NUCLEAR REGULATORY COMMISSION

ORIGINAL

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:

LONG ISLAND LIGHTING COMPANY)
) DOCKET NO. 50-322-OL
(Shoreham Nuclear Power Station))

DATE: August 3, 1982 PAGES: 8687 thru 8892

AT: Riverhead, New York

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

- -x

In the Matter of :

LONG ISLAND LIGHTING COMPANY : Docket No. 50-322-OL

(Shoreham Nuclear Power Station) :

- -x

Riverhead County Complex
Legislative Hearing Room
Riverhead, N.Y.
Tuesday, August 3, 1982

The hearing in the above-entitled matter convened, pursuant to notice, at 10:35 a.m.

BEFORE:

LAWRENCE BRENNER, Chairman
Administrative Judge

JAMES CARPENTER, Member
Administrative Judge

PETER A. MORRIS, Member
Administrative Judge

APPEARANCES:

On behalf of Applicant:

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DONALD P. IRWIN, Esq.
Hunton & Williams
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Richmond, Va. 23212

On behalf of the Regulatory Staff:

RICHARD BLACK, Esq.
DAVID A. REPKA, Esq.
Washington, D.C.

On behalf of Suffolk County:

KARLA J. LETSCHE, Esq.
Kirkpatrick, Lockhart, Hill,
Christopher & Phillips
1900 M Street, N.W.
Washington, D.C. 20036

C O N T E N T S

C O N T E N T S (cont'd)

P R O C E E D I N G S

JUDGE BRENNER: Good morning.

So far I believe we only have a cross-examination plan from the Staff on the next contention, ATWS, and I hope we get one by lunchtime.

MR. REVELEY: You should get ours by lunchtime.

MS. LETSCHE: You should get ours in about ten minutes.

JUDGE BRENNER: Lunchtime will be okay.

I assume the parties know by now the Commission issued an order relating to access to portions of the restricted version of ALAB-653 regarding Diablo Canyon security. The Commission's order doesn't disclose the mechanics of how access will be had, but I received a call yesterday from a Mr. Levi who is an attorney in the General Counsel's office. And I inferred from that that the General Counsel, in consultation with elements of the Staff -- I don't know if it is the legal Staff or the technical Staff or both -- will be selecting the excerpts that they deem fit within the Commission's description.

I think that is acceptable as a starting point, but raises the concern where you have one party choosing excerpts for the other party, particularly here where two out of three parties, or at least counsel for two out of three parties, have at o. time or another had access to the entire decision, and the Staff continues to have access, properly so.

In any event, I requested Mr. Levi to provide the Board with an entire copy of the restricted ALAB-653. We're not going to do anything on it, but if and when there is some question as to whether everything has been turned over to Mr. Ellis and Mr. Earley consistent with the description and the Commission's order has been turned over, we will take a look at it.

If there's any doubt on the Staff's part, if it is the Staff that's going to be assisting the general counsel's office in choosing what excerpts to provide, as to whether or not an excerpt falls within or without the Commission's description, and there is for one reason or another hesitancy in not turning that for which there is doubt over, I suppose then we will have to take a look at it.

But I'm very concerned as to this unilateral process, and I think it is fine as a starting point, but it is up to the Staff, and indeed counsel for the County, if they have knowledge of the entire document, to decide close questions in LILCO's favor or else to bring to the attention of the Board that there are such close questions.

As to the matter which the Commission expressly left for the Board, that is the County's two experts, we are not going to do anything unless and until we are requested to do something, and if we are requested by the County there will have to be a complete showing pursuant to the provisions cited by the Commission as to the need to know for those experts.

I am also somewhat concerned, perhaps prematurely, after seeing the documents that Commissioner Gilinsky filed in the case, and it was only through those documents that we now understand that Mr. Jenkins had consulted with Commissioner Gilinsky. The concern is that Mr. Jenkins may well have had entire access to the restricted Diablo Canyon decision in his role as assisting Commissioner Gilinsky. And if that is the case, I expect the parties to -- well, I expect the County to tell us whether that is the case at an appropriate time, one way or the other, and if that is the case whether that raises any problems.

