UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

HOUSTON LIGHTING & POWER COMPANY)) (Allens Creek Nuclear Generating) Station, Unit No.1))))	Docket No. 50-466

AFFIDAVIT OF RICHARD C. STIRN

State of California
County of Santa Clara

I, Richard C. Stirn, Manager of Core and Fuel System Design within the Nuclear Power Systems Engineering Department of the General Electric Company, of lawful age, being first duly sworn, upon my oath certify that the statements contained in the attached pages and accompanying exhibits are true and correct to the best of my knowledge and belief.

Executed at San Jose, California
July 29, 1980

Richard C. Stirn

Subscribed and sworn to before me this 29 day of July, 1980.

OFFICIAL SEAL
KAREN S. VOGELHUBER
NOTARY PUBLIC - CALIFORNIA
SANTA CLARA COUNTY
My Commission Expires Dec. 5, 1980

Karen S. Vogelhuber
NOTARY PUBLIC IN AND FOR SAID
COUNTY AND STATE

My commission expires 12-5 of 1980.

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(Allens Creek Nuclear Generating Station, Unit No. 1)	§	

Affidavit of Richard C. Stirn

My name is Richard C. Stirn. I am employed at General Electric Company as a Professional Nuclear Engineer. I have been so employed for fifteen years. A statement of my experience and qualifications is set out in Attachment 1.

I. Introduction

The purpose of this affidavit is to address Mr. Doherty's contention that the negative reactivity effect from Doppler broadening has been overstated because General Electric used experimental results obtained during testing when particles of fuel dispersed into the reactor coolant rather than upon tests using a contained, pelletized oxide form.

II. Doppler Reactivity Effect

In nuclear reactor physics calculations, the probability that a given neutron will be absorbed by a nucleus is dependent upon the energy of that particular neutron and the inherent absorption characteristics of that particular nucleus. The absorption characteristic of a given nucleus is given by the absorption "cross section" and is represented in units of area. The absorption cross section is variable over a range of neutron energies and is unique to that nucleus. There exists for every particular nucleus specific neutron energy ranges (resonances) at which the probability of absorption is very high compared to neutrons of other energies.

As fuel temperature in a reactor increases, the velocities of the target nuclei increases. This increase results in a concomitant increase in the ranges of neutron energies with a high probability of absorption. This "broadening" of the absorption cross section is known as "Doppler Broadening." Doppler Broadening in a BWR results in a negative reactivity effect as reactor fuel temperature increases because the parasitic absorption (non-fissioning absorption) by Uranium-238 and Plutonium-240 produces the primary influence which greatly offsets the increased absorption in Uranium-235 and fissile Uranium-238.

III. The Contention

The sole support for Mr. Doherty's contention is the allegation that the General Electric topical report 1/

1/ "Generation of Void and Doppler Reactivity Feedback for Application to BWR design," NEDO-20964 (December, 1975).

analyzing the Doppler reactivity effect for BWRs relies on data generated from the Special Power Excursion Tests (SPERT) conducted at the Idaho Nuclear Experimental Laboratories. Mr. Doherty further asserts that this reliance is erroneous because, during the SPERT tests, the fuel dispersed into the reactor coolant, thereby creating the appearance of Doppler feedback reactivity[2/] which would not actually occur in an operating BWR with intact fuel pellets.[3/] Quite simply, Mr. Doherty's assertion is incorrect. The General Electric mathematical model developed to calculate the Doppler effect does not rely in any way on the SPERT test data. The model was derived based on fundamental principles of Doppler Broadening known for decades and universally accepted. The increase of neutron absorption cross sections as a function of temperature increases has been thoroughly investigated and experimentally quantified. Knowing the character of this phenomenon, it is a straightforward process to analytically determine the resulting neutron population. Inputs to the

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2/ Intervenor's reference to p. 15 of NEDO-20964 is also incorrect because this section discusses only moderator void reactivity feedback, not Doppler reactivity feedback.

3/ The design basis limit on specific fuel enthalpy adopted by the NRC is 280 calories per gram. This limit is incorporated in Section 4.2 of the Standard Review Plan because it has been demonstrated that fuel dispersal will not occur below this limit.

model are empirical (experimentally determined) cross sections equally applicable to all uranium fueled reactors. The model has been verified against the widely-known Hellestrand tests.[4/] These tests measured the temperature dependence of resonance neutron absorption in clad uranium dioxide fuel rods.

Lastly, the model was compared to the most appropriate (e.g., not water-logged fuel) SPERT tests. The results compared extremely well as shown on the graphs in Exhibit A taken from the General Electric topical "Rod Drop Accident Analysis For Large Boiling Water Reactors," NEDO-10527 (Figure 5-7).

Thus, there was no "reliance" by General Electric on the SPERT results, only a secondary comparison to further support the Hellestrand verification of the Doppler reactivity model.

4/ E. Hellestrand, P. Blomberg and S. Horner, "The Temperature Coefficient of the Resonance Integral for Uranium Metal and Oxide," Nuclear Science and Engineering, Vol. 8, pp. 497-506 (1960).

