NUCLEAR REGULATORY COMMISSION

ORIGINAL

In the Matter of:

HOUSTON LIGHTING & POWER COMPANY	)	
	)	DOCKET NO. 50-466CP
Allens Creek Nuclear Generating Station, Unit 1	)	

DATE: November 18, 1981 PAGES: 20276 thru 20407

AT: Houston, Texas

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ALDERSON REPORTING

400 Virginia Ave., S.W. Washington, D. C. 20024

Telephone: (202) 554-2345

UNITED STATES OF AMERICA

BEFORE THE

NUCLEAR REG[illegible]OMMISSION

In the Matter of:

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

Advocacy Auditorium
South Texas College of Law
1303 San Jacinto Street
Houston, Texas

Wednesday,
November 18, 1981

PURSUANT TO ADJOURNMENT, the above-entitled matter came on for further hearing at 9:00 a.m.

APPEARANCES:

Board Members:

SHELDON J. WOLFE, Esq., Chairman
Administrative Judge
Atomic Safety and Licensing Board Panel
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

GUSTAVE A. LINENBERGER
Administrative Judge
Atomic Safety and Licensing Board Panel
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

DR. E. LEONARD CHEATUM
Administrative Judge
Route 3, Box 350A
Watkinsville, Georgia 30677

APPEARANCES: (continued)

For the NRC Staff:

LEE DEWEY, Esq.
-and-
STEPHEN SOHINKI, Esq.
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

For the Applicant - Houston Lighting & Power Company:

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Washington, D. C. 20037

For the Intervenors:

JOHN F. DOHERTY
4327 Alconbury
Houston, Texas 77012

I N D E X

P R O C E E D I N G S

9:00 a.m.

JUDGE WOLFE: In attendance this morning are Messrs. Copeland and Culp representing Applicant; Mr. Doherty is here; and Messrs. Sohinki and Dewey are here representing the Staff.

With regard to this coming Friday, the Board will recess at about 3:00 Friday afternoon. We would like to make our aircraft flight back to Washington, D. C. So all parties are duly notified.

Mr. Culp.

MR. CULP: Your Honor, at this time the Applicant would call to the stand Mr. Peter Stancavage and Mr. Steven Hucik to testify on Doherty Contention 5 on suppression pool uplift.

Mr. Stancavage is to your left; Mr. Hucik is to your right. I ask that they be sworn at this time.

JUDGE WOLFE: Would you please rise and raise your hands.

Whereupon,

PETER P. STANCAVAGE

and

STEVEN A. HUCIK

were duly sworn and were examined and testified as follows:

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MR. CULP: Your Honor, we have prefiled this testimony on Doherty Contention 5, but it also includes Mr. Hucik's testimony on Doherty Contention 34, which is hydrogen monitoring.

MR. DOHERTY: Excuse me. That's TexPirg 34.

MR. CULP: Excuse me, Mr. Doherty. That's TexPirg 34 on hydrogen monitoring. We would proceed with only suppression pool uplift at this time, but since the testimony is together, I believe it would be easier just to put the entire testimony into the record at this point, and then we will proceed with cross-examination of suppression pool uplift, and after the completion of that, we would go to Mr. Hucik's testimony on hydrogen monitoring.

JUDGE WOLFE: All right.

MR. CULP: Mr. Hucik will also be joined by Mr. Weingart on the issue of hydrogen monitoring.

JUDGE WOLFE: All right.

The testimony of -- what I have before me -- is the combined testimony of Messrs. Stancavage and Hucik relating to Doherty Contention 5 and TexPirg Contention 34, with regard to that testimony -- and more specifically, with regard to that testimony as to TexPirg Contention 34, that is not similar to the Weingart testimony, in which Mr. Hucik is going to join. Is that correct? They're dissimilar?

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MR. CULP: They are separate pieces of testimony.

JUDGE WOLFE: They are separate pieces, yes.

MR. CULP: Yes, sir.

JUDGE WOLFE: How are we to handle this again, to incorporate? You're going to offer the complete testimony of Stancavage and Hucik with regard to Doherty 5 and TexPirg 34; is that correct?

MR. CULP: Yes, sir.

JUDGE WOLFE: At this time?

MR. CULP: At this time.

JUDGE WOLFE: But there will be no cross-examination on TexPirg Contention 34 until Mr. Weingart and Mr. Hucik are together as a panel?

MR. CULP: That is correct.

JUDGE WOLFE: Now, how shall we handle any voir dire, if necessary?

MR. CULP: Well, I would suggest we limit the voir dire of Mr. Hucik only to suppression pool uplift.

JUDGE WOLFE: All right.

MR. CULP: Then later when Mr. Weingart is on the stand, we can have voir dire with respect to hydrogen monitoring.

JUDGE WOLFE: All right.

And then there will be no cross-examination on

TexFirg 34 until Weingart and Hucik are on as a panel. All right.

MR. CULP: One other point, Mr. Chairman, before we get started. Mr. Hucik's statement of professional qualifications is attached to the testimony that we have filed by Mr. Hucik on Doherty Contention 17, which is the SRV reliability.

That testimony appears following Transcript Page 16,146. Mr. Hucik has not testified on SRV reliability at this time. Yet, his professional qualifications are attached to that testimony.

JUDGE CHEATUM: Diagrams are always helpful.

JUDGE WOLFE: Yes. I have a note with regard to Mr. Hucik's testimony. It was incorporated into the record on August 26.

Mr. Hucik was in Taiwan at that time. And that testimony with regard to Doherty Contention 17 is subject to voir dire, and as I recall, any motion to strike, if need be.

All right.

MR. CULP: Mr. Chairman, one other point, hopefully to clarify matters. In the testimony which these witnesses will identify, there is a question that appears on the bottom of Page 1 and an answer that appears on the top of Page 2.

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That question and answer assumed that Mr. Hucik had previously testified in this proceeding. At this time I would like to delete that question and answer, since Mr. Hucik has not testified on SRV reliability, and I would like to reword the next question to state as follows: "Is the statement of your professional qualifications attached to your testimony on Do erty Contention 17 regarding the reliability of SRV safety/relief valves?"

And the answer remains the same: "Yes."

JUDGE WOLFE: All right. We will strike the question beginning at the bottom of Page 1 of the testimony of Messrs. Stancavage and Hucik and carried over to Page 2, and the answer to that question will also be stricken, at the top of Page 2.

And the first question then appearing at the top of Page 2 will be as amended by Mr. Culp.

MR. CULP: Thank you, Your Honor.

DIRECT EXAMINATION

BY MR. CULP:

Q Gentlemen, do each of you have before you a document entitled "Direct Testimony of Peter P. Stancavage and Steven A. Hucik Regarding: (1) Doherty Contention No. 5 - Suppression Pool Uplift and (2) TexPirg Contention" -- and that should be "34" instead of "40" -- "Hydrogen Monitoring"?

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BY WITNESS STANCAVAGE:

A. Yes.

BY WITNESS HUCIK:

A. Yes.

Q. Was this testimony prepared by you or under your supervision?

BY WITNESS STANCAVAGE:

A. Yes.

BY WITNESS HUCIK:

A. Yes.

Q. Mr. Stancavage, beginning with you, do you have any corrections or additions to make to this testimony?

BY WITNESS STANCAVAGE:

A. No, I do not.

Q. Attached to the direct testimony is an affidavit which you previously filed in this proceeding, which has been labelled Attachment PPS-1; is that correct?

BY WITNESS STANCAVAGE:

A. Yes, that is correct.

Q. Do you have any corrections or additions to the affidavit?

BY WITNESS STANCAVAGE:

A. Yes. At this time my job is Principal Engineer in Reactor Performance Analysis, instead of Manager of Containment Engineering.

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That appears on the first page of PPS-1.

JUDGE WOLFE: Again, Mr. Stancavage, your change in position is what now?

WITNESS STANCAVAGE: My current position is Principal Engineer in Reactor Performance Analysis, instead of Manager of Containment Engineering.

MR. DOHERTY: Your Honor, I don't have that on my PPS-1.

MR. CULP: Well, Mr. Doherty, it's Attachment 1 to Mr. Stancavage's affidavit.

MR. DOHERTY: Okay, thank you. My confusion is resolved.

BY MR. CULP:

Q. Mr. Stancavage, if you will turn to Attachment PPS-1, the affidavit itself, I believe that you also state that you are Manager of Containment Engineering. I guess you would want to make the same change on the affidavit.

BY WITNESS STANCAVAGE:

A. Yes, I would.

Q. Are there any other corrections or additions to make?

BY WITNESS STANCAVAGE:

A. Yes. The statement, "I have been employed in this capacity for 12 years," should be, "I have been

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employed in this capacity for 14 years."

Q. All right. Any other corrections?

BY WITNESS STANCAVAGE:

A. No, I have no other corrections.

Q. Mr. Hucik, do you have any corrections or additions that you would like to make to your testimony?

BY WITNESS HUCIK:

A. Yes, sir. On page 1 of the testimony my name should be spelled S-t-e-v-e-n.

Q. In the caption of the testimony?

BY WITNESS HUCIK:

A. In the caption of the testimony and on Page 2, there's a small typo between Lines 19 and 20, the word should be "boundary."

And the only other correction is the changes in those questions that have already been completed relative to the previous testimony.

Q. With those corrections that each of you have made, is the testimony true and correct to the best of your knowledge and belief?

BY WITNESS STANCAVAGE:

A. Yes, it is.

BY WITNESS HUCIK:

A. Yes.

Q. Do each of you adopt this as your testimony in

1-9

this proceeding?

BY WITNESS STANCAVAGE:

A. Yes.

BY WITNESS HUCIK:

A. Yes.

MR. CULP: Your Honor, at this time I move that the testimony identified by these witnesses, including the affidavit of Mr. Stancavage, which is attached to the testimony, be incorporated into the record as if read.

JUDGE WOLFE: Any objection?

MR. SOHINKI: No objection, Mr. Chairman.

JUDGE WOLFE: Any objection?

MR. DOHERTY: I'd like to take each witness on voir dire, Your Honor.

JUDGE WOLFE: All right.

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VOIR DIRE

BY MR. DOHERTY:

Q. Well, can you give us a little more breakdown of those first 11 years with General Electric, Mr. Stancavage?

BY WITNESS STANCAVAGE:

A. Yes. My first three years at General Electric were spent in an engineering training program, which consisted of a series of six-month assignments under the supervision of senior engineers in various nuclear and mechanical engineering disciplines, including containment safety evaluations, radiological evaluations and nuclear fuel performance evaluations.

The next five years were spent in developing models of nuclear reactor risks, in evaluating radiological consequences of reactor accidents, and developing models of radiation released from fuel due to reactor scram and depressurization.

And the next three years before I became a manager in Containment Engineering were spent as a technical leader in Containment Engineering where I worked on various aspects of containment load definition, including pool swell phenomenon, chugging, condensation oscillation, safety/relief valve loads, pressure and temperature calculations.

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Q Did you analyze loading criteria for pool swell?

BY WITNESS STANCAVAGE:

A Yes, I did.

Q Did you develop any ...

BY WITNESS STANCAVAGE:

A I'm sorry, I didn't understand your question.

Q I didn't ask it yet. I'm sorry.

Did you develop any experimental programs with regard to pool swell?

BY WITNESS STANCAVAGE:

A No, I did not directly develop any experimental programs. Rather, I analyzed the data from the programs to develop the pool swell parameters.

Q Was your pool swell work entirely with the Mark III?

BY WITNESS STANCAVAGE:

A No, my pool swell work also extended to Mark I and Mark II containments.

Q About how much of your efforts were devoted to Mark III containments?

BY WITNESS STANCAVAGE:

A I'd say about three-quarters of my effort was devoted to Mark III pool swell.

Q As a Technical Leader -- I think that's the term

1-12

you used -- were you supervising personnel?

BY WITNESS STANCAVAGE:

A. Yes, I was.

Q. How large a staff did you supervise?

BY WITNESS STANCAVAGE:

A. The number of staff varied from two to seven.

Q. Were you the -- as a Technical Leader on these issues, were you part of a team working on the suppression pool as a safety system, or were you directing that effort?

BY WITNESS STANCAVAGE:

A. I was both part of a team of people who were looking at the experimental and analytical models to predict pool swell, and I was also directing people in accomplishing various subtasks which led up to the complete definition of pool swell.

Q. Have you written any of the PSAR for the Allens Creek plant? Has that been any part of your work?

BY WITNESS STANCAVAGE:

A. No, I have not.

Q. Have you authored any GE publications on pool swell?

BY WITNESS STANCAVAGE:

A. I participated in writing parts of Appendix 3-B to GESSAR in the areas of pool swell, as well as other load definitions.

Q You say to GESSAR?

BY WITNESS STANCAVAGE:

A GESSAR.

Q Okay. You mean the --

BY WITNESS STANCAVAGE:

A Yes.

Q Right. Do you consider any of your work with regard to risk analysis and the radiological consequences of accidents related to this issue?

BY WITNESS STANCAVAGE:

A Yes, I do. Risk analysis relates to this issue, in the sense of being able to employ mathematical, statistical and engineering judgment to the selection of margins which are appropriate to bound experimental conditions.

Radiological evaluations investigated phenomena like pool swell, chugging and condensation oscillation with regard to its effect on the scrubbing aspects of the suppression pool for iodine.

Q Okay. Mr. Hucik, I'd like to ask some questions of you now. Do you work with Mr. Stancavage, sir?

BY WITNESS HUCIK:

A Yes, I have in the past worked with Pete.

Q At the time -- currently, though, do you work together on --

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BY WITNESS HUCIK:

A. No, not currently.

Q. Has he been your supervisor at times?

BY WITNESS HUCIK:

A. Yes, he was my supervisor.

Q. I see you say that your current unit is responsible for load definitions. When you say "load definitions," is that essentially calculating the load, or what is that? If it's not, what is --

BY WITNESS HUCIK:

A. Really what it means is -- it's taking the test data, using any analytical models that might be appropriate with that test data to come up with a specification -- or as we call it, a load definition -- that is used by the plant for design.

JUDGE LINENBERGER: Does this include time-dependence loads?

WITNESS HUCIK: Yes.

JUDGE LINENBERGER: Thank you.

BY MR. DOHERTY:

Q. What is the "Mark III Containment Loads Report"?

BY WITNESS HUCIK:

A. The "Mark III Containment Loads Report" is the final document that is used to actually specify all the loads for the Mark III containment system. It also is incorporated into the GESSAR document as Appendix 3-B. It's basically the same document.

Q. Is that still in progress or is it complete?

BY WITNESS HUCIK:

A. That is complete.

Q. I see. So you're no longer associated with that; is that right?

BY WITNESS HUCIK:

A. Pardon.

Q. You're no longer associated with that?

BY WITNESS HUCIK:

A. The "Containment Loads Report" itself is complete, and it's an issued document.

JUDGE LINENBERGER: Well, Mr. Hucik, repeating Mr. Doherty's question in a slightly different context, is this considered a completed task, or will there be continuing reviews to determine whether it needs updating?

WITNESS HUCIK: Yes, right now we're involved with the NRC in actually the review of that document. It's formally being reviewed under GESSAR, Appendix 3-B. Since they're the same document, it is currently undergoing review and any revision, if necessary.

JUDGE LINENBERGER: Thank you.

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1-16

BY MR. DOHERTY:

Q. You state you were also responsible for the analysis of Caroso SRV test data. Is that a Mark III system?

BY WITNESS HUCIK:

A. No, that's a Mark II system.

Q. Used to support the SRV load reduction defined in the final Mark III containment loads report. Was there some aspect of this that you feel applies to a Mark III system like Allens Creek?

BY WITNESS HUCIK:

A. Yes, there are several things that make the Caroso test data from the Mark II totally applicable to the Mark III containment system, in terms of SRV's. Number one, the safety/relief valves used are essentially similar. And, number two, the SRV lines and the geometry of those lines is also very similar to the Mark III geometry.

Number three, the quencher -- the actual device at the end of the discharge line that's in the suppression pool is essentially the same as used in the Mark III containment system.

Therefore, the phenomenon -- the loads are essentially the same as you would see in Mark II or Mark III.

Q. So then you feel that your experience with the

Caroso Mark II does give you expertise to discuss the Mark III at Allens Creek?

BY WITNESS HUCIK:

A. Yes.

Q. Now, when you say that you provide support to the Mark III customers, does that mean you did calculations that assist their construction work?

BY WITNESS HUCIK:

A. Yes. If a particular project or plant comes in with some request for, say, some plant unique analysis associated with something slightly different from their plant from what we've analyzed, we provide that analysis to them. We call that the support, or answering any questions that they may have pertaining to the loads and their definitions.

Q. Did you present any presentations to the NRC? Have you been involved in any of those? I notice the last complete paragraph there says, "Made presentations on licensing basis to U. S. Regulatory Agencies."

BY WITNESS HUCIK:

A. Yes, I've made many presentations to the Nuclear Regulatory Commission, as well as the ACRS Advisory Committee on Reactor Safeguards pertaining to containment loads, in particular Mark III.

Q. Have you ever authored any publications in

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professional journals?

BY WITNESS HUCIK:

A. No, I have not.

Q. What is the most extensive study you've made of any one problem in the Mark III containment?

BY WITNESS HUCIK:

A. There might be several. One that's very much related to Mark III, is I looked at the early Mark I and Mark II containment systems and did some pool swell modeling for the Mark I and Mark II, based on data fr Mark III.

I also did my Master's thesis at the University of California at Berkeley on safety/relief valve operation, in terms of pool dynamic loads.

Q. Did you have one of those types of programs that Mr. Stancavage mentioned, a couple of years of different areas --

BY WITNESS HUCIK:

A. Yes. As a matter of fact, I went through the engineering program myself. I had a series of five rotations in many different areas, including a couple of rotations in the containment analysis area and testing areas.

I also spent two years as a supervisor for that particular program.

MR. DOHERTY: Okay. No further questions, Your Honor.