I'm not talking about conflict problems here. At least I'm not raising those on my own. But I am talking about problems of access in one proceeding where the party wasn't granted access in another proceeding, and how that individual, if that is the case, is going to be careful about not inadvertently disclosing what he learned in one proceeding and in another proceeding. It is obviously impossible for him not to use the knowledge, and that may present other problems.

I don't know what the material is yet and I don't know if LILCO is at a disadvantage by having its experts have access to it, in addition to its counsel. I also frankly don't well understand how its counsel can prepare for the case without indirectly informing its witnesses, counsel informing witnesses, of the knowledge it has gleaned.

So I really don't understand how this whole thing came about, frankly, in terms of there being access only to counsel and not the experts. But I'm speaking very much in the abstract. Perhaps the material is easily severable, and I will know more when I read it.

Was the request to the Commission just for LILCO's counsel? I don't remember.

MR. REVELEY: I believe it was, Judge. But I will have to ask Messrs. Earley and Ellis. We had a great deal of difficulty persuading Pacific Gas & Electric that it would be appropriate for us to look at anything, and we have had difficulty persuading the Office of General Counsel to the same effect. The result was, I think we may have narrowly stated our request in order to succeed.

The problems you raise are quite real. We are aware of them, and if the security issues don't settle, which will moot the entire set of dilemmas, we may well have to engage in them. I trust this is going to be akin to the Stone & Webster quality assurance problems that drove everyone wild for a time and then absolutely vanished, but I may be wrong.

JUDGE BRENNER: Well, I agree that we're not asking for answers now, but I do want to raise these concerns. It's not clear from the Commission's order that they understood the possibility that the County's expert had full access, especially when they culled out the fact that they were not given access to that expert on their own.

MR. REVELEY: We certainly didn't understand that, either.

JUDGE BRENNER: I don't know that either. I'm inferring that from the fact that he consulted for Commissioner Gilinsky. I happen to know that one of the very hot security cases in which the Commission was involved was Diablo Canyon, and I think it is a reasonable inference that there is at least the possibility that he had access to the entire decision.

I'm not saying that's wrong. It is just a matter of adjusting the situation where one party is at an unfair advantage vis a vis the other party.

In addition, if we do give further access to anybody, pursuant to the Commission's order and in good sense we would have to give Pacific Gas & Electric an opportunity to state its position. It doesn't appear from the Commission's order that they gave PG&E that opportunity with respect to their finding, but perhaps they did. I don't know.

Well, that's where it stands. In any event, as you know, we are not involving ourselves very strongly in the security area at the present time, as we have discussed.

I guess the bottom line is, if things do not become moot consider the possibility that some of our comments are real concerns. We will try to deal with them. If we feel unable to deal with them, given the confines of the Commission's order, we will take appropriate action in going to the Commission.

I guess I will give you my personal opinion, for what it's worth. I haven't discussed this with the Board. I think it would have been smoother to go through us in the first instance, and even if we had to go to the Commission we could have done it.

I'm not upset that you saved us some work. I'm just pointing out that we may have anticipated some of these concerns earlier.

I see we have some settlement agreements just handed us, which we have not read. And at an appropriate time this week we will catch up with the status of all of the settlement agreements, either tomorrow or Thursday, whenever the parties think it is most appropriate. We will give you another day or two in case there are others that might catch up.

We have received this morning and in fact read Suffolk County's objections to our prehearing conference order and motion for reconsideration or in the alternative for certification to the Commission. Actually, if you read it, the certification only -- request for certification only covers one part. In any event, pursuant to the rules no replies are necessary by the other parties unless we ask for them.

We will come back and say more about the motion after we have a chance to confer further on it at some point this week, probably tomorrow morning.

(Board conferring.)

MS. LETSCHE: Judge Brenner, with respect to the last item, I understand you're going to look over the objections that were filed?

JUDGE BRENNER: Well, we have and we have had preliminary discussions among the Board. But we want to consider it further. It is a lengthy document.

