AFFIDAVIT OF JOETTE LORION

I, Joette Lorion, being duly sworn, say as follows:

1. I am Research Director of the Center for Nuclear Responsibility, a non-profit, nuclear information and resource center. I have been writing and researching nuclear safety issues since 1978, and have acted as a consultant to Dan Rather, 20-20, CBC, The Wall Street Journal, New York Times, Government Nuclear Oversight Committees, and others. I have personal knowledge of the matters stated herein, and I believe them to be true and correct. I incorporate, by reference, all the statements by Dr. Gordon Edwards in his of affidavit of August 30, 1984, and include them with my own is support of Intervenors' contentions (b) and (d).

2. Intervenors' contention (b) states:

> Whether the entirely new computer model used by the utility, for calculating reflood portions of the accidents, meets the Commission's ECCS Acceptance Criteria: specifically, whether a 2.2% reduction in reflood rate is misleading because for a small decrease in reflood rate, there results a large increase in fuel temperature. Reflood rates are critical if below 1 or 2 inches per second.

In support of contention (b), it is clear that the Westinghouse Emergency Core Cooling System Evaluation Model utilizing the new "BART-A1: COMPUTER CODE FOR BEST ESTIMATE ANALYSIS OF RFLOOD TRANSIENTS" (BART) is a contrived computer model, which consists of an uncertain

computer code loosely coupled with other models prepared for other fuel core designs, and does not equate a computer code specifically designed for this technology and does not constitute compliance with 10 C.F.R. 50.46.

DISCUSSION

In a loss of coolant accident (LOCA), it is in the critical time period from about 15 seconds after the rupture to 30 seconds that control of the accident must be gained by the emergency core cooling system's (ECCS) operation,and the fuel temperature excursions halted. It is of utmost importance that adequate cooling water flow upward through the core as quickly as possible in this period to prevent overheating and core melt. If the vertical flooding rate,once emergency cooling reaches the core bottom, is below some critical value (presently believed to be in the vicinity of 0.7 inches per second), then the accident will proceed out of control.

In order to ascertain that a LOCA will be controlled by the ECCS in an accident, reactor manufacturers, licensees, and the NRC resorted to computer calculations. In 1967, when the ECCS was designed, it was believed that if there were no inhibition to reflooding, the water level would rise in the core at between 8 and 10 inches per second. As studies continued, it was found that adverse circumstances could drastically reduce reflood rates. At the present time, reflooding rates expected for an accident in the operating reactor are between 0.9 and 1.5 inches per second. Thus, the lowering of the reflood rates at Turkey Point to 1.17, means that there are, at best, relatively small safety margins between effective cooling and loss of control. And, that this reduction is not sufficiently conservative to guarantee safety margins.

In 1975, the American Physical Society's Study Group on Light Water Reactor Safety, stresse the importance of conservatism on reflood rates when they stated,

> We thoroughly support the AEC's recommendation concerning PWRs that, 'the calculated reflood rate should have a substantial margin over the rate that is just sufficient to turn the plant around.' (A.P.S. Report 5.31, 1975)

WHY BART CODE DOES NOT MEET REQUIREMENTS OF 10 C.F.R. 50.46

The computer code and analysis performed by Westinghouse to support the lowering of the reflood rate at Turkey Point and subsequent reduction in safety margin is an uncertain, modified, and patched up code that does not meet the requirements of 10 C.F.R. 50.46. In fact, there is already a new improved version according to licensee's Affidavit of Marvin J. Parvin, page 3, which states, "The BART grid rewet model, which is now undergoing NRC review, is an improved version of the BART code and accounts for increased heat transfer due to the spacer grids."

NRC acceptance, although conditional, of this unfinished and uncertain computer code in order to grant FPL a license amendment that would allow them to reduce safety margins (reflood rates) at Turkey Point, shows that they clearly have not met the responsibility to establish with finality that the public health and safety will be protected by adoption of this code.