No objections.

JUDGE WOLFE: Absent objection, the testimony of Messrs. Peter Stancavage and Steven Hucik with regard to Doherty Contention 5 and with regard to -- at this time -- TexPirg Contention 34 are incorporated into the record as if read.

(Applicant Testimony of Peter P. Stancavage and Steven A. Huckin on Doherty Contention No. 5 and TexPirg Contention 34 follows.)

\- - -

September 18, 1981

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

DIRECT TESTIMONY OF PETER P. STANCAVAGE
AND STEPHEN A. HUCIK REGARDING:
(1) DOHERTY CONTENTION NO. 5 - SUPPRESSION POOL UPLIFT
(2) TEXPIRG CONTENTION ~~40~~ 34 - HYDROGEN MONITORING

Q. Mr. Stancavage, have you reviewed your prior affidavit on Doherty Contention No. 5, which affidavit is attached hereto as Attachment PPS-1?

A. Yes, I have.

Q. Are the statements contained therein still true and correct?

A. Yes, they are.

Q. Mr. Stancavage, what are the dynamic capabilities of the HCU modules during LOCA pool swell loads?

A. The HCU modules are designed to withstand loads associated with response spectra peaks in excess of 15 g vertically and 5.9 to 11.9 g horizontally. As indicated in the testimony of Dragos A. Nuta, the HCU modules will not be damaged by the hydrodynamic forces associated with the vertical water swell postulated to occur during a LOCA.

~~Q. Mr. Hucik, have you previously given testimony in~~

~~this proceeding?~~

~~A. Yes, I presented~~ testimony in ~~connection with Doherty Contention 17, regarding the reliability of safety relief valves.~~

Q. Is the statement of your professional qualifications attached to ~~that prior~~ your testimony ~~still correct?~~ on Doherty Contention 17 regarding the reliability of SRV safety/relief valves?

A. Yes.

Q. Mr. Hucik, directing your attention to page 32 of the Board's Order of September 1, 1981, can you state whether there is a possibility for simultaneous actuation of safety relief valves on pool swell?

A. The Allens Creek Nuclear Generating Station BWR uses a General Electric sixth generation, boiling water reactor nuclear steam supply system equipped with 19 safety relief valves. The purpose of these valves is to relieve pressure from the reactor pressure vessel venting steam to the suppression pool where it will be condensed by the pool water. The valves open after receiving a signal that the reactor pressure is higher than normal.

A sudden break of a high energy pipe in the reactor coolant pressure boundary of the nuclear steam supply system will cause the pool swell phenomenon if the break size is large enough. Small breaks do not release sufficient energy into the drywell to cause pool swell.

For a break large enough to produce the pool swell phenomenon, the pressure in the reactor vessel decreases rapidly due to the flow of high energy fluid from the break in the reactor coolant pressure boundary. This drop in reactor pressure ensures that the safety relief valves remain closed throughout the first few seconds when the pool swell phenomenon occurs. Thus, we do not consider the actuation of safety relief valves at the same time as pool swell.

Q. Mr. Hucik, at page 21 of its September 1, 1981 Order, the Board asked several questions regarding the hydrogen monitoring system for Allens Creek. Could you please address those questions?

A. Most of the questions have been thoroughly answered by Mr. Weingart's testimony; however, I can add certain information from GE's perspective. First, as to the question of incomplete convective circulation, Section 6.2.5 of GESSAR II demonstrates that post LOCA conditions in containment promote natural convection such that effective mixing of the containment atmosphere is accomplished. The principal reasons are as follows:

(1) heat transfer mechanism:
heat source (the suppression pool) at the bottom and heat sinks (containment wall) at the top and the sides will create unstable conditions due to buoyancy forces

(2) mass transfer mechanism:

additional density gradient due to changing hydrogen concentration near the pool surface will reinforce the thermally induced convective currents.

The convective circulation in the containment, when established, will be directed upwards near the drywell wall and downward along the containment wall. The hydrogen recombiners when in operation will not interfere with this pattern because of their location near the top of the drywell. In fact, the additional heat source they represent will reinforce it. The calculations presented in GESSAR II show that extremely small temperature and concentration differences (2.6×10^{-5}°F and 4.3×10^{-6}%, respectively) are sufficient to create a turbulent free convection regime in the containment.

Based on these considerations we conclude that the hydrogen concentration in the air supplied to the hydrogen recombiners will be at or very near the bulk concentration and the convective circulation will not be detrimental to the efficiency of these recombiners.

Second, as to the conservatism of the alarm set point, Figure 1 shows a typical hydrogen concentration time history in a Mark III Containment following a recirculation line Design Basis Accident (DBA). The analysis is based on the very conservative assumptions of Reg. Guide 1.7. At the time when the containment H_2 concentration reaches 3% (~17 days), the rate of hydrogen evolution from the suppression pool due to radiolysis is less than 1 SCFM. (It actually drops to that rate in 3 days). That translates to a H_2 concentration rise of 0.1%/day. With a nominal recombiner warm-up time of 3 hrs. there is more than enough time for the operator to activate a back-up system in case one fails.

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NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

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

AFFIDAVIT OF PETER P. STANCAVAGE

State of California
County of Santa Clara

I, Peter P. Stancavage, Manager of Containment Engineering, within in the Domestic BWR Projects Department of 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.

Peter P. Stancavage

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

Ruthe M. Kinnamon
NOTARY PUBLIC IN AND FOR SAID
COUNTY AND STATE

My commission expires March 28 of 1981.

OFFICIAL SEAL
RUTHE M. KINNAMON
NOTARY PUBLIC - CALIFORNIA
SANTA CLARA COUNTY
My comm. expires MAR 28, 1981
175 ... Ave., San Jose, CA 95125

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

Affidavit of Peter P. Stancavage

My name is Peter Stancavage. I am employed by General Electric Company as a nuclear and mechanical engineer. I have been employed in this capacity for 14 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 5 which alleges that the control rod drive mechanism hydraulic control units (HCU) and the transversing in-core probe (TIP) may be damaged by the hydrodynamic forces of a high vertical water swell in the suppression pool following a loss-of-coolant accident (LOCA).1/

1/ LOCA is the sudden break of a high-energy pipe in the reactor coolant pressure boundary of the nuclear steam supply system. The largest possible break is the break of a main steam line.

II. Description of the Mark III Containment and Pool Swell Phenomena

The Allens Creek Nuclear Generating Station design uses a General Electric sixth generation boiling water reactor nuclear steam supply system with a third generation pressure suppression containment system. (This combination bears the name BWR/6--Mark III.) The basic Mark III containment design is shown in the attached diagram (Exhibit 1). The reactor primary system is surrounded by a cylindrical concrete drywell structure which is in turn surrounded by the primary containment. At the base of the drywell a series of horizontal open-ended pipes (vents) in three rows connects the drywell to the containment. The vents are submerged in an annular pool of water that is retained by a weir wall inside the drywell. Any steam released in the drywell from a postulated pipe break will be forced through the horizontal vents into the suppression pool where it will be condensed by the pool water.

Almost immediately following a postulated LOCA, the drywell is pressurized by reactor steam, and a mixture of steam and air is directed to the suppression pool through the horizontal vents. The rapid increase in drywell pressure will accelerate the water initially standing in the weir annulus and horizontal vents. Immediately following the clearing of standing water in any vent, drywell air and steam will form a bubble at the vent exit. This bubble will expand and depressurize to the local hydrostatic pressure. These bubbles cause an upper displacement of the pool water above the vents. The bubbles rise relative to the pool water, reducing the thickness of the water ligament or film above the bubbles. When the bubbles break through the water surface, a froth is formed which rises further before falling back into the suppression pool. The initial motion of the water film and the subsequent motion of the froth create impact and drag loads on equipment and platforms located above the pool surface. The entire process is referred to as "pool swell."[2/]

The pool swell loads on structures and components above the suppression pool have been evaluated in more than fifty full-scale and subscale experiments as part of the

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2/ Safety relief valve (SRV) actuation also introduces air into the pool as the released steam displaces the smaller air volume occupying the blowdown lines. However, SRV pool swell does not exist. Extensive in-plant tests, laboratory tests and an understanding of the phenomena involved in SRV discharge demonstrate that there is no pool swell due to this discharge. An understanding of the phenomena is acquired from scaling laws and analytical models of the SRV discharge. Full-scale in-plant tests were conducted at Monticello, Caroso, Tokai, KKB, KKP and Fukushima-6. Laboratory tests were also conducted by General Electric, KWV and CNEN. All these tests confirm that SRV pool swell does not occur.

Mark III test program conducted by the General Electric Company. From this information, loads are selected and used in the design of the ACNGS plant by the architect-engineer and in General Electric's analysis to qualify equipment supplied by General Electric.

III. Mark III Test Program

Immediately following the introduction of the BWR/6--Mark III, the General Electric Company started an extensive experimental and analytical effort to confirm the Mark III design. The purpose of the Mark III Confirmatory Test Program was to confirm the analytical methods used to predict the drywell and containment responses following a LOCA and to obtain information on the hydrodynamic loads that are generated in the vicinity of the suppression pool during a LOCA.

The General Electric Mark III containment pressure suppression testing program was initiated in 1971 with a series of small-scale tests. The test apparatus consisted of small-scale simulations of the reactor pressure vessel, drywell, suppression pool and horizontal vents. A total of sixty-seven blowdown runs were made. The purpose of these tests was to determine the behavior of the horizontal vents and to obtain data for determining the acceleration of the water in the test section vents during initial clearing. This information was used to establish an analytical model for predicting vent system performance in Mark III and the resulting drywell pressure response.

In November 1973, testing in the Mark III Pressure Suppression Test Facility (PSTF) began. The PSTF consists of an electrically heated steam generator connected to a simulated drywell which can be heated to prevent steam condensation within its volume during the simulated blowdowns. The drywell is modeled as a cylindrical vessel having a 10-foot diameter and 26-foot height. A 6-foot diameter vent duct passes from the drywell into the suppression pool and connects to the simulated vent system. Pool baffles are used to simulate a scaled or full-scale sector of a Mark III suppression pool.

The full-scale PSTF testing performed between November 1973 and February 1974 obtained data for the confirmation of the analytical model. In March 1974 pool swell tests were performed in the PSTF. These full-scale tests involved air blowdown into the drywell and suppression pool to identify bounding pool swell impact loads and breakthrough elevation, i.e., that elevation at which the water slug begins to break up and impact loads are significantly reduced. Impact load data were obtained on selected targets located above the pool. In June of 1974, after the PSTF vent and pool system was converted to 1/3-scale, four series of tests were performed to provide transient data on the interaction of pool swell with flow restrictions above the suppression pool surface.

The next series of 1/3-scale testing, which began in January, 1975, measured local impact pressures and total loads for typical small structures located over the pressure suppression pool including I-beams, pipes, and grating. Data from this test series expanded the data base from the full-scale air tests. A further series of 1/3-scale tests was added in June, 1975, to obtain comparable data on pool swell velocity and breakthrough elevation to the full-scale air tests.

The emphasis in the testing described above was directed at the evaluation of the pool swell phenomena. Each test run consisted of a simulation of the postulated blowdown transient. Various postulated break sizes up to two times the Design Basis Accident for the containment were tested. Data were recorded at selected locations around the test facility suppression pool throughout the blowdown so that the hydrodynamic conditions associated with each phase of the blowdown are known and are available for selecting appropriate design loading conditions. General Electric has used this data to develop hydrodynamic loading conditions in the GE Mark III reference plant pressure suppression containment system during the postulated LOCA.

IV. Pool Swell Loadings

Equipment and platforms, like the HCU, the HCU floors and the TIP, located in the containment annulus region above the pool surface experience pool swell induced dynamic loads, the magnitude of which are dependent upon both the location and the geometry of the surface exposed. The pool swell phenomenon occurs in two phases: "bulk" pool swell followed by a "froth" pool swell. Bulk pool swell imparts two different loads on exposed structures and components: impact loads and drag loads. The froth stage of pool swell contributes only a drag load.

A. Impact Loads

The PSTF air test data show that after the pool has risen approximately 1.6 times vent submergence below normal pool level (12 feet), the slug thickness has decreased to 2 feet or less and the impact loads are significantly reduced. For evaluating the time at which impact occurs at various elevations in the containment annulus, the maximum water surface velocity of 40 feet/second is assumed because this value bounds all the test data and analysis. The basis for the loading specification is the PSTF air test impact data. These tests involved charging the reactor simulator with 1000 psia air and blowing down through an orifice. Instrumented targets located over the pool provided the impact data.

For structures above the 18-foot elevation, the conservative froth impingement load is 15 psig based on data generated during the PSTF air test series. Again, this impingement load is applied uniformly to all structures.

B. Drag Loads

In addition to the impact loads, structures that experience bulk pool swell are also subject to drag loads as the pool water flows past them. Drag loads are calculated assuming a velocity of 40 feet/second between the pool surface and HCU floors.

C. Design of HCUs for Pool Swell Loads

Large platforms or floors will completely stop the rising pool, and thus incur larger loadings. For this reason, the HCU platform is located above the bulk pool swell zone. The GE Confirmatory Test Program indicates that pure bulk pool swell terminates at levels much lower than 18 feet above the suppression pool. Consequently, General Electric advises the architect-engineer to use 18 feet as the elevation of bulk pool swell with a linear transition from water to froth in the space of 18 feet to 19 feet above the normal pool surface. Therefore, for design application, the impact of water from bulk pool swell is applied conservatively at or below elevations of 19 feet above the surface of the suppression pool. The structures above this elevation experience an impulsive loading followed by a pressure differential loading. The impulsive load is due to the momentum of the froth which is decelerated by the structure. The pressure differential is based on an analysis of the transient pressure in the space between the pool surface and the HCU floor resulting from the froth flow through the approximately 1500 square feet vent area at this elevation. General Electric test results are the basis for the froth impingement load of approximately 15 psi lasting for 100 msec. An 11 psi froth flow pressure differential lasting for three seconds is based on an analysis of transient pressure in the space between the pool surface and the HCU floor. The approximate value of 11 psi is from a calculation which assumes that the density of the flow through the annulus restriction is a homogenous mixture of the top 9 feet of the suppression pool (i.e., 18.8 lb_m/ft^3). This is a conservative density assumption confirmed by the GE one-third scale test which shows an average density of approximately 10 lb_m/ft^3. The analytical model used to simulate the HCU floor flow pressure differential has also been compared with test data. These tests indicate HCU floor pressure differential is more realistically in the 3 to 5 psig range.

Vibratory response of the HCU floor to the froth impingement would subsequently transmit a load to the HCU modules. The magnitude of this load for Allens Creek will be computed by the architect-engineer in a plant unique dynamic analysis to assure that it does not exceed the dynamic qualification of the HCUs by General Electric.

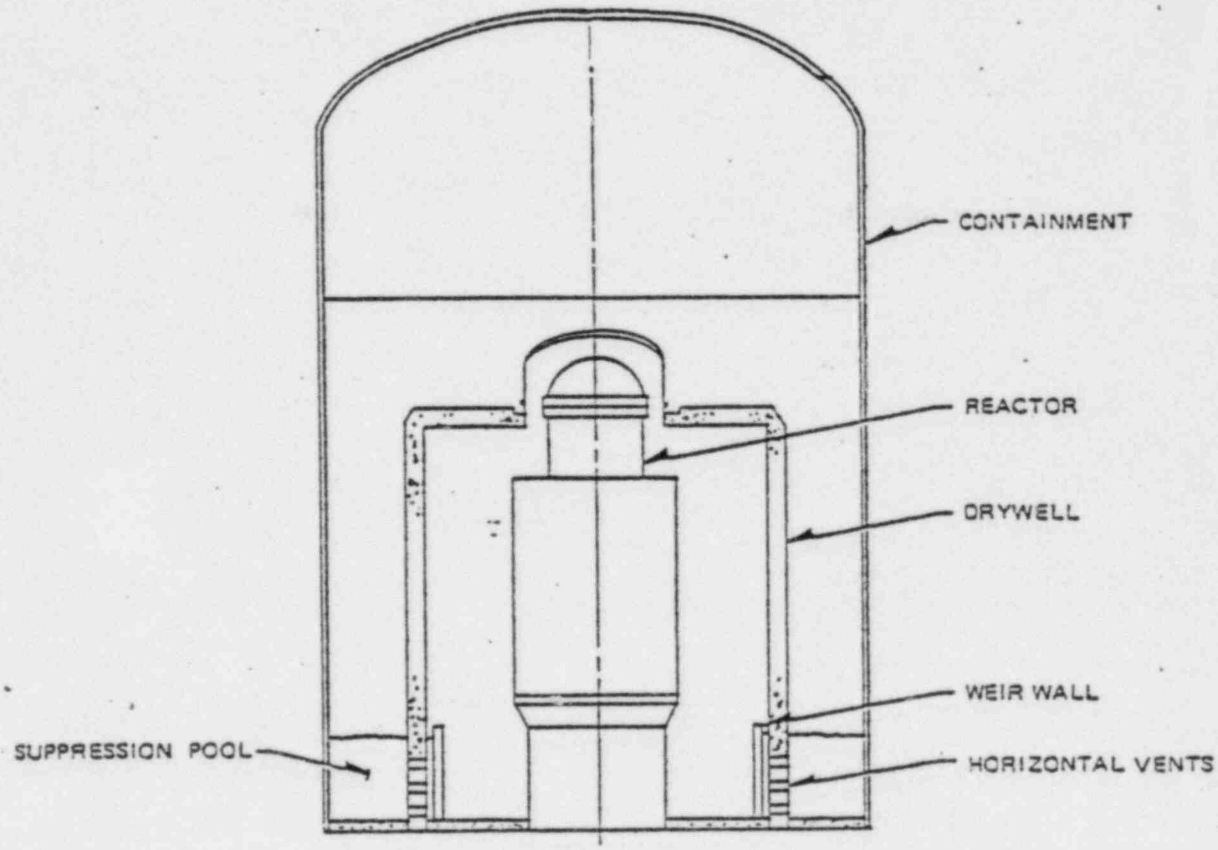
D. Design of the TIP for Pool Swell Loads

General Electric PSTF tests demonstrate that for structures such as . a TIP station, which is located approximately six feet above the suppression pool surface, pool swell impact loads are not experienced. The TIP station does experience a drag load and a "bubble" load. Bubble pressure load occurs when the air in the drywell is driven through the vents and forms air bubbles in the suppression pool prior to bulk pool swell. The pressure of these bubbles is then exerted on the wetted surfaces around the suppression pool.

