January 30, 1989

Docket Nos. 50-250
and 50-251

MEMORANDUM FOR: Luis A. Reyes, Director
Division of Reactor Projects, RII

FROM: Gus C. Lainas, Acting Director
Division of Reactor Projects I/II

SUBJECT: SUPPLEMENT TO REQUEST FOR ASSISTANCE IN RESPONSE TO A 10 CFR §2.206 PETITION

The purpose of this memorandum is to provide, for your information and use, the enclosed supplement to an earlier 10 CFR 2.206 Petition related to Turkey Point.

Our memorandum to you dated January 19, 1989 requested assistance in responding to a 10 CFR 2.206 petition, which was an enclosure to that memorandum. That petition requested that restart of the plant not be permitted until an investigation was completed. Subsequently, a supplement (dated January 13, 1989) to the petition was received by our office. The supplement expands the requested action to include "suspend and revoke" the operating licenses of Turkey Point Units 3 and 4. We are providing the enclosure for your consideration in evaluating petitioner's concerns. As requested in our earlier memo, we would appreciate your input by March 15, 1989.

Original signed by

Gus C. Lainas, Acting Director
Division of Reactor Projects I/II

Enclosure: As stated

cc w/enclosure:
S. Varga
G. Lainas
E. Adensam
H. Berkow
G. Edison
J. Norris
B. Wilson, RII
K. Eccleston

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[MEMO TO L.A.REYES]
*SEE PREVIOUS CONCURRENCE

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LA:PDII-2*	PM:PDII-2*	D:PDII-2*	ADR2:DRPR:NRR*	AD:DRPR:NRR
DMiller	GEdison:bd	HBerkow	EGAdensam	GCLainas
01/27/89	01/27/89	01/27/89	01/30/89	01/30/89

memo-4

H/2

8902020313 XA

Executive Director for Operations
United States Nuclear Regulatory Commission
Washington, D.C. 20555

cc: NRC Region II
Trent Steele

Thomas J. Saporito, Jr.
1202 Sioux Street
Jupiter, Florida 33458
(407) 747-8873

January 13, 1989

re: Title (10) Code of Federal Regulations Part (2.206)

Dear Sir:

Please be advised and officially informed as this letter represents a formal request to your office in regards to your licensee Florida Power & Light Company, (Turkey Point Nuclear Station), located in Homestead, Florida for actions by your office as specified below and pursuant to (2.202) of the Federal Code.

Specific Request:

I hereby officially and formally request that your office immediately suspend and revoke the Operating Licenses's (DPR-31 & DPR-41) of the Turkey Point Nuclear Station owned and operated by the Florida Power & Light Company in Miami Florida.

Basis and Justification:

Reference is made to basis and justification stated in the (2.206) received by your office on 27DEC88. Certified (P 982 346 203)

Reference is made to the basis and justification stated in the letter mailed to United States Senator John Glenn on 10JAN89 and copied to your office. Certified (P 617 250 005)

Reference is made to the information recovered by the Nuclear Regulatory Commission's deposition taken of myself on 12JAN89 as this record will document the willfull falsification and destruction of Safety Related Plant Documents, the severe Chilling Effect of the station personnel, and the overall poor conduct of maintenance inclusive of Safety Related procedure violations at the Turkey Point Station as this station is overwhelmed with equipment deficiencies.

Conclusion:

The immediate actions by your office in suspending and revoking the aforementioned operating licenses of the Turkey Point Nuclear Station will insure the Health and Safety of the Public, reflect a very responsible action by your department, and will finally afford your licensee with the required guidance and time to professionally address and resolve the overwhelming operating and maintenance problems at the Turkey Point Station.

Sincerely:

Thomas J. Saporito, Jr.

Certified Mail: (P 982 346 207)

~~8902030114~~ 1p.

PDR Acc# 8902030114

Reply 3/9/89

2/17/89

BEFORE THE UNITED STATES

NUCLEAR REGULATORY COMMISSION

In the Matter of	)	Docket Nos. 50-250 OLA
	)	50-251 OLA
Florida Power & Light Company	)	
	)	ASLBP No. 89-584-01 LA
Turkey Point, Units 3 & 4	)	(Pressure/Temperature
	)	Amendments)

8900689

PETITIONERS' AMENDED REQUEST FOR HEARING
AND PETITION FOR LEAVE TO INTERVENE

I. INTRODUCTION

On October 19, 1988, a notice was published in the Federal Register announcing the proposed issuance of amendments to the Technical Specifications for Turkey Point Units 3 and 4. 53 Fed. Reg. 40988. The proposed amendments would modify the pressure/temperature units for the reactor coolant system and the pressurizer for each unit.

On November 17, 1988, the Center for Nuclear Responsibility, Inc. ("Center") and Joette Lorion, collectively referred to herein as "Petitioners," filed with the Nuclear Regulatory Commission ("NRC") a Request for Hearing and Petition for Leave to Intervene ("Petition") concerning Florida Power & Light's ("FPL") amendment request.

On January 10, 1989, the NRC Staff issued Amendment Nos. 134 and 128 to the operating licenses for Turkey Point, Units 3 and 4 respectively, revising the pressure/temperature ("P/T") limits for the Turkey Point units along with their Safety Evaluation and Final Determination of No Significant Hazards Consideration.