In fact, the NRC seems to be falling into a pattern of conduct that the AEC warned against in a report in 1971 which stated,

> As reactor designs and their operating characteristics changed, the analyses methods were 'patched up', rather than redeveloped, with the net result that over all existing methods are inefficient, inflexible, and do not adequately represent the physical phenomena intended. (see 'Water Reactor Safety Program Argumen - tation Plan,' USAEC, Nov. 1971,Exhibit 1026, ECCS Hearing Record.)

One should also consider a warning by Dr. Alvin Weinberg, Director of Oakridge National Laboratory to then AEC Chairman James Schlessinger in Feb. 1972, which stated with respect to codes in reactor safety analysis, that he had"a very basic distrust of very elaborate calculations of complex situations, especially where the calculations have not been checked out by full scale experiments."

It seems that the AEC and Dr. Weinberg were referring to the type of model that has been accepted as a basis for lowering of the reflood rate at Turkey Point. It is clear that this rushed,(FPL needed the code to start-up Turkey Point #3 with the new fuel core design, see letter Uhrig, FPL, to Eisenhut NRC,July 6, 1983, regarding Pressurized Thermal Shock.) uncertain code was adopted more for the sake of expediency than its technical accuracy. In fact the letter of acceptance for the BART code from Cecil O'Thomas ,NRC, to Mr. Rahe of Westinghouse, & SER,Dec. 21, 1983, points to numerous uncertainties in the code and gives a conditional acceptance to the "extent specified under the limitations delineated in the report and associated NRC evaluation."

Some of the uncertainti , contained in the BART SER are:

a) That the small break LOCA analysis did not give much weight to the mixed fuel core.

b) BART does not have a gap heat transfer model or cladding swelling model as required by Appendix K.

c) BART was accepted without a grid spacer model because it was still being reviewed by the NRC staff.

d) Only one single test was performed in the BART topical as a basis for parameter assessment.

e) The assumption of constant pressure made in BART may preclude consideration of the oscillating antigravity reflood phenomena.

f) The Flecht Seasta data comparison were from a series of tests conducted on fuel rods in a 17 x 17 assembl y and extrapolated to a 15 x 15 assembly.

Other uncertainties are pointed out on page 14 of the SER, which states that "many more experiments were used to develop the old empirical carry-over rate correlations," and on page 17 which states that,"additional confirmatory validation of the BART/WREFLOOD model for reflood rates less than inch/sec is required."

Other areas which BART neglects entirely are:

a) BART does not address or compute the probability that steam generator tube failure and steam binding could stall the reflood.

b) BART does not compute the possibility or consequences of gross pressure vessel rupture.

c) BART does not take into account the aging to the system and components at Turkey Point.

d) BART has not conducted actual experiments on a mixed transitional fuel core, and instead adopts a purely hypothetical percentage for thermal hydraulic resistance.

e) BART does not analyze a small pipe break accident and the oscillating anti-gravity reflood phenomena that could stall reflooding.

In short, it seems that the BART-A1 computer code approved by the NRC Staff on December 21, 1983, with the subsequent amendment being granted on December 23, 1983, was more of a rushed-up, patched-up methodology, loosely coupled with computer codes models prepared for other fuel core designs,&does not meet the requirements of 10 C.F.R. 50.46 that,

> The reactor core and associated coolant, control, and protection systems be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

Since it appears that assumptions supporting the BART model were based on personal judgment rather than technical expertise or laboratory experiment, it is necessary that the Board carefully examine the accuracy of the underlying scientific data before approval of design changes that will lower a safety marging in this reactor. It is clear that an approach which tailors completion of a scientific study to time requirements, obviously does not foster technical accuracy or meet the requirements of 10 C.F.R. 50.46, nor is it the proper methodology to use in a field where lives and property are at risk.