PSTF data also establish that the TIP station would experience a maximum drag load of 11 psid and a 21.8 psid bubble pressure load. The TIP system itself is protected from the loads by cantilever structures which extend beneath the surface of the suppression pool and are specifically designed by the architect-engineer to absorb this loading.

In a larger sense, the issue of pool swell loading on the TIP station is a red herring. The TIP is a movable radiation source used to calibrate the Local Power Range Monitors when the reactor is shut down. It is not designed or used to perform any safety function whatsoever. Consequently, its ability to survive a LOCA environment, including pool swell loading, has no importance save an economic effect which pales in comparison to the other consequences of such an accident.

EXHIBIT 1



Mark III Reactor Building

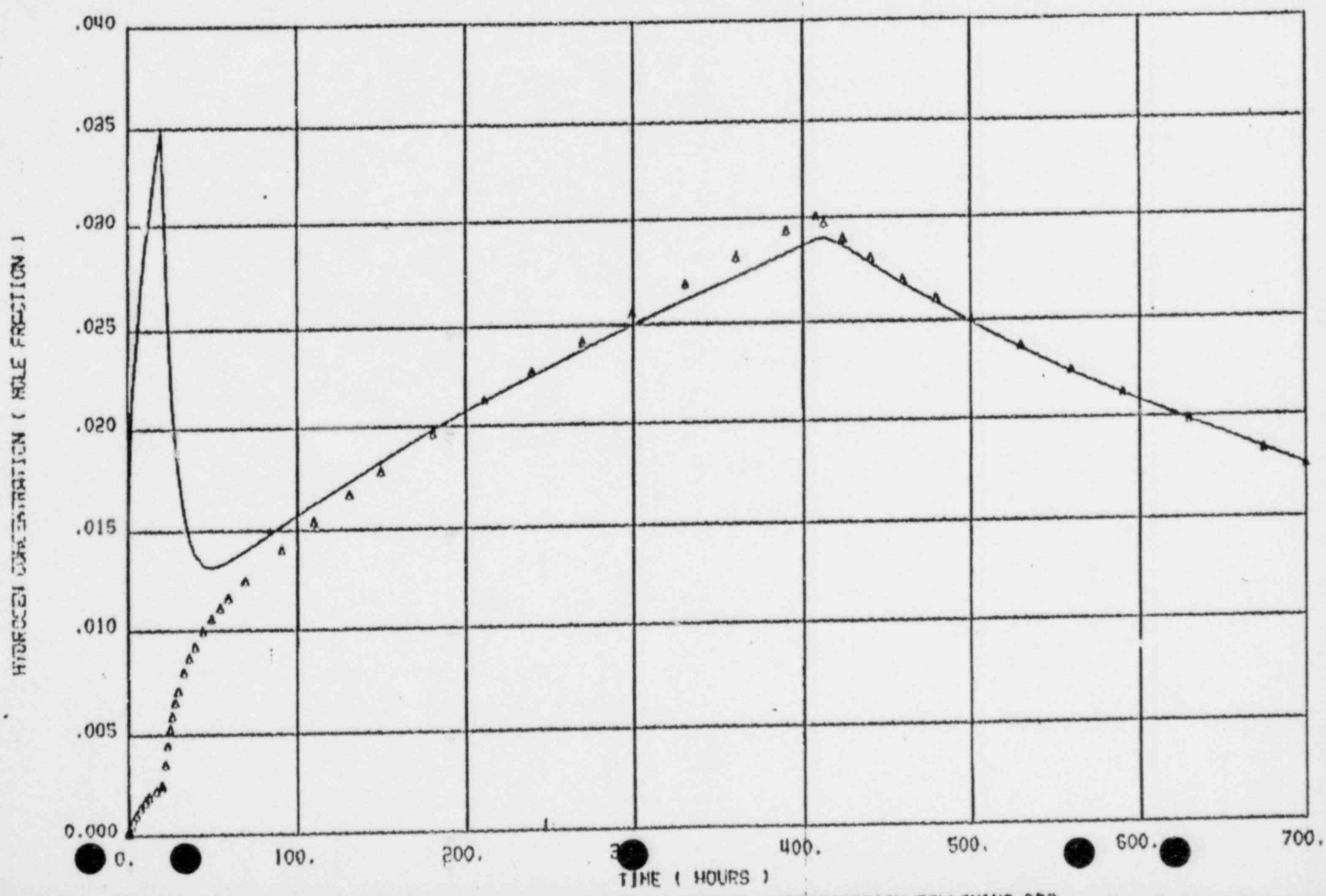
ATTACHMENT 1

PROFESSIONAL QUALIFICATIONS
PETER P. STANAVAGE
MANAGER - CONTAINMENT ENGINEERING

Mr. Stancavage has more than 13 years of Engineering experience with General Electric in the Nuclear Energy Group.

Mr. Stancavage is now the Principal Engineer in Reactor Performance Analysis, ~~Manager of Containment Engineering,~~ a position he has held for more than two years. His first eleven years with GE included a variety of Engineering jobs among which were three years in Containment Engineering, Radiological Evaluations and Nuclear Engineering.

Mr. Stancavage received his Master's Degree from M.I.T. in Nuclear Engineering. He completed his undergraduate work at U.S. Military Academy (West Point).


HYDROGEN CONCENTRATION (MOLE FRACTION)
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100.
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700.
TIME (HOURS)

MR. CULP: Your Honor, at this time the witnesses are tendered for cross-examination on Doherty Contention 5.

JUDGE WOLFE: All right.

Staff?

MR. SOHINKI: We have no questions, Mr. Chairman.

JUDGE WOLFE: Mr. Doherty?

CROSS-EXAMINATION

BY MR. DOHERTY:

Q. You give some results there on Page 1 at Line 19. What is the source of that information, Mr. Stancavage?

BY WITNESS STANCAVAGE:

A. The source of the information is a series of tests that were conducted by General Electric on the HCU modules. These tests were done on a shaker table, which is subjected to vertical and horizontal accelerations to investigate the mechanical capabilities of the HCU modules.

Q. Well, did you ever really find out what the load they could withstand was, or did that -- I'm not saying you personally did. You have given some figures there, "in excess of" -- and you stopped apparently, didn't run any higher. Do you see what I mean?

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1-21

BY WITNESS STANCAVAGE:

A. Yes, I think I understand your question.

The capability, in terms of being able to withstand loads, is somewhat higher than the numbers given here. But these numbers can be used as the maximum capability, if you will, or the design limit beyond which one should not go without further evaluation.

Q. Are you saying they're safe?

BY WITNESS STANCAVAGE:

A. They're safe. For example, take the 15 g's vertically, that was specified as an input to the test, that the test go at least 15 g's of vertical acceleration. And because of the way the test was conducted, the accelerations were slightly in excess of 15 g's.

But the test specifications said to qualify this equipment to 15 g's vertically, and so that's what the test accomplished. And, therefore, the capability has been demonstrated to 15 g's.

Q. When you say g, I have some difficulty with that. That's sort of a force of sudden movement; is that right?

How do you explain the g? That's not a pounds per square inch type of measurement, is it?

BY WITNESS STANCAVAGE:

A. No, it is not. A g is an acceleration. It's

32.2 feet per second per second.

Q. Uh-huh.

BY WITNESS STANCAVAGE:

A. A mass subjected to an acceleration would give a force, according to Newton's second law, F equals mass times the acceleration.

So if I were to put a mass of one pound in a field of one g, then it would weigh one pound.

If I were to put it in a field of two g's, it would equivalently weigh two pounds.

And a pound can be thought of as a measure of force. So it's not a sudden acceleration, like a car starting from stop, moving suddenly.

It's more of a steady vibratory kind of motion at a level corresponding to 15 times the force of gravity.

Q. Okay. I guess the source of my problem is that I'm not used to thinking of myself as subject to gravity, but I am.

BY WITNESS STANCAVAGE:

A. Okay.

MR. COPELAND: You had better hope so.

MR. DOHERTY: Not everyone is all the time, but --

BY MR. DOHERTY:

Q. Now, you also made a statement with regard to

Mr. Nuta's testimony, I guess -- his conclusions. Do you have any other source for that, besides Mr. Nuta's conclusions?

BY WITNESS STANCAVAGE:

A. No, I do not.

Q. It was General Electric who did the test you spoke of a moment ago?

BY WITNESS STANCAVAGE:

A. Yes, it was.

Q. You did those?

BY WITNESS STANCAVAGE:

A. Not me personally, but General Electric Company did the test, yes.

Q. Can these also be called vibratory response loads that you've given here? Is that a term for that? Is that an interchangeable term?

BY WITNESS STANCAVAGE:

A. Yes, that is a good term to use for it.

Q. So you testified a minute ago, I believe, that General Electric did the measurements?

BY WITNESS STANCAVAGE:

A. Yes, that's correct.

Q. And you're going to give them to Ebasco or to HL&P to give to Ebasco?

/

BY WITNESS STANCAVAGE:

A. Yes, that's correct.

Q. That's the chain.

At this time does General Electric approve of that itself as a -- Well, let's put it this way. Do they believe -- Does General Electric believe that these loads will result in no damage to HCU's or non-acceptable damage to any -- Well, let's just leave it there.

MR. CULP: Your Honor, I'm going to object to that question, because I don't understand it.

MR. DOHERTY: Well, maybe it's bordering on repetition, and that's what makes it a little bit lacking -- hard to understand.

The question I'm trying to get at is part of what I think the Board had some inquiries about with regard to this contention; and that is, was the -- were these now called vibratory responses acceptable to General Electric.

Did they find them suitable? That's what I'm trying to find out.

MR. CULP: Are you referring specifically, Mr. Doherty, to the loads that the HCU modules can withstand?

MR. DOHERTY: Yes.

MR. CULP: And you're asking whether GE finds these acceptable?

1-25

MR. DOHERTY: Yes.

MR. CULP: Okay.

WITNESS STANCAVAGE: Yes, GE finds the 15 g vertical acceleration load acceptable for the HCU modules, based on the tests that we conducted on the HCU modules.

BY MR. DOHERTY:

Q. The horizontal loads as well?

BY WITNESS STANCAVAGE:

A. Yes, and the horizontal loads as well.

Q. I guess we need to turn to you, Mr. Hucik, on Page 2. I'm trying to think ... did you actually calculate any probabilities that there could be a simultaneous actuation of any -- well, a simultaneous occurrence of a loss-of-coolant accident and an opening of a relief valve?

BY WITNESS HUCIK:

A. I haven't personally calculated those probabilities, but I believe those probabilities have been given to the NRC staff. I just do not know them off the top of my head. They're very low.

Q. I see.

BY WITNESS HUCIK:

A. Very low.

Q. Do you know if the only way that's seen as possible is just bad timing, unfortunate timing where the SRV -- unrelated to the loss-of-coolant accident -- pops?

1-26

I mean, is that your understanding of the whole --

BY WITNESS HUCIK:

A. That would be the only way because you could not get them going simultaneously, mechanistically.

Q. I see.

The high energy pipe is sort of looked at as a pressure reliever. It's sort of like a pressure relief valve itself, isn't it?

BY WITNESS HUCIK:

A. That's correct.

Q. Now -- Well, if the reactor is undergoing a pressure -- Let me ask you this: How much -- What is the operating pressure of the reactor, to your knowledge?

BY WITNESS HUCIK:

A. The operated pressure is normally around 1040 to 1050 psig.

Q. And then how much additional pressure is there until the first safety/relief valve opens? It's not a great amount --

BY WITNESS HUCIK:

A. I believe for Allens Creek it's 1103 psig. There's about 50 to 60 psi delta between the operating pressure.

Q. So the only way that you -- in theory then, there would only be that short band or small band that would be critical in a sort of hypothetical sense of a weakened pipe -- a cracked pipe, giving as pressure was rising? In other words, normal you said was ten -- something on the order of thousand -- and there would be no reason for the pipe to go at any specific time, if it were running normally. It would just go whenever it was ready to go.

BY WITNESS HUCIK:

A. That's correct.

Q. So the only way that increasing pressure would be contributory would be just that short band of 60 or so?

BY WITNESS HUCIK:

A. Well, any break of the line would actually send a decompression of the system. So it would tend to drop the pressure in --

Q. Right.

But in terms of a pipe which could stand normal pressure, but was just -- you know, could just stand slightly above it, the only time where you could get a critical situation of pressurizing, but not reaching the set valve -- the relief valve point would be in that band of 60, right?

Do you follow me?

BY WITNESS HUCIK:

A. Yes. The pressure can rise in the system up to the point of 60 psi before the valve opens, yes. It can rise in that area.

Q. Are there any -- What are some of the durations which would be required for pressure to rise that 60 pounds? Are they short times or long times, typically?

BY WITNESS HUCIK:

A. It would probably depend on the type of transient that were occurring in the system as to how fast the pressure rise is in the system.

Those different transients are normally evaluated for the plant, and the pressure rise rates are given.

Q. And do you have any ballpark figures on the durations?

BY WITNESS HUCIK:

A. Depending on the transient it might be several seconds, I believe.

Q. Uh-huh. So that critical time would be a very short space of time.

Now, how rapidly does this depressurization start in a loss-of-coolant event? How quickly is this pressure expected to drop?

BY WITNESS HUCIK:

A. It's basically instanteous. It's a sonic wave

1-29

that would be traveling backwards to depressurize the system.

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-1

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Q I have a little problem with this one area of the reactor. There's a head above the shroud, or the shroud head, and then is there a space that connects the area above the shroud and the annulus for the jet pumps? Is that an open area? It's not sealed off, is it?

BY WITNESS HUCIK:

A I believe outside the annulus, that's fairly well open, to try and drain off any of the water that comes off of the wet steam as the steam is dried in the upper shroud region.

Q What do you have in mind at line 22? You say, "Small breaks do not release sufficient energy."

Is there sort of a dividing line in terms of pipe size there?

BY WITNESS HUCIK:

A In terms of pool swell, you have to get a large air bubble formed underneath the pool, okay, and that air bubble comes from the drywell air that's initially in the drywell; and you have to get that being interjected underneath the pool in a very rapid period of time.

Only the large breaks, like the steam line break which we analyze for, has a sufficient energy rate of steam into the drywell to force the air out under the pool and lift it in a pool swell fashion.

-2

Small breaks do not pressurize the drywell fast enough to really vent that air sufficiently fast enough to get a rise of the pool water.

It kind of bubbles the air through with the steam and you get condensation of the steam and the air sort of bubbles to the surface for the smaller breaks.

Q You said main steam line. Are there any other lines?

BY WITNESS HUCIK:

A. That could cause pool swell?

Q Yes.

BY WITNESS HUCIK:

A. The other large line that's in the system is the recirculation line, okay, and that has been evaluated and we find that the steam line actually bounds the conditions between those two large break lines.

Q I see.

JUDGE LINENBERGER: Sir, perhaps for further clarification of this point, let's assume the integrity of the main steam line piping, but would you indicate how many SRV's would have to actuate in order to produce a significant pool swell phenomenon? Would one do it?

WITNESS HUCIK: No. Basically, the problem there is it's the amount of air that's carried over from the drywell that causes pool swell, and in the case of a

-3

Mark III containment, the drywell line is somewhere around 230,000 to 240,000 cubic feet of air, and that's what causes the pool swell phenomenon.

In a safety/relief valve discharge line, the air in that line is typically between 50 and 60 cubic feet.

So the total volume of air there is about what, six or seven hundred cubic feet total, and that's a much smaller volume than the 260,000 cubic feet which would cause pool swell.

In tests that we've seen in plants, with even one safety/relief valve going off, there's basically no noticeable pool swell at all.

There might be a change in the water level for an actuation of maybe an inch or so, but nothing more than that.

JUDGE LINENBERGER: Thank you.

BY MR. DOHERTY:

Q Moving on into the affidavit, I think the rest of this is with regard to the other contention, so there's kind of a tracking we have to do here.

The affidavit of Mr. Stancavage.

I notice you filed this in 1980. Have there been any significant developments in this area since that time?

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BY WITNESS STANCAVAGE:

A. No, I don't think there have been any significant developments.

Q. Okay. Now, going to page 2, Mr. Stancavage, there's a description of events following a postulated LOCA there.

You say, "The drywell is pressurized by reactor steam, and a mixture of steam and air is directed to the suppression pool..." by the vents.

That air is all just drywell air, right, the kind you'd breathe if you stood in the drywell?

BY WITNESS STANCAVAGE:

A. Yes, that's correct.

Q. Does that air condense at all once it's pushed into the suppression pool, or does it just pretty much stay constant?

BY WITNESS STANCAVAGE:

A. No, the air itself does not condense when it's in the suppression pool. It's not a condensible gas, and it rises to the surface of the pool.

Q. So it's part of the swell?

BY WITNESS STANCAVAGE:

A. Yes, it is actually the driving force for the slug of water which rides on top of the air bubble.

Q. So it's the first material through the vents

-5

pretty much?

BY WITNESS STANCAVAGE:

A. I believe it would be fair to say that the mixture through the vents is more likely to be a homogeneous mixture of air and steam, but the steam itself will quickly be condensed in the colder suppression pool water, so that the driving mechanism for pool swell is primarily air.

Q. Now, in the main steam line event, postulated break, is that steam line sort of high in the air in the drywell?

This is just a geography problem for me. It appears to me it's one of the high pipes.