Baloney - There is only one. Served Lorion is director of Center & Sponsor of this request. She should be deleted as Center's representative.

8903170001

H/3

Y DL Ltr # (which includes attachments) 8903170001

Shortly thereafter, on January 19, 1989, the Atomic Safety and Licensing Board ("Board") issued an order directing Petitioners to serve their contention(s) on or before February 13, 1989. Petitioners then requested and were granted an extension of time to file and serve their contentions until February 17, 1989.

II. BACKGROUND

> There is a high, increasing likelihood that someday soon, during a seemingly minor malfunction at any of a dozen or more nuclear power plants around the United States, the steel vessel that houses the radioactive core is going to crack like a piece of glass. The result will be a core meltdown, the most serious kind of nuclear accident.
>
> "The Risk of a Meltdown," New York Times (March 29, 1982), attached

Not really.

Papina - what does this mean?

The Turkey Point Units 3 and 4 pressure vessel welds are among the most embrittled in the entire United States. For that reason, these reactor vessels are more susceptible to rupturing from thermal shock when the plant is starting up, cooling down, or during accident conditions. A rupture of the reactor pressure vessel could result in the melting of the reactor core and release of the radioactive material therein. Emergency core cooling systems in the present generation of reactors are not designed to prevent core melting stemming from breaks in the vessel itself. According to NUREG/CR2239, a full scale accident at Turkey Point could kill and injure hundreds of thousands of

So what?

no basis

more than what?

True. But doesn't necessarily prevent them working.

?

defin

people in the Miami area and could cause 43 billion dollars in property damage.

The pressure/temperature limits currently being revised for Turkey Point Units 3 and 4 are among the most limiting conditions of operation for any nuclear plant because they define the permissible operating envelope during reactor heatup, cooldown, criticality, and testing, and are designed to ensure safe operation of the reactor pressure vessel, a critical piece of safety equipment. These limits are required to be based on the most limiting nil-ductility reference temperature (RTNDT) for the respective reactor units. Since the RTNDT, when based on tests of reactor surveillance weld samples for the respective units, is an accurate assessment of radiation embrittlement damage to the vessel welds, it is necessary to accurately and conservatively account for the effects of irradiation and other reactors on RTNDT in order to set conservative pressure/temperature limits and to protect the public from a pressurized thermal shock accident and subsequent meltdown of the reactor core. It is for the above reasons and for those reasons stated in the contentions that follow that Petitioners are requesting a hearing on these very important pressure/temperature amendments.

III. AMENDED PETITION AND CONTENTIONS

Petitioners, the Center for Nuclear Responsibility, Inc. and Joette Lorion, request a hearing and leave to intervene in the above license amendment proceedings.

1. The Center for Nuclear Responsibility, Inc. and Joette Lorion request that the U.S. Nuclear Regulatory Commission grant them a hearing and allow them to intervene in the above-captioned license amendment proceeding concerning the Turkey Point nuclear power plants as allowed by the U.S. Nuclear Regulatory Commission's Rules of Practice.

2. The Center for Nuclear Responsibility is a corporation with its principal place of business in Miami, Florida. The Center is an environmental organization.

3. Many of the Center's members live, work, vacation in, and otherwise use and enjoy a geographic area within the immediate vicinity of the Turkey Point nuclear power plants and would suffer consequences if a serious nuclear accident occurred at these facilities.

Thus, the Center and its members are significantly and adversely affected by the final agency action proposed in the October 19, 1988 Federal Register Notice. The Center is an appropriate party to represent the interest of persons similarly situated whose interests might otherwise go unrepresented. Some members of the Center who may be affected are:

Joette Lorion, 7269 S.W. 54 Avenue, Miami, FL 33143
Dr. Steven Meyerson, 12660 S.W. 97 Place, Miami, FL 33176
Brenda Meyerson, 12660 S.W. 97 Place, Miami, FL 33176

4. Joette Lorion is an individual who lives, works, and owns property real and personal in and about the city of South Miami, Florida, approximately 15 miles from the Turkey Point plants, and otherwise uses and enjoys a geographic area within

the immediate vicinity of those plants. Her interest, and that of her family, could also be significantly and adversely affected if a serious nuclear accident occurred at the Turkey Point nuclear reactors. As Director of the Center, she is an appropriate party to represent the interests of others similarly situated whose interests might otherwise go unrepresented.

5. The Commission's issuance of the proposed license amendments in the manner sought by the Licensee, Florida Power & Light Company, operation of the Turkey Point nuclear power plant Units 3 and 4 would:

(a) involve a significant increase in the probability and consequences of a serious nuclear accident;

(b) create the possibility of a new or different kind of accident from any accident previously evaluated;

(c) involve a significant reduction in the margin of safety.

6. If permitted to intervene, the petitioners would address the following contentions:

CONTENTION 1: That the Nuclear Regulatory Commission Staff's Final Determination of No Significant Hazards Consideration issued on January 10, 1989 in support of license amendment nos. 134 and 128 issued to allow FPL to revise the pressure/temperature limits for Turkey Point nuclear units 3 and 4 respectively, is based on incomplete, faulty and non-conservative data, is in error, and should be reviewed by this Atomic Safety and Licensing Board in order to protect the

public health and safety from a loss of pressure vessel integrity and subsequent meltdown.