3. This is in support of Intervenors' Contention (d), which states:

> The proposed decrease in departure in the nucleate boiling ratio (DNBR) would significantly and adversely affect the margin of safety for the operation of the reactors. The restriction of the DNBR safety limit is intended to prevent overheating of the fuel and possible cladding perforation, which would result in the release of fission products from the fuel. If the minimum allowable DNBR is reduced from 1.3 to 1.17 as proposed, this would authorize operation of the fuel much closer to the upper boundary of the nucleate boiling regime. Thus, the safety margin will be significantly reduced. Operation above the boundary of the nucleate boiling regime could result in excessive cladding temperature because of the departure from the nucleate boiling ratio (DNB) and the resultant sharp reduction in heat transfer coefficient. Thus, the proposed amendment will both significantly reduce the safety margin and significantly increase the probability of serious consequences from an accident.

In the Affidavit of Dr. Gordon Edwards, incorporated by reference, herein, he has given numerous reasons why the decrease in departure in the nucleate boiling ratio (DNBR) would adversely affect the margin of safety of the Turkey Point reactors. I would, however, offer a few points of embellishment.

In response to the claim in Affidavit by Edward A. Dzenis, August 8, 1984, page 9, that the change in minimum DNBR for the different correlations in no way implies a reduction in the safety margin of the nuclear reactor, I wish to quote recent remarks made by Robert B. Pollard of the Union of Concerned Scientists (with whom the Center has consulted on contentions (b) and (d)) made in a Southdade Newsleader article, dated August 1, 1984, "Fuel Core Design Changes at Turkey Point Debated," Exhibit A:

> Running the fuel at a hotter temperature then you should increases likelihood of a meltdown...It's quite clear that safety depends on the temperature of the fuel-not getting the fuel too hot or the cladding melts. It's clear they have cut down on safety.

In the same article, Demetrios Basdekas, a nuclear safety engineer with the NRC states,

> It certainly cuts down the safety margin, reducing the amount of fuel from which you get the power-squeezing more from less fuel density, that presents a problem...If you want to be realistic, cut down (5 percent) on power.

It is clear that the above quotes of experts in their fields, along with those of Dr. Edwards, prove that there is a genuine issue of material fact to be heard regarding the decrease in DNBR at Turkey Point, in that these changes do not meet the requirements of 10 C.F.R. Part 50 and Appendix A.

DISCUSSION

10 C.F.R. Part 50, Appendix A requires that the "reactor core, associated coolant, control, and protection of systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences."

Thus, if all FPL calculations are correct, Turkey Point should be getting excellent cooling and there should be no failure. Yet, in reality, this is not the case. On August 31, 1983, FPL was granted an amendment that allowed them to increase the radioactive iodine in the primary system by a factor of 4. The document states that "the licensee was informed by their fuel vendor Westinghouse on August 12, 1983, that the problem of fuel failure has been occurring elsewhere throughout the country."

Yet, nowhere in analysis performed to support the decrease in DNBR, does FPL take into account the fact that they are working with a fuel core that is already experiencing fuel failure, which could cause them to bein violation of 10 C.F.R. Part 50, as a result of the

decrease in DNBR in the Turkey Point Units. This is a serious omission in light of the fact that there have been two releases of radioactive iodine gas from the plant on October 8, 1983, and Jan. 5, 1984.

UNCERTAINTIES IN DNBR CALCULATIONS

a) The DNBR calculations fail to take into account the fact that Turkey Point is already experiencing fuel failure. The calculations are based on an ideal situation.

b) The DNBR analysis was performed with the assumption of a homogenous fuel core, rather than a mixed core, and may not reflect actual hydraulic resistances between the LOPAR and OFA fuel. Clearly this does not meet the requirements and an analysis of the transitional mixed core should be performed.

c) The small LOCA analysis evaluation did not analyze the hydraulic resistance of the mixed core and the effect on peak cladding temperature.

d) No data for the 15x15 Optimized Fuel Assembly Critical Heat Flux is available.

e) The analysis was performed with the WRB-1 calculation that had been approved by Westinghouse for the 17x17 OFA and applied to the 15x15 OFA fuel. An analysis should be performed for the fuel core design in question.