BY WITNESS STANCAVAGE:

A. Yes, it is relatively high in the drywell, near the reactor vessel.

Q. In the loading, then, through the vents and out to the -- well, do you assume that there's an equal discharge around the 360-degree vent wall or whatever that's called (I forget the term for it), the wall that holds the vents? Do you assume that there's a pushing out uniformly?

BY WITNESS STANCAVAGE:

A. Yes, that's an assumption that's made, that there's a uniform vent clearing, and air flows through all the vents uniformly.

-6

Q What about the steam?

BY WITNESS STANCAVAGE:

A. And the steam, also, flows through the vents in a uniform way.

Q Has there been any testing on that assumption?

BY WITNESS STANCAVAGE:

A. Yes, there has been testing on that assumption.

The most recent tests with Mark III configuration was a one-ninth scale multi-vent test which had three rows of three columns of vents, and differences were looked for in terms of pressures and flow rates through the vents and around the vents during pool swell to detect if there were any imbalances.

The conclusions were reached that essentially the flow was uniform through the vents.

Q You said it was a one-ninth scale?

BY WITNESS STANCAVAGE:

A. Yes.

Q That means in total dimensions, everything was one-ninth, right?

BY WITNESS STANCAVAGE:

A. Yes.

Q But was it a 360-degree?

//

BY WITNESS STANCAVAGE:

A. No, it was not 360-degree.

Q. So you are still postulating sort of that since it behaved uniformly through whatever section that was of the 360 degrees, it would be the same for 360?

BY WITNESS STANCAVAGE:

A. Yes, that's correct.

Q. Okay. Now, is there any kind of way you can give me an idea of the amount of steam and air there is to go through? I know it would be pretty tough to give. The volume of that?

BY WITNESS STANCAVAGE:

A. Is there any way -- I'm not sure I understand your question.

Would you ask it again?

Q. Well, what is the volume of air and steam driven through the vents?

BY WITNESS STANCAVAGE:

A. The volume of air driven through the vents is approximately 230,000 cubic feet.

Q. That's air?

BY WITNESS STANCAVAGE:

A. That's of air, and that's driven through the vents within four or five seconds after the line break.

The volume of steam is somewhat larger than

-8

that. I cannot give you at this time an exact number for it, but during the first five seconds of the break it's smaller than the amount of air, and it increases as a function of time, because the reactor continues to discharge approximately 500,000 pounds of fluid through the break during the course of a loss of coolant accident.

Q. Is the initial surge the highest surge, the highest blast through the vents, and the higher pool swell comes at the beginning then?

BY WITNESS STANCAVAGE:

A. Yes. The pool swell comes within the first three seconds after the line break.

Q. Yes, and is that the highest height of the pool swell experienced in that first three seconds, or --

BY WITNESS STANCAVAGE:

A. Yes, that is correct.

Q. -- from the discharge in those first three seconds?

BY WITNESS STANCAVAGE:

A. Yes.

Q. Were you here for Mr. Nuta's testimony yesterday by any chance?

BY MR. STANCAVAGE:

A. No, I was not.

Q. Were you there?

BY WITNESS HUCIK:

A. No, I was not either.

Q. He gave a measurement of, I think, it was 22 feet, 5 inches of the height to the HCU platform from the water in the pool. He said that -- I believe the term was at normal level.

We asked him what -- if there were times when the water would be higher and the plant still operating. He had to decline on that.

Could you answer that? Do you know?

BY WITNESS STANCAVAGE:

A. Yes. There are times when the water level can vary from the normal water level by as much as three inches either above or below the normal water level.

Q. So it's just three inches?

BY WITNESS STANCAVAGE:

A. Yes, that's correct.

Q. I see. Now, if the -- I'm referring to page 3 now of the affidavit, about in the middle. There's a discussion of impact on platforms and drag loads.

Would there be any drag loads on a platform that was a sheet, sheet metal type of platform, or a plate that was, you know, no holes? Would there be any drag loads at all?

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-10

BY WITNESS STANCAVAGE:

A. Yes. There would be drag loads on a platform, whether it had holes in it or was a solid plate.

Q. All right. Would those just be at the end of these platforms? Do you follow me?

BY WITNESS STANCAVAGE:

A. No, I'm not sure.

Q. Maybe I didn't understand what drag loads meant.

I thought that in order to have a drag load it had to pass somehow to have a drag load. How would it pass if it was a flat, no-hole platform.

BY WITNESS STANCAVAGE:

A. Okay. I understood the platform you were postulating to be f[illegible]te, have finite dimensions, so that the pool swell would a[illegible]ually flow around it.

Q. Oh, I see, [illegible]t a drag load?

BY WITNESS STANCAVAGE:

A. To get a drag load, yes. If there was total flow blockage, there would be no drag load as such.

Q. Are either of you familiar enough with Allens Creek to verify that the platforms will give total flow blockage?

BY WITNESS STANCAVAGE:

A. I'm not.

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BY WITNESS HUCIK:

A. I believe there's a requirement that at least at the HCU floor level there be a minimum opening area, which I believe Allens Creek has, for flow to go through.

Q. But that minimum opening area would be just, what, every so often going around this annulus circle? There would be one every ten feet or something like that?

BY WITNESS HUCIK:

A. Yes.

Q. Is this typical of Mark III's at this point?

BY WITNESS HUCIK:

A. Yes. All the Mark III's typically have floors with openings in various areas around that annular region of the containment pool.

Q. The idea, though, is to place an HCU where there are no openings, though, is that right?

BY WITNESS HUCIK:

A. In most plants, I think that's what they've done.

Q. I see, and yet you can walk over the openings, if necessary?

BY WITNESS HUCIK:

A. There's normally grating over the openings.

Q. Okay. There's a description of the -- There's a description of testing at the foot of the text on page 3.

-12

You mention "50 full-scale and subscale experiments." Is this testing over now, or is it still in progress? I mean, is there still more planned?

BY WITNESS STANCAVAGE:

A. Are you referring to the safety/relief valve test discussed in the footnote on page 3?

Q. No. I'm referring to the material just above it.

BY WITNESS STANCAVAGE:

A. Oh, the pool swell, okay, the 50 full-scale and subscale experiments.

These pool swell experiments are complete.

Q. I see. What stage is it at then? You have submitted your results to the NRC?

BY WITNESS STANCAVAGE:

A. Yes, the results have all been submitted to the NRC.

Q. I see. There's a statement at page 4 under Section III: "Immediately following the introduction of the BWR/6--Mark III, the General Electric Company started an extensive experimental and analytical effort to confirm the Mark III design."

Is that what you meant to say there? Is that...

BY WITNESS STANCAVAGE:

A. Yes. I believe you just read the words that

-13

are there.

Q Uh-huh.

BY WITNESS STANCAVAGE:

A. That is what I meant to say.

Q Then it goes on to say, "The purpose of the... Confirmatory Test Program was to confirm the analytical methods used to predict the drywell and containment responses."

What I want to ask is were there any predictions at that time of the hydrodynamic loads on the HCU's?

BY WITNESS STANCAVAGE:

A. As far as I understand the development of the dynamic loads on the HCU, there were no predictions for pool swell loads on the hydraulic control units prior to the conduct of these tests.

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Q. Okay. When you say "confirm" here, does that mean a use of an entirely different assessment technique working toward the same results, or does that mean redoing, sort of checking?

BY WITNESS STANCAVAGE:

A. Well, let me ask, do you mean the "confirm" in the first sentence or in the second sentence?

Q. Yes, in the first.

BY WITNESS STANCAVAGE:

A. In the first sentence. The confirmation in the first sentence refers to the fact that this Mark III design was a departure from the Mark I and Mark II designs in that it employed horizontal vents, and engineering judgment suggested that this would work; and experimental and analytical efforts were undertaken to confirm that engineering judgment.

Q. Okay.

JUDGE LINENBERGER: Sir, perhaps you can clarify that language in that same sentence.

When you talk about "introduction of the BWR/6--Mark III," I have interpreted that to mean introduction of the design concept, not introduction of a product line.

Is that the context in which you mean that?

WITNESS STANCAVAGE: Yes, that would probably

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be a better way to say it.

The idea was first proposed, and then before the designed product line was actually offered, the concept was verified analytically and experimentally.

JUDGE LINENBERGER: Thank you.

BY MR. DOHERTY:

Q. Now, you mention "small-scale tests" in the next paragraph. Were these prior to -- well, was this the one-ninth scale type of test you mentioned a while ago?

BY WITNESS STANCAVAGE:

A. No. These tests were actually smaller than one-ninth scale.

Well, maybe you know the scale.

BY WITNESS HUCIK:

A. I believe the scaling in those was about one-twelfth on those small-scale tests.

Q. Was that one-twelfth of a thousand-megawatt plant? Is that your recollection?

BY WITNESS HUCIK:

A. Yes.

Q. That was in '''1.

When was the Mark III first marketed?

BY WITNESS STANCAVAGE:

A. I believe that was done in 1972.

Q. Okay. I think at the next page you spoke of

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the Pressure Suppression Test Facility and the drywell modeling.

Is the drywell ten feet in diameter at that or is the Pressure Suppression Test Facility ten feet in diameter?

I had a little problem with that in understanding that.

BY WITNESS STANCAVAGE:

A. The drywell in the Pressure Suppression Test Facility is ten feet in diameter. The drywell itself in an actual Mark III plant is a much larger diameter.

Q. About 25 feet, at least, isn't it?

BY WITNESS STANCAVAGE:

A. I believe the diameter in a Mark III plant is on the order of 80 feet, 80 to 100 feet.

Q. Okay. Well, in the March '74 tests that you mention in the last paragraph on page 5, were there any attempts to locate the vibratory loads on equipment in those tests?

BY WITNESS STANCAVAGE:

A. No, the vibratory loads were not directly investigated during those tests.

What was investigated primarily was the behavior of the water as it rose in the air space above the suppression pool to determine how high the water went,

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how thick the water ligament was and what the characteristics of the impact loads were.

Q How many full-scale tests were done?

BY WITNESS STANCAVAGE:

A. I don't remember.

Q How much is the impact load reduced if there's a change of a water ligament to a froth, roughly?

BY WITNESS STANCAVAGE:

A. Roughly, the load goes from approximately 100 psi for a full water slug to about 15 psi for a froth load. So it's a factor of seven.

Q Well, does the Pressure Suppression Test Facility give a complete replica in these aspects as of an Allens Creek plant?

BY WITNESS STANCAVAGE:

A. Yes, it does.

Q How do you actually measure these impacts? Do you have some kind of a gimmick up there that it can hit, that water can hit? Is that how you do this?

I don't -- I've never been in such a place, so....

BY WITNESS STANCAVAGE:

A. Yeah, there's a metal plate that was put above the pool at various locations, and two kinds of data were collected.

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One was from pressure tranducers mounted on the lower placing part of the plate to catch the actual direct pressure measurements and a more accurate measurement of the integral load on the plate itself was from a load cell which is like a scale on the back end of the plate that captured the total force imposed on the plate by the rising water.

Q. It's interesting, but at the bottom of 5 and at the top of 6, you say they converted this facility to one-third scale and then ran tests to determine if -- well, apparently, there were some given floor restrictions above the pool.

That's the way I interpret that, that there are, at least in parts of the annulus, some flow restrictions.

BY WITNESS STANCAVAGE:

A. Yes, there were flow restrictions in the test, trying to simulate what typical configurations of Mark III plants might be with flow restrictions near the area at which the maximum pool swell would be expected.

Q. Are the HCU's above any of these places, to your knowledge, where there's a restriction you're just talking about?

BY WITNESS STANCAVAGE:

A. The actual HCU modules are mounted on the floor

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and the floor is the restricted -- or the area of the annulus that is restricted.

So the HCU modules are in that sense above the area that's restricted.

Q Well, when you say to me "flow restrictions." I think of something that slows down flow but doesn't stop it.

I think in yesterday's testimony Mr. Nuta said there were some cantilevered concrete platforms above -- close to the surface of the pool, but above it, of course, which would produce a flow restriction in the event of a pool swell, and it seemed as if that was planned that way, that that was desirable.

Here, I think -- well, are you saying here that a flow restriction might include a totally enclosing floor above a section of the pool?

BY WITNESS STANCAVAGE:

A Yes. In those flow restriction tests that we did, the actual roof of the facility was covered over, except for an area like an entrance hatchway, which had a variable area depending on how far the sliding panel was moved back.

This was actually considerably above the pool surface.

Q Now, are the platforms secured to the -- they are secured to the drywell; is that right?

BY WITNESS STANCAVAGE:

A. I'm not sure about that.

BY WITNESS HUCIK:

A. I believe so.

Q. Are they secured at the other end to the containment shell?

MR. CULP: Your Honor, I'm going to object to any more questions along this line.

It seems we explored this to a great extent with Mr. Nuta yesterday, and now I don't understand why Mr. Doherty is asking these witnesses the same questions.

MR. DOHERTY: I think it's appropriate on occasion to ask the same question of several witnesses to see if they agree.

JUDGE WOLFE: Objection overruled.

BY MR. DOHERTY:

Q. Do you want me to repeat the question, or do you have it in mind enough.

BY WITNESS HUCIK:

A. I believe for Allens Creek the HCU floors are attached somewhat at the drywell and cantilevered out and do not attach specifically at the containment wall.

Q. I see. Well, I've never seen an HCU, so.... Are these movable devices, typically, or are they fixed to

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the platform?

BY WITNESS STANCAVAGE:

A. I don't know how they are attached.

Q. Do you know if they are attached or are not attached?

BY WITNESS STANCAVAGE:

A. No, I don't.

Q. You can help him, if you know the answer?

BY WITNESS HUCIK:

A. Yeah, I believe they are attached to the floor to keep them stationary.

Q. I see. I think I know what you mean, but in the last paragraph of 6 you said, "Various" -- the paragraph on page 6, the latter part.

You said, "Various postulated break sizes up to two times the Design Basis Accident for the containment were tested."

Is that the main steam line break?

BY WITNESS STANCAVAGE:

A. Yes, that is two times the main steam line break.

Q. So you just postulated a main steam pipe double sized?

BY WITNESS STANCAVAGE:

A. Yes.

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Q. Okay, and is the pool uniform in width? It appears to be in diagrams.

BY WITNESS STANCAVAGE:

A. Yes, it is.

Q. On page 7 there's a discussion of impact loads and a discussion of the slug thickness. How is the slug thickness measured in an impact load test, or is it?

BY WITNESS STANCAVAGE:

A. The slug thickness is measured by a series of level probes, which are electrical contacts that behave differently when they are wet than when they are dry.

They are spaced closely enough -- close enough together in a vertical direction so that one can tell from the electrical readings how thick the slug is.

They will be dry down to a certain point. Then they will be wet where the slug is, and then they will be dry again, and the interval over which they are wet is approximately the ligament thickness or the slug thickness.

Q. Now, just reading that, are you saying there that after the pool has risen approximately 19.2 feet, we are down to two foot or less slug thickness?

BY WITNESS STANCAVAGE:

A. I'm confused by what you said. It sounded like you said when the pool swell has reached 19 feet, the slug thickness is two feet or less; is that correct?

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Q. Yes. When the swell is 19 feet above the level of the water in normal conditions.

BY WITNESS STANCAVAGE:

A. No. It's when the pool is about 12 feet above the original height of the pool surface that the ligament has dropped to two feet in thickness.

Q. Well, your statement there says, "After the pool has risen approximately 1.6 times vent submergence below normal."

I would take that to mean you would multiply 12 by 1.6.

BY WITNESS STANCAVAGE:

A. Oh, okay. The vent submergence below water level, normal pool water level, is 7.5 feet, and 7.5 times 1.6 is 12.

Q. Uh-huh, okay. So that's what the 12 refers to.

Okay. So then the last ten feet approximately is where this ligament is expected to break up?

BY WITNESS STANCAVAGE:

A. Yes.

Q. You mention a figure of 40 foot per second as bounding test data, and so I take it that's the most rapid surface velocity observed?

BY WITNESS STANCAVAGE:

A. Yes. Forty feet per second is the highest pool

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swell velocity observed.

Q How many observations were there? Can you give me an idea?

BY WITNESS STANCAVAGE:

A I'm not sure.

Do you know?

BY WITNESS HUCIK:

A I believe there were a total of 213 different tests, total.

Q Two hundred and thirteen.

Was 40 foot per second observed frequently?

BY WITNESS HUCIK:

A I believe the velocities ranged as low as 20 feet on up to around 40 feet per second, so there was quite a range.

We varied the size and other parameters, so you'd get many different conditions.

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JUDGE LINENBERGER: Mr. Doherty, perhaps you can, if you would, give us a feeling for how this line of questioning goes to either the -- how it goes to the support of the contention?

I'm just having a bit of curiosity here about it.

MR. DOHERTY: Well, I'm trying to understand what their impact load -- I'm trying to get at the strength of some of the input into their impact load calculations.

I think it's a good question to ask, when someone gives you a bounding sort of thing, to ask is that a measurement that you -- well, I think it's good to ask, first of all, how many times did you observe, you know, to get that.

And then to go into, well, did you hit 39 feet per second 212 times or something of that order, and maybe 20 foot per second once.

JUDGE LINENBERGER: Well, I guess I don't see how that's critiqueing their calculations.

True, you are getting at a --

MR. DOHERTY: I'm sorry, I can't hear you.

JUDGE LINENBERGER: -- phenomenological understanding -- I say you are getting a phenomenological understanding of what things might be going on here, but you've said the purpose is to critique their analysis, and

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I just -- I don't quite see how that's coming out of your line of questioning; but pray, continue. I just was hoping for some guidance here on what you were trying to get at.

MR. DOHERTY: Well, I am going on the assumption that the velocity of the pool would have a -- would be a sensible input into impact loading.

I may be wrong about that. I don't know for sure.