BASES FOR CONTENTION 1: The issue for consideration in revising new pressure/temperature limits for the Turkey Point reactors is whether the new limits could cause the loss of reactor pressure vessel integrity, which could in turn cause the most feared reactor accident--a meltdown. The NRC Staff in reviewing the amendment request and making their Final Determination of No Significant Hazards Consideration has erred because they have based their analysis on substantial uncertainties, incomplete data, and non-conservative assumptions in the prediction of adjusted reference temperature nil-ductility-transfer (RTNDT) for the reactor units.

Petitioners contend that the NRC could not make a valid determination of a no significant hazard consideration because (a) the NRC Staff has allowed FPL to use Unit 3 test surveillance data to set the pressure/temperature limits for the more severely embrittled Unit 4 reactor unit; (b) the NRC Staff has allowed FPL to use a lower percentage of copper than is identified in the historical documents, for both Units 3 and 4 to predict the RTNDT for those respective units and to revise the pressure/temperature limits. Petitioners contend that because the NRC Staff permitted FPL to use Unit 3 reactor test surveillance capsule data to predict the RTNDT and pressure/temperature limits for Unit 4 rather than the plant-specific data, and because the Staff permitted FPL to predict the RTNDT and pressure limits based on a

Same as contention 2

Basis 2

identify

non-conservative estimate of copper content in the welds, the Staff was unable to accurately determine whether or not the issuance of license amendment nos. 134 and 128 was and is a significant hazards consideration. Thus, this Board must review the Staff's decision in order to protect the public health and safety from the consequences of a loss of pressure vessel integrity and subsequent meltdown that could result from the Staff's error.

CONTENTION 2: That the revised temperature/pressure limits that have been set for Turkey Point Unit 4 are non-conservative and will cause that reactor unit to exceed the requirements of General Design Criterion 31 of Appendix A to 10 CFR Part 50, which requires that the reactor coolant pressure boundary be designed with a sufficient margin to ensure that, when stressed under operating, maintenance, testing, and postulated accident conditions, (1) the boundary behaves in a non-brittle manner and (2) the probability of a rapidly propagating fracture is minimized.

Petitioners contend that the new pressure/temperature limits could cause the reactor vessel to exceed these requirements because the Licensee has based its calculation of the predicted RTNDT for Unit 4 partly on surveillance capsule V test results from Turkey Point Unit 3 rather than predicting the RTNDT for Unit 4 based on Unit 4 capsule V surveillance capsule data--a practice which is not scientific, not valid, and could cause the Unit 4 reactor to behave in a brittle manner which would make the chances of a pressure vessel

failure and resultant meltdown more likely. Petitioners contend that predictions of RTNDT and pressure/temperature limits derived from the shift in nil-ductility transfer should be based only on plant-specific Unit 4 data, especially in light of the fact that the only tests ever performed on Unit 4 weld specimens demonstrated that the weld material in the Unit 4 vessel was 30% more brittle than that of Unit 3. Because Unit 4's weld material is more embrittled, Petitioners contend that the FPL Integrated Surveillance program does not meet the Requirements of 10 CFR Appendix G Parts V.A and V.B, and 10 CFR Appendix H, including Appendix H Parts IIC and IIIB. Finally, Petitioners contend that the surveillance capsule V for Unit 4 should be tested to establish the new pressure/temperature limits and should the testing indicate that the RTNDT for Unit 4 has passed the 300-degree Farenheit screening criterion set by the NRC, Unit 4 should be shut down until it is demonstrated that the Unit 4 reactor pressure vessel can maintain its integrity beyond this limit.

BASES FOR CONTENTION 2: RTNDT is an important aspect of revising pressure/temperature limits. It is widely acknowledged that the RTNDT should be based on plant-specific data. According to the Southwest Research Institute in their report on the Reactor Vessel Material Surveillance Program for Turkey Point Units 3 and 4, dated May 1979, the data obtained from the V capsules, which were to be removed from both units after 7 EFPY operation, was to provide the information necessary to revise the heat-up and cooldown limitations for operation beyond 10

EFPY. Yet, FPL in revising these limits chose only to use capsule V test data from the less severely affected reactor Unit 3 for predicting the RTNDT and revising the heat-up and cooldown limits. Additionally, Dr. George Sih, Director of Fracture Mechanics at Leheigh University, stated in a letter to Martin Hodder, the Center's attorney in a previous lawsuit, the following about the practice of using Unit 3 data to predict the rate of embrittlement for Unit 4:

> The rate at which the beltline weld material deteriorates and/or embrittles depends on the combined effects of irradiation and pressurized thermal shock. It is plant-specific in the sense that the influence differs inherently from one unit to another. In other words, the metallurgical properties alone cannot determine the damage behavior of the welds. the loading history plays a major role. Unless the rates of irradiation, fluctuations in thermal gradients and time variation in pressure are exactly the same for both Units No. 3 and No. 4, one is not justified to assume that data collected in Unit No. 3 could be applied to predict the behavior of Unit No. 4. Hence, conclusions drawn on RTNDT for Unit No. 4 based on the data of Unit No. 3 cannot be considered valid.