EXHIBIT A

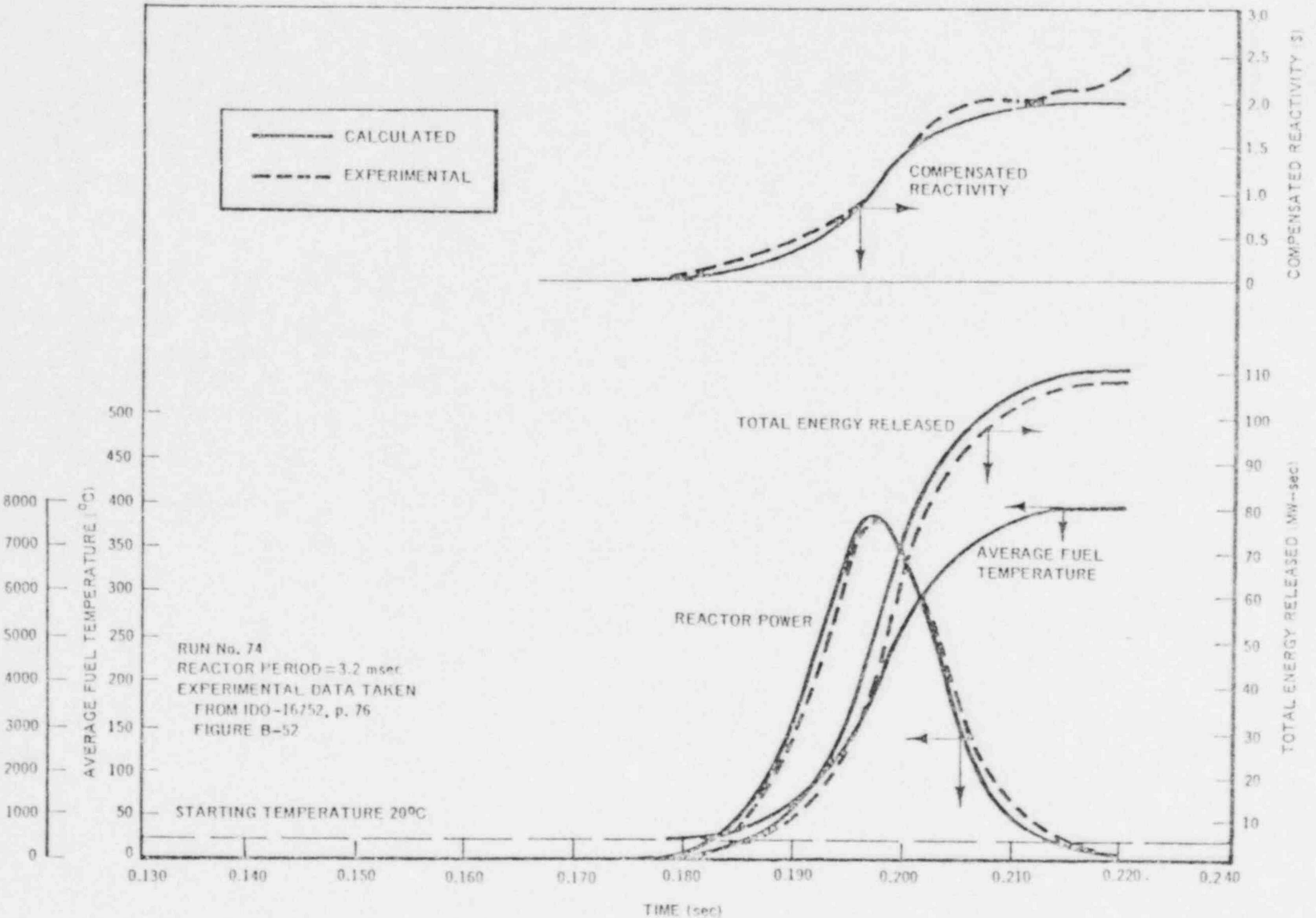

Figure 5.7 Experimental and Calculated Power, Energy, Average Fuel Temperature and Compensated Reactivity as Functions of Time

ATTACHMENT 1

QUALIFICATIONS

Richard C. Stirn, Manager
Core and Fuel Systems Design
General Electric, NEBG

My name is Richard C. Stirn. My business address is 175 Curtner Avenue, Mail Code 740, San Jose, California, 95125. I am a registered Professional Nuclear Engineer in the State of California (NU 630). As Manager I have the responsibility of directing core and fuel systems design for the General Electric Company, NEBG.

I graduated from Tennessee Technological University in 1962 where I received a Bachelor of Science Degree in Engineering Science. During the Summer of 1962 I worked for the Arnold Engineering Development Center in Tullahoma, Tennessee as an Engineer.

In the Fall of 1962 I entered Purdue University on an AEC Fellowship, and in August of 1964 I received a Master of Science Degree in Nuclear Engineering. Upon completion of my studies at Purdue I entered the University of Arizona to work toward a PhD degree in Nuclear Engineering; however, I left school in February of 1965 to work for the General Electric Company, NEBG before completing the PhD requirements.

Upon joining General Electric I entered the Engineering Training Program and had assignments dealing with light water moderated thermal reactors, steam cooled fast reactors, and sodium cooled fast reactors. After completing my training assignment in October 1967, I was appointed to the position of Technical Leader of Core Dynamics and Reactivity. In June 1972 I was appointed to the position of Manager of the Nuclear Safety Analysis Component of the Core Nuclear Engineering Unit. In this position I co-authored or contributed to three papers and three reports on the topic of nuclear reactor excursion analysis. I also participated in the development of the control rod drop accident boundary value approach for the reload licensing submittal.

In September of 1974 I assumed my present responsibilities as Manager, Core and Fuel Systems Design. In this capacity I am responsible for the development of system requirements for the Core and Fuel Perfomance, Core Performance Transient, and Fuel Mechanical Systems. Additional responsibilities include core thermal hydraulics evaluations, the development and issuance of core physics design requirements for reactivity control systems, the performance of criticality analyses of the fuel storage and handling facilities, and the development of core physics design bases for plant transients.

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