UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

DIRECT TESTIMONY OF G. L. SOZZI
ON DOHERTY CONTENTION 32
RE ECCS VAPORIZATION RATE

Q. Please state your name and job position.

A. My name is G. L. Sozzi. I am presently Manager of LOCA System Technology within the Nuclear Fuel and Services Engineering Department of the General Electric Company.

Q. Would you explain your job responsibilities and your professional qualifications?

A. I am responsible for experimental and analytical support of safety related characteristics of the Boiling Water Reactor (BWR) system. The BWR Blowdown/Emergence Core Cooling Program is one such investigation under my direction.

I received a B.S. degree in mechanical engineering in 1966 from San Jose State University, an M.S. degree in mechanical engineering from the University of California, and I also attended Stanford University where I performed additional graduate work following my M.S. degree. I have spent

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most of my professional career in thermal hydraulic experimental and analytical research and development related to nuclear reactor systems safety technology. A major portion of my work has dealt with the two-phase flow phenomenon related to the reactor loss-of-coolant accident (LOCA). This work has included critical two-phase blowdown flow, two-phase flashing and level swell, and heat transfer during a vessel blowdown.

I am a member of the American Society of Mechanical Engineers and a registered professional engineer in the State of California.

Q. What is the purpose of your testimony?

A. My testimony addresses Doherty Contention No. 32 which asserts that the General Electric Emergency Core Cooling Systems (ECCS) evaluation model underpredicts the generation of steam during ECCS injection flow after a loss-of-coolant accident (LOCA). The source of Mr. Doherty's postulation was the report of some anomalous test results at GE's Two Loop Test Apparatus (TLTA) facility as part of the Blowdown/Emergency Core Cooling Program.

Q. Would you describe the TLTA tests?

A. The Blowdown/Emergency Core Cooling program is a cooperative experimental research program jointly funded by the Electric Power Research Institute, General Electric and the Nuclear Regulatory Commission. Tests are conducted by General Electric under this program in the Two Loop Test Apparatus in San Jose, California. The purposes of the present program are:

- To simulate the LOCA from the start of the accident through the early interaction with ECCS in a configuration which has performance characteristics similar to a BWR with 8x8 fuel bundles.
- To obtain test information to support analytical predictions used in the evaluation of BWR's during postulated LOCA's.

The Two Loop Test Apparatus is an experimental scaled mockup of a BWR. A single, electrically-heated, full-size (8x8) fuel bundle simulates the core and is contained within a pressure vessel simulating a reactor vessel. Both normal and emergency cooling systems are simulated. Two loops circulate water to jet pumps within the pressure vessel. Other major BWR components are also mocked up including a steam separator. Emergency core cooling systems include scaled high and low pressure core spray, low pressure coolant injection, and automatic depressurization.

Blowdown of the reactor vessel for a simulated LOCA is initiated by operating quick-opening valves in one of the recirculation lines. Blowdown fluid from these lines is dumped into a tank of water which condenses the steam and absorbs its energy.

There are approximately 180 data channels dedicated to the Two Loop Tests Apparatus which are recorded on magnetic tape. Detailed data analysis and reduction is performed on the GE computer system.

Q. What is the source of concern expressed in Mr. Doherty's Contention?

A. During the Fall of 1978 a TLTA test was conducted with an average power bundle (5.05MW) and with average Emergency Core Cooling (ECC) injection flow. Results of this test were then compared with those from a test with the same initial conditions, but no ECC injection. The comparison showed that the system depressurized more slowly with ECC injection than without ECC injection. The slower depressurization with ECC injection was not anticipated by the NRC Staff and as such, the Staff requested that GE review the results and account for the apparent differences observed.

The Staff's concern was based on the preliminary conclusion that the slow depressurization in the TLTA test with ECC injection may have been due to greater steam generation in the core than expected, which could result in an unanticipated delay of reflood. This possibility led to a concern that the vaporization model was in error and non-conservative in its effect on the calculation of peak clad temperature (PCT). However, upon completion of its review of the data, General Electric resolved the Staff's concern about increased vaporization. The slower depressurization for the test with ECC injection was actually due primarily to the fact that the fluid exiting the break was of lower quality than for the test without ECC injection. For the test with ECC injection the emergency core cooling water refilled the system and collected in the vicinity of the break and was carried out of the break with the steam. For the test without ECC injection, the fluid discharged from the break was primarily steam. Some additional steam was generated by the ECC fluid cooling the metal masses which are part of the test assembly for the test with ECC injection. This effect would not be as significant in an actual reactor because the ratio of metal mass to ECC fluid mass is higher in the test assembly due to the scaling parameters used in TLTA testing.

Q. Was GE's account of the slow depressurization anomaly otherwise corroborated?

A. Yes, data collected on the density of fluid flow out the simulated break, and calculated mass and energy balances on the system confirmed that the observed differences in depressurization rate were due to differences in fluid quality out of the break and not due to core vaporization rate. In fact, estimates of the steam flow out of the core region, from measurements across the steam separator, demonstrated that there was less net vapor generated from the core region for the test with ECC injection.

Subsequent to these earlier tests, GE repeated these tests in the TLTA with improved instrumentation. These latter results provided further substantiation to the earlier results, i.e., the slower depressurization rate for the tests with ECC injection was due to a lower volumetric discharge from the break and not due to core vaporization.

Finally, a comparison was made between the peak cladding temperature calculated with the GE ECCS model and that measured in the average power TLTA tests, with and without ECC injection. The calculated peak cladding temperatures exceed the measured values by approximately 1000°F in both cases. Thus, the calculations indicate that the licensing models maintain a large and consistent margin of safety in the prediction of peak cladding temperature for the two test cases.

Q. Would you please summarize your testimony.

A. GE's ECCS model has conservatively accounted for the phenomenon observed in the tests referenced in the contention. It is clearly established that no revision in the ECCS model is required.