In addition, Dr. Sih analyzed the only test results ever performed on the weld metal of Turkey Point Unit 4, and, in a chart attached to the letter, demonstrated that according to FPL's own test data, Unit 4 has already passed the 300-degree NRC screening criterion. (See attached.) Thus, it is both non-conservative and unsafe to use Unit 3 data to predict pressure/temperature limits that will govern the operation of the more severely embrittled reactor 4 vessel.

CONTENTION 3: That the revised pressure/temperature limits that have been set for Units 3 and 4 are non-conservative and will not meet the requirements of General Design Criterion 31 of Appendix A to 10 CFR Part 50 which requires that the reactor coolant pressure boundary be designed with sufficient margin to ensure that, when stressed under operating, maintenance, testing, and postulated accident conditions, (1) the boundary behaves in a non-brittle manner and (2) the probability of a rapidly propagating fracture is minimized. Petitioners contend that the sufficient safety margin required by GDC 31 does not exist because the P/T limits for Units 3 and 4 were not based on the most limiting value of RTNDT as required by 10 CFR Part 50 Appendix G and H, for reactor vessel welds because the percentage of copper that was used in the RTNDT calculation is non-conservative in that it is lower than the percentage of copper that was used in previous surveillance test reports and lower than the percentage of copper quoted in many of the earlier FPL documents. Petitioners contend that the use of this non-conservative estimate of copper content means that the adjusted RTNDT is unrealistically low and that the current revised P/T limits are not restrictive enough to ensure that an adequate margin of safety against brittle fracture of the reactor vessel exists. This increases the possibility that the reactor vesses for Unit 4 will behave in a brittle manner resulting in a fracture of the vessel and subsequent meltdown of the reactor core.

Petitioners further contend that if a more conservative and accurate estimate of copper content was used to calculate the RTNDT, the P/T limits would be more restrictive and that in fact, there is a possibility that it could be discovered that the NRC screening criterion of 300-degree Farenheit has been reached and the Turkey Point Units 3 and 4 would have to be shut down because they do not meet the fracture toughness requirement of 10 CFR Part 50 Appendix G.

BASES FOR CONTENTION 3: According to the Pacific Northwest Laboratory (PNL) Review of Pressurized Thermal Shock, NUREG CR 2837, conservative estimates of embrittlement of the welds should be made by assuming the worst possible weld chemistry and maximum credible nickel and copper content for a reactor unit. In their prediction of RTNDT, FPL assumed a copper content of .26, while many of the earlier documents on Turkey Point assumed a copper content of .30 or above. According to the PNL report, a lowering of the copper content by a few hundredths of a percent of copper can lower the RTNDT by 10-15 degrees. Thus, because FPL has used a non-conservative copper content in calculating the adjusted RTNDT for the Turkey Point Units 3 and 4, it follows that the revised P/T limits which use this non-conservative RTNDT as a basis are also non-conservative and increase the possibility that when stressed these pressure vessels will behave in a brittle manner, resulting in a fracture of the vessel and subsequent meltdown of the core. This is especially disturbing in light of recent information that demonstrates that the Charpy Notch capsule V weld metal

specimens which were removed [redacted] for the limiting beltline weld material already [redacted] 10 CFR Appendix G, Section V.C.

IV. CONCLUSION

For all the above stated reasons and because a rupture of the reactor vessel at Turkey Point would result in a core melt accident that could kill and injure hundreds of thousands of people in the Miami area, Petitioners ask that their Petition for Leave to Intervene be granted so that the issues raised concerning the revision of the Pressure/Temperature limits can be reviewed by an Atomic Safety and Licensing Board in a formal hearing process so that the public health and safety can be protected.

Respectfully submitted,

Joette Lorion

JOETTE LORION

Director, Center for Nuclear Responsibility
7210 Red Road, #217
Miami, Florida 33143
(305) (661-2165

DATED: February 17, 1989

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
FLORIDA POWER & LIGHT CO.	)	Docket Nos. 50-250 OLA 50-251 OLA
	)	
Turkey Point Plant Units 3 and 4	)	(Pressure/Temperature Amendments)

CERTIFICATE OF SERVICE

I hereby certify that copies of Petitioners' "Amended Petition for Leave to Intervene and Request for Hearing" have been served on the following parties by deposit in the U.S. Mail, first class, postage prepaid on the date shown below:

Dr. Paul Cotter
Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Glenn O. Bright
Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Jerry Harbour
Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Office of Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Janice Moore
Office of General Counsel
U.S. Nuclear Regulatory Commission
WAshington, D.C. 20555

John T. Butler
Steel, Hector & Davis
4000 SE Financial Center
Miami, Florida 33131

Steven P. Frantz
Newman & Holtzinger P.C.
1615 L. Street NW
Suite 1000
Washington, DC 20036

Joette Lorion

Joette Lorion
Director, Center for
Nuclear Responsibility
7210 Red Road #217
Miami, Florida 33143
(305) 661-2165

Dated: February 17, 1989

LEHIGH UNIVERSITY

Institute of Fracture and Solid Mechanics
Packard Lab. Bldg. #19
BETHLEHEM, PENNSYLVANIA 18015
Telex No. Lehigh Univ. UD 710-670-1086

G. C. Sih
Director

October 10, 1985

Attorney Martin H. Hodder
1131 N.E. 86th Street
Miami, Florida 33138

RE: Turkey Point Nuclear Power Plant Unit No. 4: Reactor Vessel Embrittlement and Surveillance Program

Dear Attorney Hodder:

In response to your letter dated August 29, 1985 and the above referenced subject matter, I have read the package of documents on the RPV embrittlement program at Turkey Point Unit No. 4. A number of supporting arguments with reference to the calculation of ΔRT_{NDT} are questionable, if not invalid from the scientific view point. In what follows, the SWRI report and the FPL letter shall be referred to as [1]* and [2]**, respectively.