JUDGE LINENBERGER: Excuse me, sir, but --

MR. DOHERTY: Perhaps you can set me straight.

JUDGE LINENBERGER: You haven't demonstrated that these gentleman haven't given any consideration to such a matter, nor have you even asked them whether they did it.

So if that's your concern, there's a pretty direct way to kind of pin it down.

Well, I'm sorry. You conduct your cross as you see fit.

BY MR. DOHERTY:

Q. Well, would the maximum water surface velocity be a factor in determining the impact loads?

BY WITNESS STANCAVAGE:

A. Yes, they would. The water impact velocity is a major determinant of impact load.

Q. In this testing, has there been any source of

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similar testing done for other industrial, or whatever, type -- in other words, of experiments?

In other words, have you been the first people to ever try to really measure this kind of thing? Were you confronted with a totally strange situation when people started to tell you that you were going to have to measure these things?

JUDGE CHEATUM: Mr. Doherty, how does that question further your cause, any answer to that question?

MR. DOHERTY: If they can tell --

JUDGE CHEATUM: The question is, what have they done to show this or that.

MR. DOHERTY: If they can tell me that, "We did extensive background research into hurricane impacts on docks and from there we were able to find out some long-term, well-known engineering theory which supports this," or if they have to say, "No one ever did it before," then I think the Board has learned something.

JUDGE CHEATUM: What would that have to do with your contention?

MR. DOHERTY: That would show that the calculations are -- that everyone is new at this, that there's no other scientific source to look at for judging if this type of work is accurate or not.

I think it's a point worth getting.

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JUDGE CHEATUM: Okay.

JUDGE LINENBERGER: F equal MA was new to Newton, but it survived pretty well. Just because they are pioneering -- and I don't know whether they were or not, but just because they are pioneering, how does that undercut them and the credibility of what they've done?

I guess that's my problem. That is the problem we are having here.

JUDGE WOLFE: Of if you could ask a question with regard to what you know about hurricane pressures or what have you, and ask them precisely if they took that into consideration in their testing, this might impeach their testimony or their testing abilities; but this sort of cross-examination, Mr. Doherty, is really without focus.

We'll listen to a little bit more of it and then are just going to have to terminate your cross-examination.

You are going to have to be more precise and dig in there and just don't ask educational questions. You should have educated yourself before you came in.

Put questions to these witnesses and test their testimony.

All right.

MR. DOHERTY: Your Honor, I'd like to take

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a break now.

JUDGE WOLFE: We'll recess until 10 of 11:00.

(Recess taken.)

JUDGE WOLFE: All right, Mr. Doherty.

BY MR. DOHERTY:

Q. At the foot of 7, in the last sentence you speak about a reactor simulator and that it discharged air through an orifice.

Doesn't the reactor in the event of this accident, don't we get a discharge of air and steam through this orifice?

BY WITNESS STANCAVAGE:

A. Actually, during the postulated accident one gets a discharge of steam and liquid through the break, and no air at all.

The air was used in the test to provide more driving force for the pool swell, because it does not condense in the pool water, instead of steam.

Q. Was the orifice a vent size orifice, essentially? Was that part of the simulation in this test as well?

BY WITNESS STANCAVAGE

A. I'm not sure what your question was.

Q. The last word on page --

BY WITNESS STANCAVAGE:

A. Orifice?

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Q. Orifice.

BY WITNESS STANCAVAGE:

A. Yes.

Q. Was that vent size?

BY WITNESS STANCAVAGE:

A. Was that vent size?

Q. Vent size.

BY WITNESS STANCAVAGE:

A. No, that was break size. That was the orifice in the blowdown pipe which leads from the reactor vessel into the drywell.

Q. At the top of 9, what's the "pressure differential loading" there? This is a pressure on the platform itself, just an air pressure?

BY WITNESS STANCAVAGE:

A. Actually, this is an air pressure difference across an expanse of structure like a platform.

Q. I see. The "1500 square foot vent area," is that an attempt to take all the 120 vents? Is that what that would be, the sum of those areas, of 120 vents?

BY WITNESS STANCAVAGE:

A. No. The 1500 square foot or square feet of vent area is actually the open area of the floor at that point.

Q. Okay. With regard to the Pressure Suppression

Test Facility, I believe you stated earlier that the vertical dimensions were all full scale; is that right?

BY WITNESS STANCAVAGE:

A. Yes, that is correct.

Q. Now, the horizontal dimensions, are they only different as regard to using a section rather than -- do they only differ because you've had to make a section rather than have an entire full-scale containment?

BY WITNESS STANCAVAGE:

A. No. They are also reduced from a full-scale section, if you will, with full-scale vents, so that the area is one-third of the full-scale area.

In other words, looking down at the top, the area is one-third of the full-scale area.

Q. So you don't have a 120-degree section, do you?

BY WITNESS STANCAVAGE:

A. No.

Q. Then I don't understand what you said.

BY WITNESS STANCAVAGE:

A. Okay. The one-third -- the length in the vertical direction is full scale, but the cross-sectional area is one-third the area of a full-scale section of equivalent angle.

Q. Okay. That would mean like you'd have one-third of the platform, for example?

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BY WITNESS STANCAVAGE:

A. Yes, that's correct.

Q. Okay.

MR. DOHERTY: All right. No further questions of these gentlemen. Thank you very much -- on this issue.

JUDGE WOLFE: Redirect, Mr. Culp?

MR. CULP: I have no questions.

JUDGE WOLFE: Board questions?

JUDGE CHEATUM: I have no questions.

JUDGE LINENBERGER: No questions.

JUDGE WOLFE: Mr. Stancavage is to be excused permanently?

MR. CULP: Yes, sir.

JUDGE WOLFE: All right. You are excused, Mr. Stancavage.

(Witness Stancavage was excused.)

MR. COPELAND: We would like to recall Mr. Melvyn Weingart, Your Honor.

I do not recall whether Mr. Weingart was excused or not, so I would ask that he be resworn.

JUDGE WOLFE: Stand and raise your right hand.

Whereupon,

MELVYN WEINGART

was recalled as a witness and, having been first duly sworn, was examined and testified as follows:

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MR. COPELAND: As an initial matter, Your Honor, I would note his testimony has a typographical error and it should be "TexPirg A-34" instead of "A-40."

JUDGE WOLFE: "A-34"?

MR. COPELAND: Yes, sir.

DIRECT EXAMINATION

BY MR. COPELAND:

Q. Mr. Weingart, do you have in front of you the "Direct Testimony of Melvyn Weingart Regarding Additional Contention TexPirg A-34 - Hydrogen Monitoring"?

BY WITNESS WEINGART:

A. I do.

Q. Was the document prepared by you or under your supervision and direction?

BY WITNESS WEINGART:

A. It was.

Q. Do you have any corrections to make?

BY WITNESS WEINGART:

A. The only corrections I have are the ones you just identified, the reference to TexPirg A-40 is also noted on the first page on line 17 and on line 21, I guess it is. It should be A-34.

Q. Is the testimony true and correct to the best of your knowledge and belief?

//

BY WITNESS WEINGART:

A. Yes, it is.

Q. Do you adopt it as your testimony in this proceeding?

BY WITNESS WEINGART:

A. I do.

MR. COPELAND: Your Honor, at this time I would move that the direct testimony of Mr. Weingart on TexPirg Additional Contention 34 be incorporated into the record as if read.

JUDGE WOLFE: Any objection?

MR. DEWEY: No objection, Your Honor.

MR. DOHERTY: No objection, Your Honor.

MR. COPELAND: The witnesses are tendered for cross-examination, Your Honor.

I'm sorry, I jumped the gun on you.

JUDGE WOLFE: The testimony of Melvyn Weingart regarding TexPirg Additional Contention 34 is incorporated into the record as if read.

(Applicant's testimony of Melvyn Weingart concerning TexPirg Additional Contention A-34 follows:)

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

DIRECT TESTIMONY OF
MELVYN WEINGART
REGARDING ADDITIONAL CONTENTION
TEXPIRG A-~~40~~ 34 - HYDROGEN MONITORING

Q. Mr. Weingart, have you previously testified in this proceeding?

A. Yes. I testified in connection with that portion of TexPirg AC 36 (McCorkle 17) regarding charcoal adsorber fires and on Board Question 4A regarding combustible gas control.

Q. What is the purpose of this testimony?

A. The purpose of this testimony is to address TexPirg Contention A-~~40~~ 34 regarding the adequacy of the Combustible Gas Control System being provided for ACNGS. It should be noted that my testimony presented on August 25, 1981, concerning Board Question 4A/Combustible Gas Control (Tr. 15986-15923) also addresses the hydrogen control concerns identified in TexPirg Contention A-~~40~~ 34. TexPirg Contention A-40 reads as follows:

> TexPirg contends that the Applicant monitoring of in containment building events during LOCA or similar events is not adequate to detect immediately the occurrences of hydrogen explosions. That the recent

Three Mile Island incident shows that current approved containment building monitoring apparatus did not bring such an event to the attention of operators immediately, and that therefore the strong possibility existed that actions which would prevent a second hydrogen explosion were not taken. There is danger that hydrogen explosions will endanger TexPirg members because of the containment building during a LOCA is likely to contain radioactive gases which would be released from the building damaged even lightly by the explosion and in excess of 40 CFR.190 or 10 CFR 20.

Q. Is it accurate to compare the ACNGS Hydrogen Monitoring System to TMI?

A. No. The ACNGS Hydrogen Monitoring Subsystem (see PSAR Sections 6.2.5.2.2 and 7.5.1.4.2.11(d)) of the Combustible Gas Control System will be capable of withdrawing and analyzing samples from the ACNGS drywell and containment in order to provide sufficient information to the plant operators regarding hydrogen buildup inside the containment and drywell during accident conditions so that they can maintain the concentration of hydrogen below the flammability limit (4% by volume).

The hydrogen monitoring subsystem for ACNGS is significantly different than the system provided at TMI-2. To determine hydrogen concentration inside the containment at TMI-2, personnel had to go to the sample room, manually draw a sample of the containment atmosphere into a container, take the container to another area, and insert the content into a gas analyzer. As I will point out in the following discussion, the hydrogen monitoring system at ACNGS is substantially different.

Q. Can you answer the questions raised by the Board at pages 21 and 22 of the September 1 Order?

A. I believe the Board's questions can best be answered by describing the integrated combustible gas control system. The Hydrogen Monitoring Subsystem for ACNGS will be actuated from the Control Room after an accident and will then automatically provide a record over time of the hydrogen concentration at various locations within the containment and drywell for the operator's use in the Control Room. An alarm will actuate if the hydrogen analyzer detects a concentration of 3.0 volume percent. As indicated in Mr. Hucik's testimony, in connection with Doherty Contention 5, this alarm setting will provide adequate time to initiate the hydrogen control systems before the flammability limit (4% by volume) is reached.

The ACNGS Hydrogen Monitoring Subsystem, which is designed to the requirements of Regulatory Guide 1.7, will have the abil[illegible] to obtain samples from various locations within the drywell and the containment. These points are selected to provide complete coverage of the drywell and containment. The system consists of two identical analyzer trains each powered from a different emergency bus, and each having the ability to monitor any of the sample points.

Redundant connections will be provided at each sampling location (one for each analyzer). The redundant analyzer equipment will be located in the Reactor Auxiliary Building approximately 135° apart. Readouts and control capability will be provided in the Control Room.

The analyzer systems will be periodically calibrated (tested) using a 'zero' gas, i.e. a gas that does not contain hydrogen, and a span gas, i.e. a gas that contains a known hydrogen concentration. It should be noted that calibration can be accomplished remotely from the main control room. The sample withdrawal system will also be functionally tested on a periodic basis.

The Drywell-Containment Mixing Subsystem (see PSAR Section 6.2.5.2.3) is part of the Combustible Gas Control System. Its function is to dilute the hydrogen content in the drywell by mixing the drywell and containment atmospheres after LOCA. This safety related system is completely redundant with duplicate piping, equipment and instrumentation.

The mixing subsystem capacity is 500 cfm for each of the redundant subsystems. The compressor in each subsystem has the capability of transferring the containment atmosphere into the drywell and discharging it at sufficient pressure to depress the water level in the drywell weir, expose the drywell suppresssion pool vents and cause the air flow to exit through the vents. The hydrogen air mixture bubbles through the suppression pool and is then dispersed within the containment.

The ACNGS Mark III containment utilizes thermal convective mixing to assure that the hydrogen concentration throughout the containment is uniform. The mixing of the containment atmosphere is further discussed by Mr. Hucik in his testimony. PSAR Section 6.2.5.3.3 describes the various analyses performed to demonstrate drywell and containment hydrogen mixing, and hydrogen redistribution from the drywell to the containment due to the operation of the Drywell-Containment Hydrogen Mixing Subsystem.

The Hydrogen Recombiner Subsystem (see PSAR Sections 6.2.5.1 and 6.2.5.2.4) will be manually activated from the Control Room as early as 24 hours following a design basis loss-of-coolant accident but before the hydrogen concentration in the containment reaches 3.5 volume percent, to ensure that the four volume percent is never exceeded following a design basis LOCA.

The Hydrogen Recombiner Subsystem consists of two redundant thermal units (such as the recombiners manufactured by Westinghouse Electric Corp.) located inside the containment; one at elevation 207.33 feet and the other at 232.25 feet, approximately 150° apart. The power supply panels are located in the Reactor Auxiliary Building at elevation 164.00 feet. Controls for the Hydrogen Recombiner are located in the Control Room.

Hydrogen recombination is a thermal process, using heat to cause recombination of the hydrogen and the oxygen in air to form water vapor. The recombiners for ACNGS utilize natural convection as the driving force to circulate containment atmosphere through equipment for processing. The recombiners are designed to maintain containment hydrogen concentration below 4 percent by volume.

The subsystem consists of an inlet preheater section, a heater-recombination section and an exhaust chamber. When the recombining subsystem is initiated from the Control Room, the heating elements within the recombiner are energized, increasing the temperature of the recombination section. Containment atmosphere is drawn first into the preheater section at a controlled flow rate, then into the heater-recombination section where water vapor is formed due to the high temperature of approximately 1,150°F. Following the high temperature section, the hot water vapor/air mixture is cooled down to approximately 50°F above the ambient temperature in the containment.

There are no moving parts or piping between sections. The unit is completely enclosed and the internals are protected from impingement by containment spray. The inlet and outlet ports employ a louver arrangement to permit containment atmosphere to flow through the unit. In addition, a major advantage of this design is that there are no catalysts employed which could be subject to degradation by "poisoning".

The Westinghouse recombiner design has been thoroughly tested to assure their performance during post LOCA conditions. Westinghouse Document WCAP-9347 entitled "Qualification Testing for Model B Electric Hydrogen Recombiner" dated July, 1978 and reports referenced therein, reports the results of the latest testing program for this type of recombiner. These test results confirm that the hydrogen recombiner of the size and type to be used at ACNGS will perform as indicated on PSAR Figure 6.2-29.

For testing purposes, each recombiner will be energized once every six months at 10KW for five minutes, to check the electronics and to apply voltage to all other electrical components. In addition, once a year, a heating test will be performed, allowing temperature to stabilize at operating conditions, to check calibration of the unit and proper operation of heaters.

The Containment Hydrogen Purge Sub-System, PSAR Section 6.2.5.2.5, (CHPSS) is a part of the Combustible Gas Control System and has the capability to purge the Containment atmosphere through the Stand-by Gas Treatment System (SGTS) at a sufficient rate (equivalent to the processing capability of the hydrogen recombiners) to control hydrogen concentration below 4% by volume. This post accident purge capability as a backup to the hydrogen recombiner is provided in accordance with Item C4 of Reg. Guide 1.7, Rev. 1 (September 1976). The CHPSS is designed to exhaust the air-hydrogen mixture from the Containment to the Shield Building Annulus for dilution and "hold-up" and replace it with filtered air. The Air-Hydrogen mixture in the annulus is then filtered through the SGTS before final release to the environment.

MR. COPELAND: I will now tender them for cross-examination.

I thought I could do that in my sleep, but I guess it's....

(Laughter.)

JUDGE WOLFE: Mr. Sohinki?

MR. DEWEY: The Staff doesn't have any cross-examination, Your Honor.

JUDGE WOLFE: Mr. Doherty?

MR. DOHERTY: Yes, Your Honor. Thank you.

CROSS-EXAMINATION

BY MR. DOHERTY:

Q. Mr. Hucik, part of this contention is -- you are submitting some, too, right? Okay.

At page 3 of the testimony, at line 21 you are listing some convection promoters, I guess we could call them, and one of them you lisced is a containment wall.

Are you speaking of the steel shell or are you speaking of the --

BY WITNESS HUCIK:

A. Yes, it's the steel shell of the containment building itself.

Q. That's about an inch thick, isn't it?

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-12

BY WITNESS HUCIK:

A. I believe it varies in thickness, but it averages about an inch and a half or so in thickness.

Q. Is there any way the shield building can function the same way, to your knowledge?

BY WITNESS HUCIK:

A. The shield building will act as a heat sink itself, yes.

Q. Were any of these heat transfer mechanisms ever measured in any way?

BY WITNESS HUCIK:

A. In some of the Pressure Suppression Test Facility work that's been done, you know, in the previous pool swell area, they have a simulated drywell wall there for our drywell vessel, and there were tests conducted where that drywell vessel was heated to about 300 degrees above the saturation temperature, and there were also tests run where it was not heated, and steam was injected into that vessel.

So there was a qualitative measure of the amount of condensation that steel structures will give for the type of environment that we would see.

So we've had some test data that we got indirectly that does support good condensation. There's also additional data in the industry that helps support that.

Q This is qualitative data, though?

BY WITNESS HUCIK:

A. Yes, it was more qualitative. The tests were not directed at obtaining that information.

Q You also mention that there's a "mass transfer mechanism: additional density gradient due to changing hydrogen concentration near the pool surface."

First of all, does that mean that the hydrogen concentration will decrease near the pool surface?

