for Unit 1 beyond the cost cap will be considered "imprudent expenditure" that will not be allowed in the rate base.

As for the APS deadline, "I don't see anything from an

operational or financial standpoint that's magic about Jan. 1," Parker said.

Because the plant cannot generate revenues for APS until the March 27 rate hearing, there are even some financial disincentives to putting the plant into the rate base between now and then, said Tom Mumaw, chief hearing officer for the commission.

"They can't get money out, and they will incur operating expenses," he said. "Once they are certified for commercial operation, they lose certain accounting advantages they now have. It all involves funny money on the books anyway, but

—Palo Verde, H12

Palo Verde

Continued from H7

it's a reality that provides a certain disincentive,"

Greg Cook, a Nuclear Regulatory

Commission spokesman in Walnut

Creek, Calif., said the fact that the

Jan. 1 deadline will be missed

"makes no difference to us. We're

only concerned that they take care

in operating the plant."

Cook said delays could be viewed

as favorable from one standpoint

because delays indicate caution.

Though not being able to pin-

point a start-up date, Palo Verde

spokesman Dan Canady said,

"We've got three to four weeks of

additional checks before overall

testing is completed."

For a successful commercial run,

the unit must operate at 95 percent

power or more for 100 continuous

hours, according to the federal

agency.

"I don't know when APS is going

to start their 100-hour clock. They

can start it anytime," Cook said.

Parker later said he doesn't know

when APS will begin the 100-hour

run.

"That's an unknown quantity,

but the impression I get is that it

will start at the end of the testing

period," he said.

Despite the fact that plant opera-

tors missed their own deadline,

"we're extremely pleased with its

operation," Parker added.

He said the main delays resulted

from a failure of the emergency

auxiliary spray system in August

and the need to tighten several

hundred bolts in pipe supports in

the plant. Both problems caused

several weeks' delay.

"Sure, we would have liked to

have met it (the deadline), but we

aren't disappointed," Canady said.

The unit was put back into

service late Wednesday night and,

by midafternoon Thursday, was at

40 percent power.

It was taken out of operation

Monday when it shut itself down

after receiving a low-water-level

signal from a steam generator.

Plant suffers 1st-of-a-kind blues

Unit 1's problems
few but serious

1-9-86 By Victor Dricks F-1
The Phoenix Gazette

The Palo Verde Nuclear Generating Station may have a good construction record, but its testing program for Unit 1 has been nothing to crow about.

Although Palo Verde 1 has had fewer problems than three other plants, the problems that did arise seemed more serious and took longer to solve.

As a result, it will take longer for Palo Verde 1 to get into commercial operation than scheduled — and longer than it took several other plants undergoing testing at the same time, a survey by *The Phoenix Gazette* shows.

Diablo Canyon 2 in California will have taken seven months to get into commercial service if it makes its March deadline.

It took Waterford 3 in Louisiana six months and the Wolf Creek nuclear plant in Kansas 3½ months.

In contrast, it will have taken Palo Verde eight months — if project officials get the reactor into commercial service by the end of the month.

Three other plants in the testing pipeline — Shoreham, on Long Island, N.Y.; Detroit's Fermi 2 reactor and the Limerick 1 plant in Pennsylvania — will take longer than Palo Verde.

But that's only because Shoreham and Limerick became enmeshed in legal battles after

Plants undergoing testing

Plant	Licensee	Size/design	Initial criticality	Commercial operation
Fermi II (Detroit)	Detroit Edison	1093/Bwr	June 20	March
Wolf Creek (Kansas)	Kansas Gas & Electric	1150/Pwr	May 22	Sept. 3
Waterford III (Louisiana)	Louisiana Power & Light	1165/Pwr	March 4	Sept. 24
Limerick I (Philadelphia)	Philadelphia Electric	1055/Bwr	Dec. 22, 1984	February
Shoreham (N.Y.)	Long Island Lighting	809/Bwr	Feb. 15	?
Diablo Canyon II (California)	Pacific Gas & Electric	1190/Pwr	Aug. 1	March
Palo Verde I (Arizona)	Arizona Public Service	1270/Pwr	May 25	Late January

Source: U.S. Nuclear Regulatory Commission, Atomic Industrial Forum, Nuclear Information Resource Service and individual utilities.

PWR — Pressurized water reactor
BWR — Boiling water reactor

Palo Verde testing

First of two articles

start-up that prevented testing progress.

Testing at Fermi 2 has been so plagued with problems that U.S. Nuclear Regulatory Commission officials have threatened to withhold a full-power license.

At Palo Verde, Ed Van Brunt Jr., executive vice president of the Arizona Nuclear Power Project, said he has been extremely pleased with overall testing performance despite problems.

"On a first-of-a-kind design like Palo Verde things take longer. We expect start-up for units 2 and 3 to be much shorter," he said, noting that project officials anticipated a 50-week testing program following fuel loading in early January 1985.

"We figured it would take us

longer than most," he said.

But he said the proof of the testing program for Unit 1 will be "in the pudding" — the efficiency with which it operates after entering commercial service.

Many of the problems that delayed testing had origins stemming from design and construction of the plant, Van Brunt said.

"We didn't do too well in our ability to get the plant back into

See • Testing, F-6

• Testing

service after it shut down on numerous occasions," he said.

The plant missed its end-of-the-year deadline.

The performance of a nuclear plant during testing is not a reliable indicator of how well it will perform later, an analysis of NRC records shows. Some plants like Duke Power Co.'s McGuire 2, which have had the worst test records, have operated with extremely high efficiency later.

Although it suffered far fewer equipment malfunctions during testing than Waterford, Wolf Creek and Limerick, the problems that did arise at Palo Verde proved time-consuming, according to a computer analysis of NRC reports provided to *The Gazette* by the Washington, D.C.-based Nuclear Information Resource Service.

Palo Verde suffered 14 equipment "trips" or malfunctions while undergoing testing, according to documents filed with the NRC.

A radiation sampling system had to be relocated, hundreds of bolts on pipe supports had to be tightened, project officials became enmeshed in a debate with federal regulators about the adequacy of a back-up pressurizer system, and leaks in the plant's cooling systems bedeviled operators.

On two occasions, problems kept the plant out of service for periods longer than 30 days.

Waterford 3 suffered a 60-day outage because of strange vibrations detected in its turbine generators. But it didn't stop Mississippi

Power & Light Co. from getting its plant into service quickly.

The problems that arose at Palo Verde also seemed more significant.

Palo Verde officials were criticized by the NRC for the "informal" manner in which they tried to solve difficulties with a misplaced radiation monitoring system designed for use during a severe emergency at the plant.

And Harold Denton, chief of the NRC's Office of Nuclear Reactor Regulation, criticized the project for what he said was a "significant failure" of a system designed to reduce pressure in the reactor cooling system after the plant is shut down.

Only Fermi 2 has raised more eyebrows at NRC headquarters in Bethesda, Md., during recent testing.

NRC officials in Chicago notified utility executives in late-December about concerns that significant safety problems might develop if changes were not made in plant management and operator training.

The \$3.765 billion Fermi 2 reactor has been in a "cold shutdown" since Oct. 9 because of problems that may have affected the ability of diesel generators to provide the plant with emergency power, and glitches affecting a reactor coolant pump, Frank Agosti, Detroit Edison's manager of nuclear operations, said.

NRC officials also are investigating an incident that occurred July 2 in which operators improperly removed control rods that moderate nuclear reactions within the Fermi plant. This initiated a condition called "premature criticality," Agosti said.