It is clear that the fact that FPL is pushing the DNBR closer to the bulk boiling region means that the safety margins have been reduced and the Turkey Point reactors are in greater danger of experiencing fuel failures that could lead to a serious accident.

It is obvious that the NRC Staff has once again granted a license amendment that reduced a safety margin on the basis of uncertain, incomplete , and borrowed data that does not equate a sufficient analysis for the Turkey Point reactors, nor does it constitute compliance with 10 C.F.R. Part 50, Appendix A.

It is known that fuel failure and radioactive emissions are occurring at Turkey Point possibly because the fuel is being run hotter and for longer periods of time to achieve economy of operation.

It is certain that FPL could have stayed within existing safety margins at Turkey Point if they had been willing to follow the European experience and derate the Turkey Point Units.

By permitting FPL utilize an unproven technology at Turkey Point and lower the DNBR based on "unreal" analysis, so that they can alleviate the pressure vessel embrittlement problem without power penalties, the Commission permits FPL to experiment in the field, rather than the laboratory, and increases the chances of massive fuel failure and a serious nuclear accident at Turkey Point.

Again, I point to the words of Demetrious Basdekas in the Southdade Newsleader article that discusses the fuel core design change,

> I wish that we could be more prudent with the public's safety than we are. I wish we were doing more.

This Licensing Board can do more by carefully analyzing the data upon which the lowering of the DNBR at Turkey Point is based.

Further deponeth sayeth not.

Joette Lorion

Joette Lorion

State of Florida)
) ss
County of Dade)

Subscribed and sworn before me this 4th day of September, 1984.

My commission expires: _____

NOTARY PUBLIC STATE OF FLORIDA
BONDED THRU GENERAL INSURANCE UND.
MY COMMISSION EXPIRES JULY 16 1986

M Gaye Zarbock
NOTARY PUBLIC

Exhibit A

South Dade News Leader

Our 73rd Year of Service, No. 110 | Wednesday, August 1, 1984 | 5 Sections

Fuel core design changes at Turkey Point debated

By LILLIAN MARTIN
Staff Writer

• Second in a four-part series

The new fuel design changes made at the plant reactor unit 3 in December 1983 and in unit 4 in April 1984 were preventive measures to ensure embrittlement would not occur.

HOMESTEAD — The nuclear reactor units at Turkey Point, which began operation in 1972, were to last until early next century. But the reactor vessels were becoming unacceptably brittle and would make operating the plant a risk after 1988 — about 20 years before the expected life span — unless something was done, according to projections by Nuclear Regulatory Commission (NRC) reports.

But a spokesman for Turkey Point said that embrittlement is not a problem at the plant.

"We showed the NRC it was not true," said Tony Bruns, spokesman for Florida Power and Light Co.'s nuclear power plant.

There are theories which say that the metal in the vessels could lose its ductility (resistance to fracture), but he does not feel it would have ever been reached at the plant.

The company did, however, make changes in the fuel core design.

"We knew it would be a problem down the road," Bruns said.

The new fuel design changes made at the plant reactor unit 3 in December 1983 and in unit 4 in April 1984 were preventive measures to ensure embrittlement would not occur. The new design changes keep the radioactive neutrons from hitting the walls, he said.

"I don't think we would have ever reached it (unsafe level of embrittlement). It will not reach it in the lifetime of those reactors," Bruns said.

Nuclear safety engineers disagree.

There is no way to eliminate the problem, but steps can be taken to cut down the radiation hitting the vessel walls, said Demitrios Basdekas, nuclear safety engineer with the NRC in Washington, D.C.

One method which could slow down this process is to redesign the fuel core. In this case "dummies" (inert metal fuel rods) or partially burned-out fuel rods are placed around the outer shells of the fuel core to reduce the radiation hitting the walls of the vessel. But it will not stop the radiation, only decrease the amount, said Basdekas.

"It will not reverse the damage," he said. "Is it sufficient? In my opinion, no."

The new fuel core design changes at Turkey Point include using the inert fuel rods. Bruns said with their new design embrittlement will not occur.