BY WITNESS HUCIK:

A. Yeah, basically, the hydrogen will come out of the pool surface, so your main concentration will be right at the pool surface level, and then as that diffuses and basically moves off with the air in that, the concentration will obviously drop from right at the pool surface where it emanates.

So there is a concentration gradient from the pool surface on up into the containment volume.

Q Okay. Now, how does a concentration gradient, how does that encourage movement, or does it?

BY WITNESS HUCIK:

A. Well, the concentration gradient will effectively tend to mix the hydrogen gas. It moves -- you know, gases, ideal gases, will move from a high concentration

-14

to a lower concentration to try and reach equilibrium.

Q Yes.

BY WITNESS HUCIK:

A. Therefore, at the high concentration levels near the pool surface, the hydrogen will tend to move off into lower concentration areas.

Q Okay. At line 15 you speak about "bulk concentration." Is that meant -- the term "bulk concentration" throws me.

Does that just mean the concentration of the whole containment?

BY WITNESS HUCIK:

A. It's the total average, right.

Q Okay. There's a figure that you provided. Is that intended to show just the hydrogen from radiolysis and what happens to it?

BY WITNESS HUCIK:

A. I believe this is the total hydrogen concentration in the wetwell and drywell, including the radiolysis.

Q I see. Now, in looking at this, my Figure 1 says something about "Alto Lazio." Does yours?

BY WITNESS HUCIK:

A. Yes.

Q Then it says, "Wetwell and Drywell Hydrogen Concentration Following DBA." Was there anything else

-15

written there at all that I just didn't get?

It looks like there was something maybe --

BY WITNESS HUCIK:

A. No, that should be the full title there.

Q. That's the full title?

BY WITNESS HUCIK:

A. You have "Figure 1" in the left-hand corner that....

Q. Yes. What is your understanding of the conservative assumptions in Reg Guide 1.7, or very conservative assumptions?

BY WITNESS HUCIK:

A. A couple of the main conservative assumptions have to do with the release of the hydrogen from the core within the first two minutes.

That's an assumption that the Reg Guide 1.7 states that you use in your analysis, and the second conservative assumption is the amount of cladding that's assumed to react with the water in the metal/water reaction which generates the hydrogen. That's normally five times the calculated metal/water reaction that is used in much of the Appendix K calculations for emergency core cooling system analysis.

So there's sufficient level of conservatism there in the amount of hydrogen and the rate of hydrogen

3-16

generation.

Q What's the source of Figure 1?

BY WITNESS HUCIK:

A Figure 1 is the result of an analytical model calculation of the hydrogen generation rates following the Reg Guide 1.7.

It's basically a computer plot of the analytical results.

JUDGE LINENBERGER: Excuse me, sir, but on that point, since we're discussing Figure 1, there's a solid curve and a curve -- or a collection of triangular, presumably data points.

Which representation stands for what? The solid curve first, what does it....

WITNESS HUCIK: That may go back to Mr. Doherty's question. I actually have another figure and there was something left off the title, so I'll change my statement earlier.

On the figure that I have, the triangles denote the wetwell region, which is the containment region, and the solid line denotes the drywell region.

So, yes, there was something left out of the title there. I'm sorry.

JUDGE LINENBERGER: Thank you.

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3_17

BY MR. DOHERTY:

Q. On the assumption with regard to the amount of hydrogen generated from the cladding, do you know, first of all, if the Reg Guide 1.7 you were using, do you know if that was one of the revisions?

BY WITNESS HUCIK:

A. The Reg Guide that I have is Revision 2, dated November 1978, Reg Guide 1.7.

Q. Does that assume 30 percent?

BY WITNESS HUCIK:

A. Thirty percent for what?

Q. Thirty percent of the cladding is oxidized?

BY WITNESS HUCIK:

A. This revision tends to mention in terms of the amount of metal of the cladding surfaces. It doesn't necessarily state a percentage, as far as I can see.

Q. It says 30 percent of the metal or what?

BY WITNESS HUCIK:

A. It just says it goes to a certain depth of the metal.

Q. Does it give a depth?

BY WITNESS HUCIK:

A. Yes, it gives a depth of .00023 inches.

Q. Okay. Mr. Weingart, I'm going to ask some questions from your testimony.

3-15

On the hydrogen monitoring system on page 3, line 4, is it your understanding that the system sort of -- well, I use the phrase lies in wait.

Is it your understanding that this system is passive until called upon?

BY WITNESS WEINGART:

A. That's correct.

Q. Is it tested? Do you know anything about testing of it?

BY WITNESS WEINGART:

A. Yes, it's tested periodically to make sure that the components are functional from an operation standpoint.

Q. Is the system in use in any other plant so that we might have an idea what the surveillance requirements are?

BY WITNESS WEINGART:

A. These systems are installed in all the plants now.

Q. What are the typical surveillance requirements; do you know those?

BY WITNESS WEINGART:

A. They are periodically calibrated using a zero and a span gas.

They also energize the pumps that are associated

3-19

with them, the removal system.

Q. It's the period I'm interested in; do you know?

BY WITNESS WEINGART:

A. The period, I believe, gets into a tech spec situation, whatever is required by the tech specs.

Q. Okay.

BY WITNESS WEINGART:

A. I'm not sure exactly how frequently it is tested, but it is tested.

Q. Now, after an accident, you state there will be automatically provided a record over time.

Is this a paper record type of thing?

BY WITNESS WEINGART:

A. Yes, we use recorders in the main control room.

Q. Okay. There's a volume percent there which is an alarm set point, I guess you'd say.

Is this arranged so that it will alarm if the volume reaches three percent at any one place?

BY WITNESS WEINGART:

A. That's correct.

Q. Okay. How accurately is this device at hitting three percent?

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3-21

BY WITNESS WEINGART:

A. Well, the accuracy is about two percent full scale.

Q. Okay.

JUDGE LINENBERGER: And full scale corresponds to approximately what?

WITNESS WEINGART: Well, if you had zero to ten percent, it's accurate within two percent of the total scale.

JUDGE LINENBERGER: I understand the arithmetic, but what is proposed as the full-scale value for the instrumentation?

WITNESS WEINGART: What we are looking at right now is a dual range monitor. It hasn't fully been pinned down yet, but what we're looking at is possibly a zero to ten and a zero to thirty percent range.

A lot of the monitors that are going in now are zero to four percent. We haven't pinned down the low range yet.

JUDGE LINENBERGER: Thank you.

BY MR. DOHERTY:

Q. Is there a sampling station at the top of the drywell above the reactor pressure vessel?

BY WITNESS WEINGART:

A. Would you repeat that, please?

Q All right. I wanted to know if one of the stations, one of the alarm -- I don't know what you call them -- things in the ceiling -- is above the reactor pressure vessel in the drywell?

BY WITNESS WEINGART:

A. There's one in the vicinity of the top of the drywell.

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JUDGE LINENBERGER: Mr. Weingart, with respect to Mr. Doherty's last question and as an aid to understanding your answer, can you perhaps refer to Exhibit 1 associated with Mr. -- with the Stancavage/Hucik testimony which shows a line drawing.

WITNESS HUCIK: Figure 1.

JUDGE LINENBERGER: My Exhibit 1 does not look like what I see you showing there. Where is that?

WITNESS HUCIK: I've got it here.

JUDGE LINENBERGER: Well, perhaps the other figure you had is more appropriate. I'm just wondering where it occurs.

WITNESS WEINGART: The figure that I have was in Mr. Fields' testimony -- the Staff's testimony on the same subject. It's a PSAR figure.

JUDGE LINENBERGER: Mr. Doherty, please excuse the interruption, but I think it is important to find out what these locations are that you're asking about. And I haven't understood his answer to your question.

I want to get out a PSAR figure, and let's see if it's the same.

6.2-1.

WITNESS HUCIK: Do you want to borrow mine?

JUDGE LINENBERGER: Is it 6.2-1, a PSAR figure?

WITNESS WEINGART: I don't have a number. I just happened to bring the testimony from Mr. Fields along. I don't have the exact PSAR figure number.

(Witness Hucik hands document to Judge Linenberger.)

JUDGE WOLFE: Mr. Copeland, do you have that figure from the PSAR, 6.2-1? We'd like the witness to use that.

MR. COPELAND: I can go get it, Your Honor.

WITNESS HUCIK: You can borrow this one if you like.

MR. COPELAND: Your Honor, if we could take a short break, I think there's a figure in the PSAR that shows the actual location of the monitors, rather than try to mark up something.

JUDGE WOLFE: All right.

WITNESS WEINGART: It is a Chapter 7 figure.

JUDGE WOLFE: All right. We will have a short recess in place.

(Pause.)

MR. COPELAND: Your Honor, I have just distributed a partial copy of Figure 7.5-9(a) from the PSAR.

JUDGE LINENBERGER: Okay. I guess since I caused this hiatus, I should close the loop here. Before

I injected myself, Mr. Doherty had asked you, Mr. Weingart, about the location of -- well, my words would be -- the location of the uppermost intake station for the hydrogen monitoring system.

I'm not sure that Mr. Doherty phrased it as the uppermost. But with respect to Figure 7.5-9, can you say approximately where the uppermost intake station for the hydrogen monitoring system is located?

WITNESS WEINGART: Your Honor, I think he referenced the drywell specifically, if I'm not mistaken.

JUDGE LINENBERGER: He did reference the drywell?

MR. DOHERTY: Yes.

JUDGE LINENBERGER: Okay, fine.

WITNESS WEINGART: In response to that, you'll notice that there are three points in the top of the drywell, number two, three and four.

JUDGE LINENBERGER: Yes.

WITNESS WEINGART: Those are three sample points at the top of the drywell area.

JUDGE LINENBERGER: All right. As long as I'm interrupting, just above the top of the RPV, there is a horizontal line drawn across the full diameter of the containment building.

Is there a sample point above that horizontal

4-4

line?

WITNESS WEINGART: Yes. Sample Point No. 5.

JUDGE LINENBERGER: No. 5. Thank you, sir.

I'll get out of this act right now. Sorry for the interruption, Mr. Doherty, but this, I think, will be helpful later.

BY MR. DOHERTY:

Q Now, above the RPV, but below that long horizontal line which goes almost -- it almost measures the -- it looks like it measures the containment shell -- the diameter.

There is a line drawn which kind of resembles a wicket or a -- it's the only line between the representation of the metal reactor head and the long horizontal line, and it is sort of a U-shape -- inverted U-shape.

Is that line a barrier to hydrogen or to any gas moving, or is that penetrated by --

BY WITNESS WEINGART:

A I'm sorry, I don't understand your question.

Q Perhaps I could show the witness the diagram --

JUDGE WOLFE: Yes, you may approach the witness.

BY MR. DOHERTY:

Q It's Figure 7.5-9(a).

/

BY WITNESS WEINGART:

A. To the best of my knowledge, that is a solid area, but it does prevent a barrier.

Q. Uh-huh.

JUDGE LINENBERGER: Mr. Weingart, can you identify for the record how that structure is designated? Is there a name for it or something, so that the record is clear here?

WITNESS WEINGART: There is a name for it. I think it is the drywell head.

MR. COPELAND: How about the drywell closure head?

WITNESS WEINGART: Drywell closure head.

JUDGE LINENBERGER: Fine, thank you.

BY MR. DOHERTY:

Q. Do you believe that that space above the reactor -- directly above the reactor that we've referred to could be adequately monitored by Stations 2, 3 and 4?

BY WITNESS WEINGART:

A. I believe Station 2 would provide a fair monitoring of that.

Q. Do you believe that the gas located in that space could not reach four percent -- 4.0 volume percent before the alarm point of 3.0 volume percent were reached at Alarm Station 2?

4-6

BY WITNESS WEINGART:

A. I would say that's probably correct.

Q. What do you base this on, some experience of yours in this kind of thing or --

BY WITNESS WEINGART:

A. I base this on the thorough mixing that's going on in that area -- a tremendous amount of convective mixing and what not. I would anticipate that any hydrogen that is in there will be thoroughly mixed with the drywell atmosphere via the purge blowers that are initiated approximately 30 minutes after the -- one hour after the accident.

Q. Do the purge blowers have direct fanning of this area?

BY WITNESS WEINGART:

A. We are presently evaluating this particular item. The purge blowers in the present design discharge directly into the drywell from the containment.

There are several plants which take a bypass line up into this area, and we are in the -- or will be evaluating this during the FSAR phase to see that -- if we have a problem in this area.

If we do find that we have a stagnant area, we will modify our dischargers on our purge blowers. That is one option for correcting the problem.

4-7

Q Okay. On page 4 you talk about the mixing subsystem. How many of these subsystems are there? Just one?

BY WITNESS WEINGART:

A. No, there is a redundant system. There are two blowers.

Q You said, "The mixing subsystem capacity" -- at Line 13 -- "is 500 cubic feet per minute for each ... system."

Does that mean that it can draw 500 cubic feet through itself, or what --

BY WITNESS WEINGART:

A. Yes, it draws 500 cubic feet per minute from the containment and pressurizes the drywell at that rate. If you'll recall my last testimony, I described the system, which basically pressurizes the drywell to a high enough pressure to uncover the suppression pool vents and thus allow the drywell atmosphere to bubble through the suppression pool into the containment.

Q How long would it take for this pressure to build up, using this blower system, roughly?

BY WITNESS WEINGART:

A. I don't have an exact number on that. If you'll refer to -- here we go again with figures -- Figure 6.2-29 of the PSAR, it indicates that the containment concentration starts to increase within the first few hours after the purge blowers are turned on, and the dry-well decreases in an associated amount.

So I would say you're talking in hours before you start to uncover the vents. That's my own opinion on this.

Q Are you the person from Ebasco who has to see that this is done, that these blowers and so forth can meet some kind of time criteria?

BY WITNESS WEINGART:

A. The criteria for the blowers is set by, I believe, General Electric. It's a standard criteria -- 500 cfm.

I do not directly procure the blowers, or specify the blowers.

Q Okay. Looking at Page 5, in previous -- well, in your testimony you mention at Line 14, " ... such as the recombiners manufactured by Westinghouse ...."

Do you know if tha Westinghouse units are to be used?

BY WITNESS WEINGART:

A. We have not purchased them yet, but that's the manufacturer from whom we intend to procure.

Q Is the one from whom you intend -- is that what you said?

4-9

BY WITNESS WEINGART:

A. Yes.

Q. Now you mention there power supply. Do you know the source of that power? Will that be off-site, or do you know anything about that?

MR. COPELAND: Object to the relevance of that, Your Honor.

MR. DOHERTY: Okay, I'll try again in a different way.

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4-10

BY MR. DOHERTY:

Q Will there be a way for the control room to know that there is power available to operate the recombiners?

BY WITNESS WEINGART:

A Yes, there will be readouts in the control room.

Q When you say readouts, that will be a sort of system saying "Power adequate"?

BY WITNESS WEINGART:

A Well, you'll have temperature readouts on the unit. If the temperature is where it's supposed to be, then you know you have power to it.

Q Yes. But if you're not using it, will you know that it's available anyway?

BY WITNESS WEINGART:

A I'm not sure I understand your question.

Q Well, you know any electric appliance that doesn't have a pilot light or something, you assume will work, and then ever so often when it doesn't work, you don't know it until you try it.

BY WITNESS WEINGART:

A The recombiners are on emergency power supplies, both are diesels.

Q There will be two recombiners?

4-11

BY WITNESS WEINGART:

A. That's correct.

Q. Okay. At Page 6, you state that the unit is completely enclosed and the internals are protected from impingement by containment spray.

It's a small point, but the containment spray does no protecting, does it?

BY WITNESS WEINGART:

A. Would you repeat that?

Q. The containment spray itself isn't protecting this at all? In other words, the -- It almost reads "from impingement by containment spray." Is the containment spray protected from impingement?

That's not what you mean?

BY WITNESS WEINGART:

A. No, what I mean -- I don't want to put words in your mouth, but what I mean is when the containment spray is spraying in that area, it will not affect the operation of the recombiner by impinging on the recombiner.

Q. Well, is this recombiner -- it's a method of heating hydrogen. But is its covering itself extremely hot, to your knowledge?

BY WITNESS WEINGART:

A. No, it's a steel --

4-12

Q Casing?

BY WITNESS WEINGART:

A. Casing, yes.

Q So when the containment spray hits it, you don't see any problem with that?

BY WITNESS WEINGART:

A. No.

Q -- spiriting up a reaction or anything. Okay.

Do you still have Figure 6.2-29 there? Do you still have it out?

(No response.)

Now, do those tests -- Does that figure report the use of that system in a containment such as -- the size of ACNGS?

BY WITNESS WEINGART:

A. These curves are based on the containment -- of a Mark III containment of the nature of Allens Creek.

Q And the size of Allens Creek?

BY WITNESS WEINGART:

A. Yes.

Q Okay. Now, I note here that the containment hydrogen purge subsystem is a backup system; is that a fair --

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4-13

BY WITNESS WEINGART:

A. That's correct.

Q. And if ever required, it would need this space between the shield building and the shell, right?

BY WITNESS WEINGART:

A. The annulus.

Q. Okay. Just what is the design pressure for that "hold-up" space?

BY WITNESS WEINGART:

A. I'm not sure off the top of my head.

Q. Okay.

MR. DOHERTY: I have no further questions. Thank you very much.

JUDGE WOLFE: Redirect, Mr. Copeland?

MR. COPELAND: No, sir.

JUDGE WOLFE: Board questions?

JUDGE CHEATUM: I have no questions.

BOARD EXAMINATION

BY JUDGE LINENBERGER:

Q. Gentlemen, is the hydrogen recombiner system of the Westinghouse type that you have been discussing intended to cope with hydrogen build-up subsequent to a core degradation accident?

BY WITNESS WEINGART:

A. No, it is not.

4-14

Q The TexPirg contention that presumably prompted this testimony talks almost exclusively about detecting hydrogen explosions and about the potential danger of hydrogen explosions.