MS. LETSCHE: I understand that. My only point was, if you determine that it would be preferable to have -- obviously, the attorneys who were primarily responsible for that are in Washington. If the Board determines that it would be helpful to have one of them present tomorrow, if you could let me know I could see if that can be arranged.

JUDGE BRENNER: I don't think it will be necessary, in the sense that I don't think we need any further argument. But if we do we would not require that of the County without further notice.

MS. LETSCHE: That's fine. Thank you.

JUDGE BRENNER: And in fact, in case you don't realize, Ms. Letsche, because I think we did this off the record, although everyone was present with Mr. Lanpher, the same applies to your security counsel. Wait until we have at least a preliminary reaction to the reports before you decide whether to bring counsel, and maybe we could save you the inconvenience if it turns out not to be necessary.

MS. LETSCHE: That was my only point. If you all will let me know at some point, then I can contact them if necessary.

JUDGE BRENNER: Okay.

(Board conferring.)

JUDGE BRENNER: If there is nothing further -- there is something further.

MR. BLACK: Judge Brenner and members of the Board, I would like to make an announcement. The parties already understand what the schedule for onsite -- for the onsite appraisal is. But the Board has not been apprised of that, so I would like to take this opportunity to apprise the Board of the schedule. Pursuant to conversations conducted by the Staff and LILCO last week, they agreed on a schedule which would start the onsite appraisal August 23rd, to continue for approximately two weeks.

An interim report will be issued by the Staff the week of September 6th, with a final detailed report by October 1st, 1982.

JUDGE BRENNER: That doesn't quite fit in with the schedule we had contemplated.

MR. BLACK: I am aware of that. There may be several fixes that could be appropriate.

JUDGE BRENNER: Well, I don't want to get into it, partly because not all counsel handling it are here. Let me suggest that at the time of the filings of the further contentions and responses thereto, which will be August 20th and then August 24, as I recall, and as part of the process that we have required and which the parties on their own in fact have undertaken, and that is to keep talking with each other, the parties can suggest a date for the filing of testimony.

In light of the date you just gave us, our existing date as of now is September 14. There are various options that come to mind that I think it would be best if the parties explored among themselves in the first instance.

I suppose as part of that process you want to consider where we would be at that time, that is, the beginning to mid-October, on other issues. The Board thought it not impossible that we could be ready for emergency planning by the middle of October, which would have required the testimony to be filed by the beginning of October.

MR. REVELEY: Judge, we certainly haven't given up on that possible schedule, so far as the company is concerned. We hope that the interim report, if that is the route followed, will be sufficiently fulsome so that even if testimony can't be filed on September the 14th, at least it could be filed shortly thereafter. We are aware of the difficulties.

JUDGE BRENNER: Well, I don't know whether the interim report would be sufficient, and the problem is, neither does anybody else until it is almost too late. Well, no, that's not correct. We will have the interim report early in September. We might even be able to adjust after that. It is going to have to be a darn good interim report to serve that purpose, good in the sense of thorough.

It is also possible that some of these deferred issues would be ready to hear in the gap between the completion of the issues we now have scheduled and emergency planning. We are going to have to hear them some time, and I am very anxious that the narrowing and settlement discussions take place with respect to those issues, too, and that is another reason why the schedule is somewhat uncertain. It won't be the case that as soon as the review is complete, we are going to start the hearing the next day on them, but unless some of those issues close out very quickly, that possibility is going to be lost also.

The reason I raise those other issues is, because as part of the discussion between the parties, the parties should consider what we can be kept busy with if the emergency planning testimony has to be deferred beyond the end of September. The Board was aware that there would undoubtedly be a deferral from the middle of September until about the end of September, but we were hoping it would not be deferred beyond that, it being the filing of testimony on the Phase 1 emergency planning contentions.

Any other preliminary matters?

MS. LETSCHE: Judge Brenner, I think you had asked that the parties inform you whether or not we intended to file any kind of response to the staff report concerning SAI, and Suffolk County does not intend to file a written response to that.