(1) SWRI Prediction [1]

Based on the RPV material surveillance methodology, SWRI [1] estimated the shift in RT_{NDT} for Turkey Point Unit No. 4. The results pertaining to wall location 1/4T based on the data of Capsule T in terms of EFPY are summarized graphically on the sheet attached to this letter. The shift in RT_{NDT} is found to be approximately 324°F at 8 EFPY. This is beyond the NRC screening value of 300°F.

* E. B. Norris, "Reactor Vessel Material Surveillance Program for Turkey Point Unit No. 4: Analysis of Capsule T", Southwest Research Institute Technical Report No. 02-4221, June 1976.

** Letter, Uhrig, FPL, to Eienhut, "Re: Turkey Point Unit 4, Docket Nos. 50-251, PTS to Reactor Pressure Vessels", January 21, 1982.

(2) FPL Response [2]

With reference to the material in Docket No. 50-251 on PTS of RPV as stated in [2], a lower ΔRT_{NDT} value of 211°F was obtained for Unit No. 4. This result, however, was obtained by application of the surveillance data taken from Turkey Point Unit No. 3. The justification was that the metallurgical properties of the beltline welds of the Turkey Points Units No. 3 and No. 4 are the same and that data on Unit No. 4 are not sufficient.

(3) Comments

The rate at which the beltline weld material deteriorates and/or embrittles depends on the *combined* effects of irradiation and pressurized thermal shock. It is plant-specific in the sense that the influence differs inherently from one unit to another. In other words, the metallurgical properties alone cannot determine the damage behavior of the welds. The *loading history* plays a major role. Unless the rates of irradiation, fluctuations in thermal gradients and time variation in pressure are exactly the same for both Units No. 3 and No. 4, one is not justified to assume that data collected in Unit No. 3 could be applied to predict the behavior of Unit No. 4. Hence, conclusions drawn on ΔRT_{NDT} for Unit No. 4 based on the data of Unit No. 3 cannot be considered valid.

I will not delve into the other details concerning the actual calculation of ΔRT_{NDT} as they are beyond the scope of our immediate concern.