Now, I note that you gentlemen have not discussed hydrogen explosions at all. I put the following question, which either one of you may answer: Why is it that your testimonies do not go to the subject of hydrogen explosion?

BY WITNESS WEINGART:

A. The purpose of the systems is preventative in nature. In other words, we put the hydrogen analyzers in to detect the levels. We put the recombiners in and the purge systems to remove the hydrogen to prevent explosions. We don't want explosions. We want to prevent them from happening by use of this equipment.

That is the intent.

Q Mr. Hucik, do you have anything to add to that?

BY WITNESS HUCIK:

A. No.

Q All right, sir. That leaves a gap in my understanding. You speak of this system as one designed to prevent a hydrogen explosion. My understanding of -- perhaps faulty -- the nature of these Westinghouse recombiners is such that I would be inclined to conclude that

4-15

if there were a core degradation event, let's say -- a power plant event leading to core degradation and associated therewith interaction of fuel cladding with steam, that none of the systems you've talked about today would indeed prevent reaching an explosive condition.

So therein lies the hole. You've said these are to prevent explosion, and I think I see a regime of accident conditions where it would not so prevent.

Would you comment, please?

BY WITNESS WEINGART:

A. These systems are designed based on the requirements of Regulatory Guide 1.7 and 10 CFR 50.44. The Staff of the NRC is presently in a rulemaking on what -- on the degraded core situation.

HL&P has discussed in previous testimony what we call the post-accident inerting system, which is a design to handle the degraded core situation.

Q. Therefore, it is not strictly correct to characterize the system that today's testimony is talking about as being one whose purpose is to prevent hydrogen explosions under all accident conditions; is that correct?

BY WITNESS WEINGART:

A. That's correct.

The system we are talking about is based on the -- as I said before, the Reg Guide 1.7 requirements.

4-16

Q. With respect to the recombiner, is there -- given the temperature at which they're intended to operate -- and I don't remember whether you've mentioned that temperature or not -- but given the proposed operating temperature for the recombiners, is there a minimum level of hydrogen concentration for which they do not work?

BY WITNESS WEINGART:

A. They are designed to operate at -- initiating at about 3 1/2 percent. The lower the concentration of hydrogen, the less efficient they will be, as is any recombiner.

Q. Is it just that the efficiency slowly falls off, or is there a threshold concentration at which they start to work for the operating temperature proposed?

BY WITNESS WEINGART:

A. Regarding these recombiners, I don't really know what the threshold is.

Q. Well, do you know whether there is a threshold, even though you don't know where it is?

BY WITNESS WEINGART:

A. Theoretically, if you heat oxygen and hydrogen up to 1150 degrees, you get complete recombination.

Q. Even though the starting concentration of hydrogen were only one-hundredth of one percent?

4-17

BY WITNESS WEINGART:

A. I said theoretically. I really don't know.

Q. Okay, fine. Let's not dwell on that.

Your testimony indicated that there are two recombiners, and you gave elevations for them. The elevation of the upper one, I believe you gave as 232 feet approximately.

BY WITNESS WEINGART:

A. That's correct.

Q. If I look at PSAR Figure 7.5-9 and compare it with PSAR Figure 1.2-8, I learn that Elevation 232 feet occurs very closely at the horizontal line shown on Figure 7.5-9 located just above the drywell closure head.

Now, does that represent a level at which the upper recombiner is supported or mounted?

BY WITNESS WEINGART:

A. I don't have the other figure that you're referring to.

I would --

Q. Well, what is your understanding as to where the upper recombiner is located relative to Figure 7.5-9?

BY WITNESS WEINGART:

A. It's up in the area that's broadly called the -- where it's indicated as RWCU pump area. It's up in that area.

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They both are up in that area.

Q. They both are?

BY WITNESS WEINGART:

A. Yes.

Q. Well, all right. I have -- excuse me, I'm not trying to nit-pick here, but your testimony at Page 5 gives the lower one at an elevation of 207 feet. And I have a PSAR Figure 1.2-8 that places 207 feet considerably below that RWCU pump area.

Now, is there -- Am I missing something, or has there been a change?

BY WITNESS WEINGART:

A. I don't think you're missing anything. I think this drawing may be somewhat misleading. I don't have your other drawing, but they're both in the containment area.

The 207, I believe, is the operating deck of the containment, and the 232 is the elevation -- one elevation above the operating deck.

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BY JUDGE LINENBERGER:

Q Again, with respect to .igure 7.5-9, do all of those circled Arabic numbers represent sampling points?

BY WITNESS WEINGART:

A That's correct.

Q I want to just hold up for your glimpse at that distance Figure 1.2-8 of the PSAR just for the sake of illustrating that it shows tremendous structural complexities within the volume we're talking about and location of many items of equipment; and when I compare that with Figure 7.5-9, I get two differing feelings about how well hydrogen is going to mix or not mix.

Now, I think I've heard in discussions with Mr. Doherty an aspect of the situation that did not come through in the prefiled testimony; namely, in discussions with Mr. Doherty there was a discussion of purge blowers for the purpose of mixing or circulating hydrogen.

The impression I got from the testimony that was prefiled is that the problem is solved.

The impression I got from the purge blower discussion is the problem is still being looked at and it is yet to be determined whether there may be a problem in adequate mixing.

Now, have I misinterpreted? I don't want to put words in your mouth, but I get two different feelings from what I've heard and what I've read.

BY WITNESS WEINGART:

A. Let me try to clarify it.

Q. All right, sir.

BY WITNESS WEINGART:

A. The purge blowers are -- they are really not -- they are for dilution of the hydrogen and transfer into the containment.

The specific area that was brought up as questionable is an area that is subject to some discussion or some additional consideration.

The sample points, the purge blower discharges as they are right now are based on GE standard plan, the locations and everything else.

We intend during the FSAR stage to fully evaluate the sample point locations, to fully evaluate the air flow patterns in the drywell, and if we find a particular spot that we have a problem with, we will take corrective action to rectify the problem.

The key here is that this work will be done during the operating license stage. It's something that we have to see the final product to fully evaluate all the sample point locations and do the air flow analyses that have to be done to determine whether or not we need a sample point in a given spot.

Q. All right. For just a moment, back to the subject of the two recombiners, will they -- is it intended that they both -- that operation of both of them be initiated simultaneously, or that they both function reasonably simultaneously, or is one a backup to the other?

BY WITNESS WEINGART:

A. One is a backup to the other.

Q. How is it decided which is the one that's the backup and which is the one that the button is pushed on in turn, since they are at two different elevations; or is this something yet to be determined?

BY WITNESS WEINGART:

A. I would say that it's something to be determined. In my own mind, I don't think it really matters which one you turn on. Operator discretion.

Q. Did I understand correctly -- let me check something -- that several hours are required for the recombiners to come to temperature, three hours warmup time?

BY WITNESS WEINGART:

A. That's correct.

Q. Well, I don't know what your analyses are going to show down the road a ways, but is the length of this warmup time something that can be, say, cut in half

5-4

by just putting more electrical power to the recombiner, to bring them up to temperature faster, or is this --

BY WITNESS WEINGART:

A. No, I don't think that would do that, because the three hours is the length of time the manufacturer recommends.

You do have plenty of time to turn these recombiners on. You are not talking of a matter of hours or minutes until they are needed. You are talking days.

Q. For the non-degraded core --

BY WITNESS WEINGART:

A. Non-degraded core situation.

Q. -- situation.

JUDGE LINENBERGER: Thank you. That's all I have, Judge Wolfe.

JUDGE WOLFE: Cross on Board questions, Mr. Dewey?

MR. DEWEY: No, sir.

JUDGE WOLFE: Mr. Doherty?

RECROSS-EXAMINATION

BY MR. DOHERTY:

Q. I know the recombiner locations are not nailed down tight, but I'm wondering what it is in your judgment that makes you think it can be left to operator judgment which one to turn on, since there is the height difference

5-5

and that height isn't just height alone. There's also difference in objects.

BY WITNESS WEINGART:

A. Mr. Doherty, the recombiners, the locations are really independent of how effective they are going to operate.

There's total -- there's a mixing condition in there and convective mixing and various thermal gradients are going to move that hydrogen around -- that air around in the containment.

In addition, the recombiners, due to the heat that the heaters generate within themselves, also fosters air movement.

So I don't see where there's any problem at all whether you turn on the one at the lower elevation or the one at the elevation above. They'll both function adequately.

Q. So then what you are saying is that even though there may be barriers, these convective abilities will still be sufficient such that that large open area at the top above the horizontal line that we've talked about so much would still be reachable by one of the lower recombiners?

BY WITNESS WEINGART:

A. Well, your area where the recombiners are located themselves is up in that free area.

Q Well, isn't one not, though?

BY WITNESS HUCIK:

A. Maybe I can try and clarify something here. The Figure 1.2-8 that the Judge here mentioned, if I'm not mistaken, that picture may look fairly cluttered due to the fact that you are looking through one cut through the containment and they have, I believe, rotated a lot of the equipment into this view to look at it.

So if you were to really look at a 360-degree range of the containment, it would not be as cluttered as this drawing tends to show you; but there's a lot of equipment in there.

The elevation change here is not that critical, as he is saying, though.

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BY MR. DOHERTY:

Q Well, is there a solid 360-degree barrier above the drywell as a drywell top, sort of? Just from the drywell walls inward?

BY WITNESS WEINGART:

A. No.

BY WITNESS HUCIK:

A. No. That imaginary line on that PSAR Figure 7.5-9(a) --

Q All right, we don't understand each other because that line is not what I'm referring to. There is a -- If you look at Figure 1.2-8, there is a drawing -- There's drywell walls in there. It's apparently walls moving toward the center line, just one -- at the same elevation.

It's -- It appears solid. Is that what you're saying is not solid, that -- It also appears on Figure 7.5-9(a) directly above the number four?

BY WITNESS HUCIK:

A. Those are the drywell ceiling, and those are indeed solid.

Q Those are solid.

BY WITNESS HUCIK:

A. It's the one up above that is not solid.

Q Yes. All right.

MR. DOHERTY: Thank you.

JUDGE WOLFE: Redirect, Mr. Copeland?

MR. COPELAND: I'm afraid I didn't understand anything that just occurred. I have no redirect.

JUDGE WOLFE: Mr. Weingart is to be permanently excused?

MR. COPELAND: Yes, sir.

JUDGE WOLFE: All right. You're permanently excused, Mr. Weingart.

(Witness Weingart was excused.)

JUDGE WOLFE: We will recess until 1:30.

(Whereupon, at 12:15 p.m. the hearing was recessed, to reconvene at 1:30 p.m. of the same day.)

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AFTERNOON SESSION

1:30 p.m.

JUDGE WOLFE: All right.

MR. COPELAND: Your Honor, over the lunch period we checked once again on the location of these hydrogen recombiners. And I would like to represent to the Board that Judge Linenberger was correct in his reading of the elevations.

And Mr. Weingart has checked the figures again, and you were correct in your determination that the elevations which show the recombiner to be outside of the RWCU area as shown on Figure 7.5-9(a).

That figure is just not very representative of what actually is in there.

At this time, Your Honor, we would like to move on to Mr. Hucik's testimony on SRV reliability. That testimony was previously incorporated into the record following Page 16,146 of the transcript on August 26, 1981.

Whereupon,

STEVEN A. HUCIK

resumed the stand as a witness and, having been previously duly sworn, was examined and testified further as follows:

MR. COPELAND: I will now ask Mr. Hucik if he has a copy of his testimony in front of him.

THE WITNESS: Yes, I do.

DIRECT EXAMINATION

BY MR. COPELAND:

Q. Do you have any corrections you would like to make at this time, Mr. Hucik?

A. No, I do not.

Q. Are the answers provided therein by you true and correct to the best of your knowledge and belief?

A. Yes, they are.

Q. Do you now adopt those answers as your testimony in this proceeding?

A. Yes, I do.

MR. COPELAND: I would move for the admission of his testimony now, Your Honor.

JUDGE WOLFE: It is my recollection that his testimony was incorporated in the record, subject to voir dire if necessary, and subject to a motion to strike, if any.

So it has already been incorporated, subject to the condition of voir dire or motion to strike. Do you have any voir dire?

MR. SOHINKI: No, sir.

JUDGE WOLFE: Mr. Doherty?

MR. DOHERTY: No, Your Honor, I have no voir dire.

JUDGE WOLFE: All right.

BY MR. COPELAND:

Q. Mr. Hucik, as Judge Wolfe noted earlier this morning, you were not able to be here as originally scheduled because you were in Taiwan; is that correct?

A. That is correct.

Q. Could you explain what you were doing in Taiwan?

A. Actually, the purpose of my trip to Taiwan was to monitor some safety/relief valve testing being done at the Kuosheng Nuclear Plant in Taiwan with the first Mark III containment system actually in operation down there.

The same valves, the same quencher system that's being used on Allens Creek was actually tested in the Kuosheng Plant, and that's what I was there for.

Q. Did the results of those tests confirm the answers that you have provided in your testimony?

A. Yes, it confirmed it.

MR. COPELAND: Thank you. I now tender the witness for cross-examination.

JUDGE WOLFE: Unless my recollection of the record is wrong and Mr. Hucik's testimony on Doherty Contention 17 was not incorporated into the record as if read, it is now incorporated into the record as if read.

7-4

All right. Cross?

MR. SOHINKI: No, sir, we have no questions.

JUDGE WOLFE: Mr. Doherty.

CROSS-EXAMINATION

BY MR. DOHERTY:

Q. As your testimony now stands, the statements on -- that the Kuosheng SRV's were actually tested. What tests were these relief valves subjected to, please?

A. Okay. During the normal start-up process of a reactor system, they cycle the valves to make sure the systems work correctly, the valves open fully and they also measure the flow rate through the valves.

In addition to the normal start-up testing that was performed in Kuosheng, the plant actually ran about a series of 43 different tests to measure pool boundary loads, accelerations, pool temperature transients and heat up due to extended discharges of the valves, so there was really a containment-loads type test.

Like I say, there were about 43 different tests that included a single valve going off, two valves going off simultaneously and up to four valves going off simultaneously.

Q. Were these tests done at full power?

A. These tests were done at about 50 to 60 percent power; the reactor pressure was almost at full pressure.

7-5

Q. What would be full pressure at that unit? Would it be --

A. Reactor pressure was at about -- it varied between nine -- about approximately 970 psi to about 980 psi with around 1000 to 1040 being full pressure operated.

Those valves have also been actuated at full power/full pressure. The plant is currently operating at full power, 100 percent power right now.

Q. So -- Well, you say they have been actuated at full power. But that was not a test or --

A. Yes, it was a test. They recently ran a test where they closed all the main steam isolation valves and monitored the transient reactor pressure rise and the number of valves that actuated, and they measured boundary pressures and accelerations during that test.

Q. Were you present for that?

A. I was not present for that.

Q. I see.

A. That was just recently run.

Q. Uh-huh.

A. The data, by the way, is no different than the original data that we obtained during the initial testing back in August.

Q. That's August 1981?

A. Yes.

7-6

JUDGE LINENBERGER: By the way, Mr. Hucik, prior testimony has a discrepancy in the spelling of that facility. What is the correct spelling?

THE WITNESS: The correct spelling is capital K-u-o-s-h-e-n-g.

JUDGE LINENBERGER: Thank you.

BY MR. DOHERTY:

Q Well, in your testimony -- and I'm starting on Page 5 of that testimony submitted back in July, I guess -- yes, July 20th.

You state that the quenchers -- this is at Line 16 -- are attached to the end of the safety/relief valve discharge piping.

Now, does that piping run straight from the safety/relief valve to the quencher? Is it one straight piece of pipe, or does it curve?

A It has got curves and bends in it as it goes, you know, from the valve itself down through the drywell and then over to the containment pool.

Q But you state here that the quenchers are uniformly distributed in the suppression pool. By that do you mean they are distributed equidistant in the pool?

A Yes, I believe they're in a -- you know, a 360-degree arc. They are distributed uniformly around that

7-7

360-degree arc.

Q. So there's the same arc between each one?

A. Yes. The same distance from the drywell and wetwell walls, the same distance from the pool floor.

Q. Okay.

MR. DOHERTY: May I approach the witness, Your Honor?

JUDGE WOLFE: Yes.

BY MR. DOHERTY:

Q. Mr. Hucik, did I show you Figure 2.2-1 from the Containment Structures Design Report of December 2nd, 1979, Revision 2 of Ebasco Services, which has a figure marked the PSAR and Figure 2.2-1 just now?

A. Yes.

Q. Now, do each of these sort of four-pointed stars represent a quencher?

A. Yes, they do.

Q. Now, if we count from the top -- imagine this is a clock for a minute -- if we count down to seven and then to the eighth and then to the ninth, would you say that the distance between the seventh and the eighth quencher is equal to the distance between the eighth and the ninth quencher?

A. No, there is some difference.

Q. Can you explain why the difference occurs?

A. That may be an arrangement where they're trying to fit the quencher. There may be other equipment or something in the pool at that region. That is basically, though, a very good uniform distribution implied by tnis drawing.

There are some minimum specs as far as distance between quenchers that have been -- it looks like -- accomplished with this arrangement. But that's more than adequate.

Q. Well, wasn't your testimony earlier that they were equidistant apart?

A. The testimony is really -- it says they are uniformly distributed in the pool, not necessarily equidistant. But that's a very good uniform distribution of the quenchers.

That's only a slight difference.

Q. All right. I'm going back to my table a minute. You can keep that there.

I want you to look at the figure a little longer. I know you're fairly familiar with this kind of thing.

Do you see any other places, other than that one I pointed out, where the quenchers are not the same distance apart?

MR. COPELAND: Well, Your Honor, I don't

understand what the relevance is of any further questions along that line. This witness has explained, in looking at it, that he thinks the distribution is uniform, as he has described it, and that there are minimum specifications set on the distances between these.