MR. REVELEY: Judge, I am sorry. I wasn't paying attention. We don't plan to file a response to the SAI report, either, if this is the appropriate occasion to say that.

JUDGE BRENNER: I guess it was now.

(General laughter.)

JUDGE BRENNER: Yes, we did appreciate hearing that now, so we know not to eagerly await those filings. Incidentally, since you raised that matter, the staff counsel at our request had stated that they would undertake the filing of all of those documents in the Limerick proceeding, and actually we had requested in any other pertinent proceedings, and we left it open-ended. I guess the staff meant only Limerick, because of the commonality of two Board members, but we did not by any means mean to restrict it to that proceedng.

In any event, since we received documents in Limerick also, I haven't seen any such documents filed in that case yet, so hopefully that will be done soon. That would be all of the written filings as well as the pertinent transcript pages. And there is at least one other proceeding that is arguably pertinent, namely, Indian Point. If there are others, the staff would be in a better position to know that than this Board.

All right. I think we are ready to proceed now with the County's testimony on the two safety relief valve contentions. Mr. Bridenbaugh and Mr. Minor.

You have both been previously sworn. In fact, welcome back to the stand, if that is the right word.

MS. LETSCHE: Judge Brenner, I am first going to introduce into evidence the testimony relating to Suffolk County Contention 22, and on behalf of Suffolk County, we have called to the stand Mr. Dale G. Bridenbaugh and Mr. Gregory C. Minor, to testify on that issue.

Whereupon,

DALE G. BRIDENBAUGH

and GREGORY C. MINOR

were recalled as witnesses, and having been previously duly sworn, resumed the stand, and were examined and testified further as follows:

DIRECT EXAMINATION

BY MS. LETSCHE:

Q Mr. Bridenbaugh and Mr. Minor, do you have before you a copy of the document entitled Prepared Direct Testimony of Dale G. Bridenbaugh and Gregory C. Minor on Behalf of Suffolk County Regarding Suffolk County Contention 22, SRV Test Program?

A (WITNESS BRIDENBAUGH) Yes, we do.

A (WITNESS MINOR) Yes, we do.

Q Have your professional qualifications been previously admitted into evidence in this proceeding?

A (WITNESS MINOR) Yes, they have.

A (WITNESS BRIDENBAUGH) Yes.

Q Do you have any additions or corrections to the prepared direct testimony regarding Suffolk County Contention 22?

A (WITNESS BRIDENBAUGH) Yes, we do. We have a couple of typographical corrections to make on that testimony. The first one is found on Page 1 of the testimony. The fourth line of the statement of the contention, there has been a persistent error that has occurred in a lot of the discussion of this, and that has to do with the number of the general design criteria. It should be GDC 14 rather than 4.

JUDGE BRENNER: I am afraid when we finally get to 4, I guess that is the environmental qualification area, I am going to read it at 14.

(General laughter.)

WITNESS BRIDENBAUGH: The second one is found on Page 5 of the testimony, near the top of the page, Line 3. The verb "are," a-r-e, should be "is." And then the next correction is on Page 8 of the testimony, which is a listing of the references. Footnotes 6 and 7 should be referring to Reference 2 rather than Reference 1 in both cases. That should be "Ibid. 2."

MS. LETSCHE: Judge Brenner, I will note for the record that these corrections have been made on the copy of the testimony that has been given to the Reporter to be bound into the record.

JUDGE BRENNER: To exhibit my lack of memory once again, I believe that nothing was struck from this testimony. Is that correct?

MS. LETSCHE: That is correct, Judge Brenner.

JUDGE BRENNER: Is that also true for the other contention testimony?

MS. LETSCHE: Yes, it is.

BY MS. LETSCHE: (Resuming)

Q Gentlemen, just so the record is clear, your testimony consists of -- is it true that your testimony consists of a three-page summary outline with a listing of attachments, seven pages of testimony followed by a page of references and two attachments?

A (WITNESS BRIDENBAUGH) I believe there are three attachments.