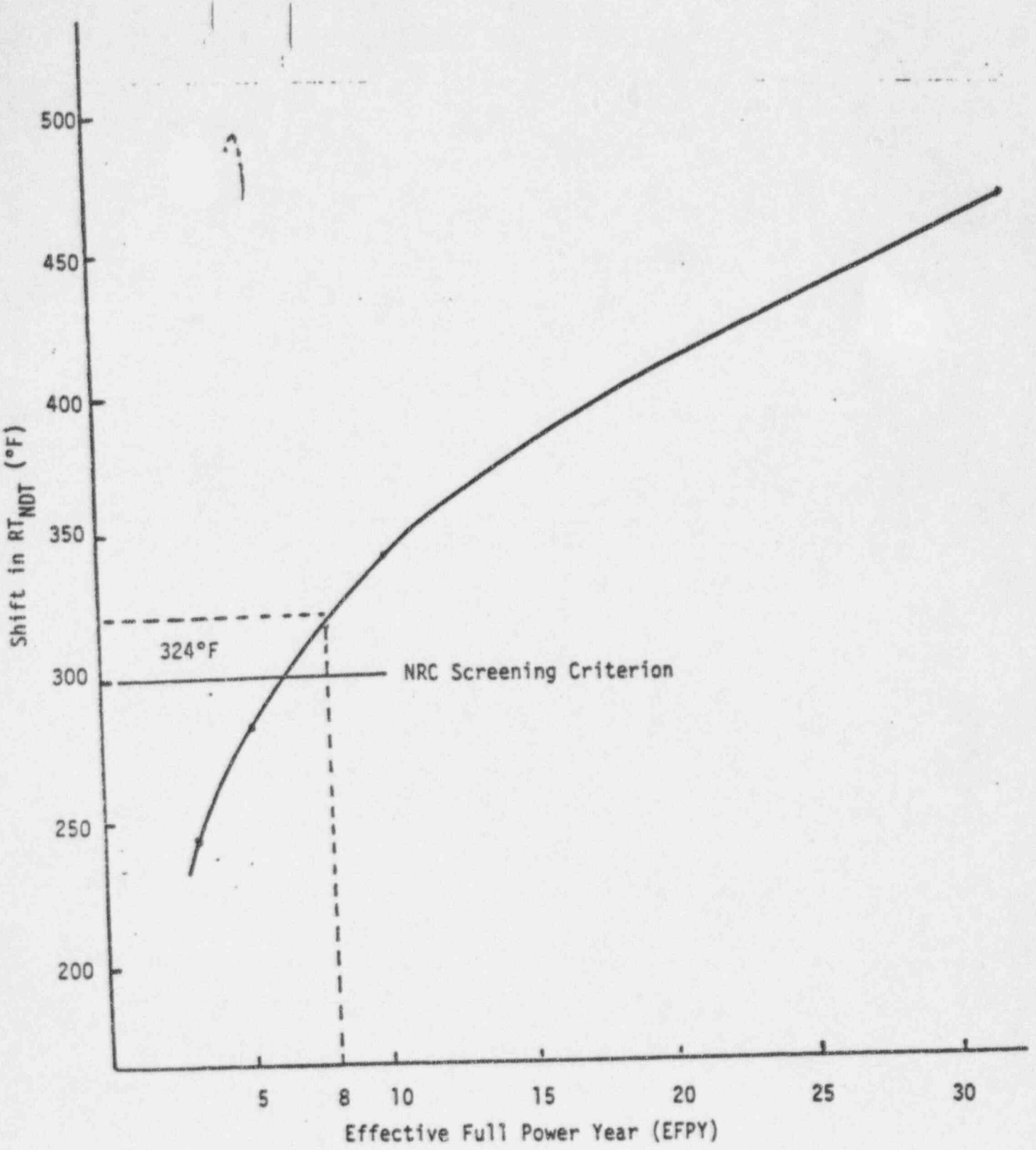
Very sincerely yours,

George C. Sih
Professor of Mechanics

GCS:bd

Enclosure

Data Reproduced from Table on Page 3 at Wall Location 1/4T, Report by E. B. Norris, "Reactor Vessel Material Surveillance Program for Turkey Point Unit No. 4: Analysis of Capsule T", Southwest Research Institute Technical Report No. 02-4221, June 1976.



Biography

of

Dr. George C. M. Sih

Professor of Mechanics and Director of the
Institute of Fracture and Solid Mechanics

Dr. Sih is currently Professor of Mechanics and Director of the Institute of Fracture and Solid Mechanics at Lehigh University, Bethlehem, Pennsylvania. He also holds the appointment of Adjunct Professor at The Hahnemann Medical College and Hospital of Philadelphia since 1972. He received his B.S. at the University of Portland, Oregon, 1953; his M.S. at New York University, 1957; and Ph.D. at Lehigh University, 1960; all of these degrees in Mechanical Engineering.

Dr. Sih has engaged in research in the interaction of mechanical deformation and heat flow (1960) supported by the Koppers Foundation, in Fracture Mechanics (1960 and 1961) for the Boeing Company Transport Division and (1962 to 1965) for the National Science Foundation, and as a member of the Technical Staff, Bell Telephone Laboratory (Summer 1961). He has been engaged as Principal Investigator in more than fifty projects at Lehigh University sponsored by the Office of Naval Research, Naval Research Laboratory, the National Aeronautics and Space Administration, the Air Force, the Army, etc., all of which are concerned with optimizing the use of high performance material with design, a discipline that has been frequently referred to as "Fracture Mechanics". Much of his work has been concerned with estimating the remaining life of material and structural components damaged by yielding and/or fracture. He specializes in developing computer software for predicting the mechanical behavior of structures and the stability of objects moving through fluid media. His more recent activities are concerned with the influence of moisture and temperature in composite materials, laser glazing techniques and non-destructive testing methods involving high-voltage electrophotography.

From 1953 to 1957, Dr. Sih was employed by Radio Corporation of America as a project and research engineer. He worked on the research and development of input and output devices for the first generation "Bizmark" computer system. Among the significant patents he obtained were:

1. Adjustable optical system for line printing.
2. Automatic magnetic disc printing device for the Xerox process.

In 1957 and 1958, Dr. Sih returned to the academic life and served at the City College of New York as Lecturer in Mechanical Engineering. He came to Lehigh University in 1958 as Instructor in Engineering Mechanics and was appointed Assistant Professor after completion of his doctorate. From 1965 to 1966, Dr. Sih held the position of Visiting Professor in Aeronautics at the California Institute of Technology and participated in an Air Force research project on the dynamics of crack propagation and size effects in the fracture of plates.

Dr. Sih assumed in 1970 the duties of Regional Editor, International Journal of Fracture Mechanics, and the responsibilities of soliciting and reviewing papers in the field of Fracture Mechanics. From 1971 to 1975, he served as an Associate Editor of the ASME Journal of Applied Mechanics. He is also on the Editorial Advisory Board of the Journal of Engineering Fracture Mechanics. He is also Editor-in-Chief of an International Journal of Theoretical and Applied Fracture Mechanics. Dr. Sih is a Fellow of the American Society of Mechanical Engineers and Honorary Fellow of the International Congress of Fracture. He is also a founding member of the International Cooperative Fracture Institute, an organization established to promote the interchange of ideas and information among active researchers in fracture mechanics.