"It totally eliminates the problem as far as Turkey Point is concerned," Bruns said.

However, these changes in the pressure vessel can cause other problems for the plants. Because less uranium fuel would be placed in the core — if the dummies are used — the plant should reduce power.

"It certainly cuts the safety margin reducing the volume of the fuel from which you get the power — squeezing more from less fuel density. That presents a problem," said Basdekas.

"If you want to be realistic cut down (5 percent) on power," he said.

But utilities don't want to reduce their power because it means losing money. "Megawatt means make-a-buck," said Basdekas.

"I wish that we could be more prudent with the public's safety than we are. I wish we were doing more," Basdekas said.

But FPL does not expect the core to overheat running at full power, said Bruns.

"When you rearrange the fuel core, the fuel doesn't burn as hot," Bruns said.

The change in design will increase the heat in certain parts of the reactor core, said Bob Pollard, nuclear safety engineer with the Union of Concerned Scientists (UCS) in Washington, D.C., a non-profit organization which studies nuclear power.

Pollard worked with the NRC for six and a half years before resigning. He said he became disenchanted with the way the agency was run.

"Here I am not censored by my supervisor as to what I could or could not say," he said of the UCS.

With the change in design, you get less neutron bombardment, but at the same time, the hotter you run the core, the more dangerous in case of an emergency, he said.

"Running the fuel at a hotter temperature than you should increases the likelihood of a meltdown," said Pollard.

"It's quite clear that safety depends on the temperature of the fuel — not getting the fuel too hot or the cladding (cover surrounding uranium fuel) melts. It's clear they have cut down on safety," he said.

Bruns said he doesn't feel that poses any problem and they don't expect it to overheat.

"It does not add to the danger, it just mitigates the neutron bombardment. It extends the life of the plant," said Bruns, adding that now the plant can reach its licensed lifetime of 40 years — from 1972 to 2012.

Joe Gilliland, spokesman for the NRC in Atlanta, Ga., agrees with Basdekas about the new design not eliminating the problem. He does, however, disagree with the danger.

See TURKEY POINT, 3A

Turkey Point

Continued from 1A

"The safety analyses would show it would raise the temperature, but not enough to have any safety consequences," Gilliland said.

Another consideration of the new design is the increase in "control drop time" — control rods are dropped to stop the nuclear reaction — which could cause a minor incident to turn into a major accident if the reactor couldn't be shut down fast enough, said Joette Lorion, director of the Center for Nuclear Responsibility, an organization concerned with the safe operation of nuclear power plants in South Florida.

In a request for a hearing and leave to intervene on the amendment request for fuel core design changes in 1983, Lorion's attorney, Martin Hodder, listed the following as one of the considerations:

"The increased fuel core temperatures generally would exceed safety margins and specifically would result in unacceptable swelling or bowing of fuel rods. During an accident, fuel rod swelling due to higher temperatures displaces cooling water and impedes insertion of control rods by the physical phenomenon of increased size. This could result in a significant increase in the possibility and/or increase of an accident."

Bruns said that control drop time is not a problem, if it was the NRC would not have given them clearance for the design changes.

"We feel it is under control. We don't feel it poses a problem," Bruns said.

Which would Pollard consider preferable, use the new design and run at less power or continue with full power?

"The preferable is neither," Pollard said.

"That is when the NRC doesn't do its job. There's no excuse to cut down the safety margin when it doesn't stop the problem, only slows it down," he said.

In the Oct. 16 issue of the *New York Times*, U.S. Rep. Edward J. Markey was quoted as saying that there is a coziness between the NRC and the utilities which makes them incapable of watching over the nuclear industry. The NRC has become "a lapdog rather than a watchdog," Markey said.

Gilliland argues with those charges.

Every plant has two or three licensed inspectors working there full-time. The public document room of the library contains correspondence between the NRC and utilities which shows that "we're really nitpicking at our own expense," he said.

"Last year we had the largest amount of civil penalties in our history," Gilliland said.

Part III — Where spent nuclear fuel is stored