Q I am sorry, you are right. Gentlemen, does the testimony that we have been discussing regarding Suffolk County Contention 22, is that testimony true and correct to the best of your knowledge?

A (WITNESS BRIDENBAUGH) Yes, it is.

A (WITNESS MINOR) Yes.

MS. LETSCHE: Judge Brenner, at this time I would like to move the prepared direct testimony of Messrs. Bridenbaugh and Minor on behalf of Suffolk County regarding Suffolk County Contention 22, SRV Test Program, into evidence as if read.

JUDGE BRENNER: In the absence of objection, it will be admitted into evidence and bound in.

(The exhibit follows.)

Lay-in #1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

LONG ISLAND LIGHTING COMPANY

(Shoreham Nuclear Power Station, Unit 1)

Docket No. 50-322 (O.L.)

PREPARED DIRECT TESTIMONY OF
DALE G. BRIDENBAUGH AND GREGORY C. MINOR
ON BEHALF OF SUFFOLK COUNTY

REGARDING

SUFFOLK COUNTY CONTENTION 22

SRV TEST PROGRAM

May 25, 1982

SUMMARY OUTLINE OF SUFFOLK COUNTY

CONTENTION 22

Suffolk County contends that LILCO has not adequately demonstrated the reliability of the Safety/Relief Valves (S/RV's) used at Shoreham. This is a safety concern because faulty S/RV's could create or extend a loss-of-coolant-accident (LOCA). It is also possible that a S/RV failure could occur in a non-detectable mode, lending to upset conditions and safety system challenges when the valve later was called upon to operate.

A long history of S/RV reliability problems, combined with the events of the accident at Three Mile Island (TMI), prompted the NRC in NUREG-0737, Section II.D.1, to require all operating reactors and license applicants to investigate the reliability of their S/RV's to assure that the valves performed adequately. To comply with this requirement, LILCO joined the BWR Owners' Group, which appointed General Electric (GE) to coordinate one generic test program for BWR S/RV's that would be applicable to all BWR plants. GE's program included testing of the Target Rock two-stage 6R10 type of S/RV Model No. 7567F, which is employed at Shoreham, and found the valve to be operable and able to maintain structural and pressure integrity under the GE program. Thus, LILCO reported that it had met the requirements of NUREG-0737.

Despite LILCO's position, however, it has failed to fully meet the NUREG-0737 requirement demonstrating the reliability of Shoreham S/RV's. There has been no indication that LILCO has conducted a plant specific analysis comparing the piping configuration, structures, controls and instrumentation used at Shoreham to those used in GE's test program. Such an analysis is the only way to fully assure the reliability of the Shoreham S/RV's.

Therefore, the witnesses believe LILCO should conduct a detailed plant specific evaluation of Shoreham S/RV's, piping and supports in full accordance with NUREG-0737 requirements to verify their reliability and assure the health and safety of the public.

Attachments:

1. "An Analysis of the Reliability of Light Water Reactor Power-Actuated Pressure-Relieving Valves and Safety (Relief) Valves and Their Component Parts Using the Nuclear Plant Reliability Data System (NPRDS) - Final Report". Southwest Research Institute, November 16, 1981. pp. 1-4, B11-B18.
2. NUREG-0737 "Clarification of TMI Action Plan Requirements," Section II.D.1.

3. "Analysis of Generic BWR Safety/Relief Valve Operability Test Results". General Electric, October, 1981. pp. 57-59, 78-83.

PREPARED DIRECT TESTIMONY OF
DALE G. BRIDENBAUGH AND GREGORY C. MINOR
REGARDING SUFFOLK COUNTY CONTENTION 22

SRV TEST PROGRAM

I. INTRODUCTION

1. This testimony was jointly prepared and edited by Dale G. Bridenbaugh and Gregory C. Minor. A statement of the qualifications of Messrs. Bridenbaugh and Minor has been separately provided to this Board.