Dr. Sih is also a member of the following societies:

1. Society of Sigma Xi
2. ASTM Committee E-24 on Fracture Testing of Materials
3. International Society of Engineering Science
4. American Society of Civil Engineering
5. American Society of Mechanical Engineering
6. International Society for the Interaction of Mechanics and Mathematics

Dr. Sih is the Editor of three book series. Seven volumes on the Mechanics of Fracture series have been or are about to be published:

Volume I - Methods of Analysis and Solutions to Crack Problems, 1973

Volume II - Three-Dimensional Crack Problems, 1974

Volume III - Plates and Shells with Cracks, 1976

Volume IV - Elastodynamic Crack Problems, 1976

Volume V - Stress Analysis of Notch Problems, 1976

Volume VI - Cracks in Composite Materials, 1980

Volume VII - Experimental Evaluation of Stress Concentration and Intensity Factors, 1980

The two other series are Fatigue and Fracture:

Volume I - Fatigue and Fracture, S. Kocanda, 1978

Volume II - Fracture Micromechanics of Polymer Materials, V. S. Kukshenko and V. P. Tamuzh, 1980

and Engineering Application of Fracture Mechanics:

Volume I - Fracture Mechanics Methodology: Evaluation of Structural Components Integrity, edited by G. C. Sih and L. Faria

Volume II - Mixed Mode Crack Extension by E. E. Gdoutos

Volume III - Fracture Mechanics of Concrete: Material Characterization and Testing, edited by A. Carpinteri and A. Ingraffea

Volume IV - Fracture Mechanics of Concrete: Numerical Analysis and Structural Application by G. C. Sih and A. DiTommaso

Volume V - Bonded Repair of Aircraft Structure by A. A. Baker and R. Jones

Volume VI - Crack Growth and Material Damage in Concrete: Limit Load and Brittle Fracture by A. Carpinteri

Dr. Sih has also served as principal organizer and editor of proceedings of several conferences:

1. International Conference on "Dynamic Crack Propagation", (1972), Lehigh University
2. International Conference on "Prospects of Fracture Mechanics", (1974), The Netherlands
3. Conference on "Linear Fracture Mechanics", (1975), Lehigh University
4. International Conference on "Fracture Mechanics and Technology", (1976), Hong Kong
5. 14th Annual Meeting of the Society of Engineering Science, (1977), Lehigh University
6. First USA-USSR Symposium on "Fracture of Composite Materials", (1978), USSR
7. International Conference on "Fracture Mechanics in Engineering Applications", (1979), India
8. International Conference on "Analytical and Experimental Fracture Mechanics", (1980), Italy
9. International Conference on "Defects and Fracture", (1980), Poland

10. International Conference on "Mixed Mode Crack Propagation", (1980), Greece
11. International Conference on "Absorbed Energy and/or Specific Strain Energy Density Criterion", (1980), Hungary
12. International Conference on "Defects, Fracture and Fatigue", (1982), Canada
13. International Conference on "Fracture Mechanics Technology Applied to Material Evaluation and Structure Design", (1982), Australia
14. International Conference on "Application of Fracture Mechanics to Materials and Structures", (1983), Germany

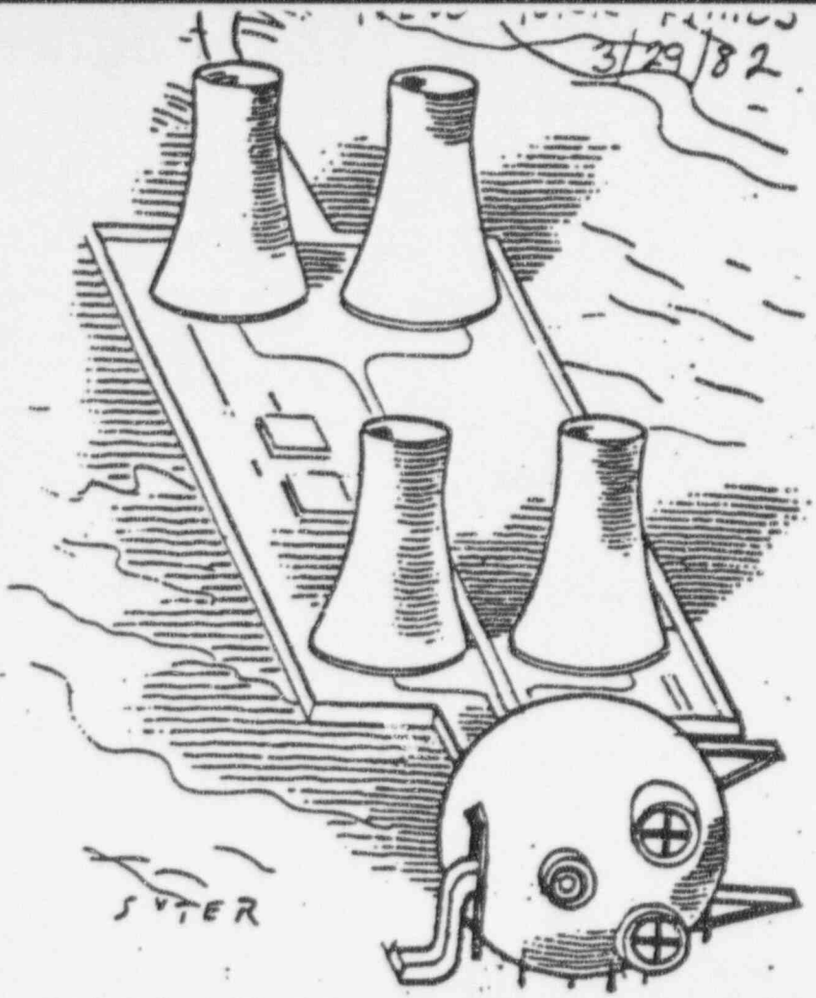
Dr. Sih has approximately two hundred publications principally in the area of solid and fracture mechanics. He has authored and co-authored a total of three books.