And it seems to me that he has answered the question and provided as much information as could reasonably be necessary.

MR. DOHERTY: I don't think he has answered this question. I'm trying to clarify the figure to some extent. I could supply the figure --

JUDGE WOLFE. Trying to what, please?

MR. DOHERTY: Trying to clarify the figure at this point.

JUDGE WOLFE: What figure?

MR. DOHERTY: Figure 2.2-1.

JUDGE WOLFE: Clarify it in what respect?

MR. DOHERTY: In what this term, "uniformly distributed" means.

JUDGE WOLFE: I thought the witness had already indicated what he meant in his testimony by that.

MR. DOHERTY: I didn't believe that he had. He just said that was uniform distribution. He didn't say what the distribution was or -- We haven't established any more on the record about that.

7-10

He has said it's a good arrangement, I believe, and that's all.

MR. COPELAND: That's exactly the point. He has said that the arrangement that Mr. Doherty has shown him is a satisfactory, uniform distribution of those valves.

So what good does it do to nit-pick over whether one is a little bit more than another, in terms of distance between any two of them?

JUDGE WOLFF: I think if you're going to press in on the, quote, "uniform distribution" language, that before you go any farther, you ought to get that clarified.

It may not be necessary, once you get the witness' meaning of the term, "uniform distribution," to go into whether there are any other quenchers that are farther distant from one another than Quenchers 1 through 9 or whatever.

All right. I'll overrule the objection at this point. You may inquire of the witness as to his meaning of "uniform distribution."

MR. DOHERTY: Okay.

BY MR. DOHERTY:

Q What does that phrase, "uniform distribution," mean then, since we've discovered that it doesn't mean

7-11

purely equidistant by arc around there?

A. Basically, if you look at all -- I believe there's what? 19 quenchers here. They are situated very uniformly -- in other words, there are only two locations in the total arrangement where there is a difference in position relative to the two different quenchers.

Those two locations are, in fact, 180 degrees apart, it looks like, so that's a uniform distribution of this total nonuniformity. So there is some uniformity there.

And, basically, you have a very excellent spacing of all the quenchers along the -- you know, perimeter of this drywell wall. So you want a very good arrangement to space them out. You want to meet the minimum requirements set down by GE specs that there be a certain distance between each quencher.

And that has been attained. And, therefore, with the number of quenchers and the distance they've got, they've got a very good and uniform distribution of the energy into the pool.

Q. Well, what is satisfactory in arranging these?

A. "Satisfactory" would be that it meets the minimum requirements of the specifications that say you must have quenchers separated by a certain distance,

7-12

separated by the drywell wall at a certain distance, and those have all been met, plus an adequate distribution of those quenchers around the total circumference of the pool.

Q I gather then the specifications don't set that the quenchers be in the pool equidistance by arc, but rather just set a minimum distance; and it's up to the applicants to --

A. That is correct.

Q -- to work those out.

Do you know for a fact that the minimum distances are met for the Allens Creek plant?

A. Based on this drawing, I can't tell at this point. There's actually not enough information on this drawing to be able to tell.

Q Yes, I was --

A. But it looks in general like they are. I might add that many of the Mark III containments has a similar discontinuity.

JUDGE LINENBERGER: Mr. Doherty, I've got a little problem here. The record to this point, so far as I know, doesn't establish what it is that a quencher does.

And since the contention goes to the reliability of safety/relief valves, then the record further does not

7-13

establish how distribution of quenchers, whose function we don't have in the record, is relevant to the reliability of safety/relief valves.

Now, maybe this doesn't bother you; but if the record stays this way, it's going to bother the Board.

MR. DOHERTY: Well, the contention, if I may read it -- although it has been called a reliability contention -- does have, essentially, a part which talks about loads.

And that's why this has come up at all and come up as 17, rather than as 5, which we talked about earlier and which was exclusively loads.

There is a part -- I'm trying to locate it now -- of Contention 17 that does talk about the loading. It isn't meant in the sense that the valve won't open. It's just poor contention writing, I guess you would say.

I don't have a copy of Contention 17 with me.

JUDGE LINENBERGER: Well, the Board does and had that in mind in our comment. And I guess I have to repeat myself that absent a determination that quencher distribution in function and location -- excuse me -- the existence of quenchers with respect to function and

7-14

location has not been established.

The relevance of your line of questioning is hard to comprehend.

MR. DOHERTY: May I ask the Board's permission to see the contention? I don't have a copy with me. We started on this three months ago, and it just hasn't stuck with me.

(Pause.)

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MR. DOHERTY: All right. Thank you.

BY MR. DOHERTY:

Q. Well, why is it necessary to set minimums in the spacing of these?

A. You are trying to prevent basically two things. Number one, you are trying to get an even distribution of the air bubbles that come out of the quencher arms so that they don't interact with each other if you have adjacent quenchers going off, and you are also trying to get a uniform spacing of the energy of the steam condensing mode of the quenchers.

Q. Why are you trying to get a uniform distribution of the energy?

A. The main purpose of that is to try to get more of the energy distributed into the pool region.

Q. Well, what value would it be to have the energy distributed around the pool?

A. To take advantage of more pool volume initially.

Q. What advantage does more pool volume give you?

A. It's able to keep the pool temperature cooler.

Q. Would it also assist in distributing the force of the blowdown?

A. Yes, that is also very true.

Q Is it possible to put these so close together that the force from the blowdown might damage the pool, following a poor construction practice?

MR. COPELAND: I object to that, Your Honor. I object to that question because it calls for specualtion that bears no relationship to the facts in this case.

The witness has testified that they are indeed uniform in space. There's nothing to indicate that anybody is going to group them together any differently.

MR. DOHERTY: But he did not testify when I asked him if these were sufficiently far apart. I asked him if they were; he said he couldn't tell from the drawing.

So I think I have a right to ask him if indeed they are not spaced sufficiently far apart, if indeed they are not sufficiently placed far apart, what the hazard might be.

JUDGE LINENBERGER: Well, sir, in essence your most recent question could be interpreted to ask is there a way to redesign this system such that it could damage certain structures operating in a redesigned mode, and the problem the Board has here is it's not the obligation or the objective of the vendor to redesign things so that they will be destructive.

He has tried to design them in a way so that they won't cause a problem, and you are asking could he design it in a way that would cause a problem; and that seems to be a -- that's a question I have a hard time granting your prerogative to ask in this kind of proceeding.

You know, you can design a gun so that it will blow up before it will fire a bullet, but nobody tries to do that. So I'm curious how your question has meaning: Could it be designed so that it wouldn't work right.

As an aside here, I'll say if you'd let me design it, I'll guarantee you it won't work right, but that's not my business.

MR. DOHERTY: I have answered the objection.

JUDGE WOLFE: Sustained.

BY MR. DOHERTY:

Q. Didn't you state a moment ago that you weren't certain if these quenchers were designed far enough apart to meet General Electric specifications?

A. That's just based on the minimum amount of information that's contained on this drawing. Just from my judgment in looking at it, they look more than adequate.

You try and scale this drawing and look at some of the dimensions that are involved on that; it looks

8-4

more than adequate.

Q Can you tell for certain?

A. Not specifically from this figure.

Q All right. What would happen in terms of loading if the GE tech specs or the GE specifications were not met?

MR. COPELAND: Your Honor, I'm going to object to that.

It seems to me that Mr. Doherty for some reason or other has gotten way off the point of the contention.

The point of the contention is the reliability of the safety/relief valves, not the location of those valves in the suppression pool, and how they -- how some error in location of those valves would affect the loads following a blowdown.

I guess it also goes back to Judge Linenberger's point, that quenchers are nowhere mentioned in the contention.

MR. DOHERTY: I don't think there's any need to label the various components by name, such as quencher. Indeed, it isn't even certain that in 1979 there was such a thing as a quencher involved in the plant.

I think we're within the bounds of the contention to ask the question.

JUDGE WOLFE: May we have the question re-read, please?

(Question read by reporter as follows:

"What would happen in terms of loading if the GE tech specs or the GE specifications were not met?")

(Bench conference:

JUDGE WOLFE: Sustain the objection. The question calls for speculation and is exceedingly vague, in the second place.

MR. DOHERTY: Your Honor, I move we strike the testimony beginning on page 6, line 17, and continuing to page 7 at line 15 as irrelevant to the contention.

That testimony has nothing to do with safety/ relief valve reliability.

JUDGE WOLFE: This is beginning at line 14, page 5, through --

MR. DOHERTY: It looks like line 14, page 5, or line 13 1/2.

JUDGE WOLFE: Once again, beginning at line 14 on page 5?

MR. DOHERTY: That's right.

JUDGE WOLFE: Through where?

MR. DOHERTY: Line 17, page 6.

(Bench conference.)

MR. DOHERTY: Excuse me, Your Honor. I meant line 16, page 7.

JUDGE WOLFE: All of page 6 then?

MR. DOHERTY: Yes.

MR. COPELAND: Well, Your Honor, I really don't understand Mr. Doherty's motion, because if you read the first sentence of the contention it says that, "The pressure following a LOCA and other events combined with a single or stuck relief valve may hit the suppression pool with sufficient force to crack the containment wall," and as I read Mr. Hucik's testimony, he is saying in direct response to that, "GE has looked at those load combinations and demonstrated that that's no problem."

I don't understand how it could be any more responsive to the contention.

MR. DOHERTY: Well, the contention --

JUDGE WOLFE: The basis for your motion to strike? I guess that's first.

MR. DOHERTY: It's irrelevant, I believe. I believe the testimony is irrelevant to the contention.

(Bench conference.)

JUDGE WOLFE: The motion to strike is denied. As I understand what the witness has said, he did show the relevancy of addressing the quenchers in establishing that there is a nexus with the thrust of Doherty Contention 17; namely, that the quenchers have a definite purpose in serving to minimize the pressure of the force that might be occasioned by a single or several stuck relief valves.

All right. Next questions.

BY MR. DOHERTY:

Q. Mr. Hucik, has a BWR ever been damaged by a stuck-open relief valve, to your knowledge, in the United States or in Europe or in the world?

A. There have been instances of stuck-open relief valves, but I don't know of -- what do you mean by "damage"?

Q. Well, I was asking you to kind of use that word. Have you ever heard of an event at the Vergassen plant?

A. Yes.

Q. Was there, in your opinion, any damage to the pressure suppression in that plant?

A. Yes, there was some damage to that containment.

Q. What type of containment was it?

A. That's a German design and it was, I believe, a pressure suppression style containment. It was not a Mark III design. It did not have quenchers.

It had a straight down pipe.

Q. Was it like the Mark II design?

A. No. Mark II's have either quenchers of the same style that Allens Creek has, or they have another style quencher called a T-quencher, which is basically a

8-8

T on the end of a line with many holes.

Q You testified you thought there might be some equipment in the suppression pool a moment ago.

Do you know for a fact if there's any equipment in the pool of Allens Creek?

A Yes. There are some suction lines for different syste s, some discharge lines for testing different systems, the other quenchers themselves in the pool.

Q Is there a suction line for the emergency core cooling system?

A Yes.

Q Is it your understanding that that water is drawn upon as a source at want?

MR. COPELAND: Object to the relevance, Your Honor.

MR. DOHERTY: Well, the contention says that there will be danger to the public if the suppression pool is damaged by blowdown from a stuck-open relief valve.

He says that there are some structures in the pool. One of them turns out to be the emergency core cooling system, which is necessary for the protection of the public, and that's the reason I think it's relevant.

MR. COPELAND: I don't think you have recollected properly what the contention says, Mr. Doherty.

It says, "The SRV may hit the suppression pool with sufficient force to permit the escape of radioactive gases by causing cracks in the containment building wall."

It is very specific as to where you have alleged the damage will occur.

MR. DOHERTY: I still think it is relevant to protection of the public to take it from there.

JUDGE WOLFE: Take what from where?

MR. DOHERTY: I think it's still relevant.

JUDGE WOLFE: To include --

MR. DOHERTY: I don't think I have to include exactly which wall or that sort of thing. I think it's within the bounds of the contention, because the contention speaks of damage from SRV actuation that Applicant would be on notice that even though it might not crack the wall, it might do something else hazardous, so they should --

JUDGE WOLFE: And your something else?

MR. DOHERTY: Damage to the ECCS suction in the suppression pool.

JUDGE LINENBERGER: Excuse me, Mr. Chairman, but literally then, Mr. Doherty, it seems to me that you may be amending the scope of your contention by this line of cross-examination in going from damage to structures now to damage to components in the suppression pool.

Is that what you're shifting over to now?

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I am just asking for a clarification here. Are you switching emphasis now from the contention's emphasis on structural damage to now an emphasis on damage to components in the suppression pool?

MR. DOHERTY: Yes.

JUDGE LINENBERGER: I see.

(Bench conference.)

JUDGE WOLFE: Objection sustained. The question is outside the scope of the contention, the specific wording and scope of the contention.

BY MR. DOHERTY:

Q. Now, you refer at the foot of page 6 to the automatic depressurization system as pertinent to the contention, and then you don't seem to develop or say anything more about the ADS.

Is that a system that just opens one valve?

A. No. Actually, the automatic depressurization system is the opening of either seven or eight valves to depressurize the reactor.

MR. COPELAND: Which is described on page 7, Mr. Doherty.

THE WITNESS: It is eight valves, by the way.

BY MR. DOHERTY:

Q. But in general, is the load smaller -- does the load decrease as the number of valves simultaneously

8-11

actuated increases?

A. No. The load is actually greater for more valves than for a single valve, and that is specified in the design.

Q. I mean, factually that's known?

A. Yes.

Q. And is that part of the work at Kuosheng?

A. The data to show that the loads increase for multiple valves, two or more, was demonstrated at Kuosheng and also at Caroso.

It was shown, though, that the increase in the loading due to multiple valves, the test data shows that we are more conservative; in other words, our values are greater than actually seen in the test data.

There was not too great of an increase in the test data relative to what we predict for design.

MR. DOHERTY: Okay. No further questions. Thank you very much, Mr. Hucik.

JUDGE WOLFE: Redirect, Mr. Copeland?

MR. COPELAND: Just one second, Your Honor.

(Pause.)

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MR. DOHERTY: May I approach the witness, Your Honor.

JUDGE WOLFE: Certainly.

MR. COPELAND: No questions, Your Honor.

JUDGE WOLFE: Board questions?

JUDGE CHEATUM: I have none.

JUDGE LINENBERGER: Only one question.

BOARD EXAMINATION

BY JUDGE LINENBERGER:

Q. Mr. Hucik, it's not clear with respect to the subject of quenchers whether each safety/relief valve is associated with a single quencher or whether all safety/relief valves communicate to a common manifold that all quenchers exhaust from.

Now, which is the situation?

A. Each safety/relief valve has its own discharge line and its own single quencher, and they do not communicate at all.

JUDGE LINENBERGER: All right. Thanks.

No further questions.

JUDGE WOLFE: Any cross in light of the one Board question?

MR. DOHERTY: No, sir.

JUDGE WOLFE: Is the witness to be excused?

MR. COPELAND: Yes, sir.

9-2

JUDGE WOLFE: The witness is excused permanently.

(The witness was excused.)

JUDGE WOLFE: I understand this is the last witness for today?

MR. COPELAND: That's correct.

JUDGE WOLFE: We will recess until -- unless there are other matters?

MR. COPELAND: There is another matter, since we have time, and that relates to something concerning me a great deal, and that is a motion we filed for the joint briefing schedule.

It's couched in terms of starting that schedule when the record closes in this case, and I'm worried, in light of the Board's order on the Quadrex Report that the record -- well, that the Board may construe that as leaving the record open until that matter is resolved one way or another.

I would like it understood that we could start the briefing schedule when we conclude the hearings in December.

It seems to me that there is nothing unfair about that, that whatever anybody is going to -- whatever Mr. Doherty is going to do in terms of filing his motion and the work associated therewith, will be done before the hearings end in December.

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I am worried about, you know, having a situation where it takes several weeks to get a ruling on that order and several weeks if we had to bring a witness back, several weeks to get a hearing set down and a time to file testimony.

I mean, I can visualize losing a month to two months from the time we end the hearings in December before we resolve that, and I just don't think there's any reason not to go ahead and start the briefing schedule, because certainly, any equitable adjustment in the briefing schedule that would need to be made because of whatever came out of that could be done.

I would like to get that matter cleared up.

JUDGE LINENBERGER: By briefing schedule here, we assume you are talking about the schedule for proposed findings?

MR. COPELAND: Yes, sir.

MR. DOHERTY: Well, Your Honor, I know Judge Linenberger wants to talk, but I have foreseen that scenario myself and I would like to request, though, that if we do have any hearings beyond the December 7th day that the briefers, that is, the parties, get one extra day for each day we have hearings.

MR. COPELAND: I have no objection to that. That's what I meant by an equitable adjustment in the

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schedule, Your Honor.

For example, if we spent two days in hearings between December and the end of January or sometime in that time period, I would certainly agree that Mr. Doherty ought to be given another two days on the end of his 65 days for his findings of fact and conclusions of law to be filed. But I don't think we ought to wait until the end of January to start the whole briefing schedule. That seems to me to be clearly uncalled for.

(Bench conference.)

JUDGE WOLFE: We will take that under consideration, Mr. Copeland, and let you know as soon as we can.

MR. COPELAND: All right, sir.

JUDGE WOLFE: We will recess until 9:00 a.m. in the morning.

(Whereupon, at 2:25 p.m., the hearing was adjourned, to reconvene at 9:00 a.m., Thursday, November 19, 1981.)

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This is to certify that the attached proceedings before the

NUCLEAR REGULATORY COMMISSION

in the matter of: HOUSTON LIGHTING & POWER COMPANY

Date of proceedings: 18 November 1981

Docket Number: 50-466 CP

Place of proceedings: Houston, Texas

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Mary L. Bagby

Official Reporter (Typed)

Mary L. Bagby

Official Reporter (Signature)