1. Handbook of Stress Intensity Factors, 1973
2. Three Dimensional Crack Problems (with M. K. Kassir), 1974
3. Cracks in Composite Materials (with E. P. Chen), 1980

Dr. Sih received the 1975 Achievement Award from the Chinese Institute of Engineers in the United States and the 1984 Achievement Award from the Chinese Engineers and Scientists Association of Southern California for his accomplishments in research and teaching in fracture and solid mechanics.

Dr. Sih has also been active in serving as members of national committees. Among them are the National Materials Advisory Board concerning with the Dynamic Response of Materials Subjected to High Strain Rate Loading; Ship Materials Fabrication and Inspection; and other committees concerning Nuclear Reactor Components.

The Risk Of a Meltdown



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By Demetrios L. Basdekas

WASHINGTON — There is a high, increasing likelihood that someday soon, during a seemingly minor malfunction at any of a dozen or more nuclear plants around the United States, the steel vessel that houses the radioactive core is going to crack like a piece of glass. The result will be a core meltdown, the most serious kind of accident, which will injure many people, destroy the plant, and probably destroy the nuclear industry with it.

On the third anniversary of the Three Mile Island accident, the Government and industry are unable or unwilling to deal honestly and urgently with far-reaching nuclear-safety problems.

Another serious accident is very likely because the wrong metal was used in the reactor vessels, and with each day of operation, neutron radiation is making the metal more brittle, and more prone to crack in case of sudden temperature change under pressure.

The manufacturer of nuclear reactors has reported to the Nuclear Regulatory Commission that in three to five more years, the vessels in some plants will be too brittle to operate safely. But this estimate is wishful thinking, based on unrealistic assumptions about plant operators' actions and accident sequences. Some plants are already too dangerous to operate without corrective measures.

The commission could do a great deal to prevent such an accident, and thereby save the lives of many of these people, if it ordered the type of corrective steps already taken at some European reactors. But the commission, regulating an industry that has serious financial and technical problems, instead of taking initiatives tends to sweep difficult technical problems under the rug, reacting to them only after they occur.

The commission must realize that the crisis is upon us. A temperature change severe enough to crack a brittle reactor vessel already has occurred, in California, but not at one of the older, more vulnerable plants. The commercial nuclear industry's admirable safety record — no deaths caused by radiation — still is intact, but this cannot last much longer, because the reactor vessels and other critical components are aging.

For many years, it has been known that vessels are becoming brittle. What makes the problem urgent is that the metal is aging more rapidly than expected, and the circumstances that would cause such an accident now are more likely.

At the Rancho Seco plant, near Sacramento, Calif., in March 1978 a worker dropped a small light bulb into an instrument panel, causing an electrical short circuit. The short wreaked havoc on the plant's control systems — a variety of instruments that run crucial pumps and valves — and the result was that too much water was pumped through the reactor, chilling it suddenly. It is very doubtful that some of the older plants operating today would be able to withstand the same shock. Fortunately, Rancho Seco had been in operation less than two years; had it been in operation for 10, its pressure vessel most likely would have ruptured.

The kinds of control systems that went haywire at Rancho Seco are very likely to fail at crucial times in other nuclear-power plants. When a pipe bursts, or a seal fails, or a valve sticks, automatic control and safety systems almost instantly take action to compensate, but they do not always take the right action.

Control systems are not reviewed by the Nuclear Regulatory Commission. They are not immune to fire or power failure; they often have no backups, so are prone to simple failure. They are not even earthquake-proof.

The N.R.C. staff has taken the position that if a plant gets into trouble because of control-system malfunctions, it has safety systems to take care of any problems. But this is not so, as events of the last few years show. At Rancho Seco, at Three Mile Island, and at other plants, control systems not thought vital to the safe operation of a plant ended up causing serious problems.

The Nuclear Regulatory Commission is charged with ensuring that nuclear plants are operated "with adequate protection" of the public health and safety. But bureaucratic foot-dragging and preoccupation with public relations and financial problems of the industry are contributing to a shortsighted view — that technical problems can wait or do not exist. Some members of the staff acknowledge the safety problems associated with control systems, but the agency has yet to demand from utilities operating nuclear-power plants the technical data on control systems necessary to assess the systems' safety fully.

It may be that we need nuclear power to maintain our standard of living. But there is a vast difference between having to accept something, and making it acceptable. We can make nuclear power acceptable.

The Nuclear Regulatory Commission chairman, Nunzio Palladino, has spoken of cleaning up our nuclear act. As a private citizen, I hope that we do so, beginning with vigilance at the N.R.C. One more accident the size of Three Mile Island's, and the public's reaction almost certainly will foreclose the nuclear option.

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