II. STATEMENT OF CONTENTION

2. The purpose of this testimony is to address Suffolk County Contention 22 as admitted by the Board as follows:

> Suffolk County contends that LILCO has not adequately demonstrated that the safety/relief valves to be used at Shoreham meet the requirements of 10 CFR 50, Appendix A, GDC 14 and 30, and 10 CFR 50, Appendix B, Sections III and XI, in that the functionability of the valves, as-installed, has not been established by the generic test program results. Specifically, NUREG-0737, item II.D.1, performance testing of BWR relief and safety valves, requires that BWR SRV valves be tested to demonstrate that the valves will open and reclose under the expected flow conditions. It additionally requires that ATWS testing be considered.
>
> LILCO has not yet provided a detailed plant specific evaluation of the Shoreham safety and relief valves, piping, and supports in accordance with the NUREG-0737

requirements. Additionally, no commitment has been made on ATWS testing. Therefore, it has not been demonstrated at this time that the specific requirements have been met.

The results of our review of some of the important matters encompassed by this Contention are summarized in the following paragraphs.

III. DISCUSSION OF ISSUES

III.A. BACKGROUND AND SUMMARY OF POSITION

3. The essence of Contention 22 is that Safety/Relief Valves (S/RV's) used at Shoreham have not been proven reliable over the full range of operating and accident conditions. The S/RV's, in fact, may fail in a mode that could either create or extend a loss-of-coolant-accident (LOCA). Furthermore, it is entirely possible that if such an event occurred, the status of the problem would not be known to the plant operators because there are no failure detectors/indicators on the S/RV's that would indicate passive failure. This concern for reliability of S/RV's emerged particularly from the accident at Three Mile Island (TMI) and prompted the NRC to require all operating reactors and operating license applicants to investigate the reliability of their S/RV's to assure that the valves perform adequately. While the Shoreham BWR will not be subject to the same failure sequence as that experienced at TMI, there is reason

for serious concern because of the numerous cases where S/RV's in general, and particularly Target Rock S/RV's (the type used at Shoreham), have failed to close after being operated. Examples of Target Rock S/RV failures as reported to the Nuclear Power Reactor Data System, are enclosed herein as Attachment 1. Target Rock valves were the subject of specific consideration in the Southwest Research study because "they have been identified as causes of unscheduled outages with a frequency high enough to be of concern..." 1/

4. NUREG-0737, Section II.D.1, required that performance testing of S/RV's be conducted and an associated report be submitted to the NRC by October 1, 1981. This requirement is attached herein as Attachment 2. Thus, the NRC required that submitted information include: a) evidence that the valves would open and reclose under the expected flow conditions; b) documentation from each licensee and applicant substantiating that the results for the valves tested in generic test program were applicable to the in-plant valves; c) demonstration of the integrity of the discharge piping and supports for expected load conditions; and d) test data, including criteria for success and failure of valves tested, for the purpose of NRC Staff review and evaluation. In addition, it required test configurations suitable for testing of the S/RV's under ATWS conditions.

(The TMI Action Plan specified no date for completion of the ATWS testing but it clearly states that the test facility be designed to accommodate such conditions.)

5. To comply with NUREG-0737, LILCO joined the BWR Owners' Group which was formed to combine the efforts of BWR owners by preparing and conducting one generic test program for BWR S/RV's that would be applicable to all BWR plants. On behalf of this group, General Electric (GE) conducted the investigation and submitted its findings in October, 1981. 2/

6. GE's analysis included testing of the Target Rock 2-stage, 6R10 type of S/RV, Model No. 7567F. This particular valve was found to be operable and able to maintain structural and pressure integrity under the GE test program. Based on the fact that this is the type of S/RV employed at Shoreham, LILCO reported that the operational adequacy of the S/RV's for the Shoreham station had been demonstrated. 3/

7. In response to a Suffolk County discovery request, LILCO provided a copy of the GE generic test program report. 4/ This non-proprietary version of the full test report (NEDE-24988-P) was transmitted via B. R. McCaffrey's March 5, 1982 letter. 5/ The non-proprietary version of this report is particularly inscrutable. All of the test data have been omitted and only very general statements remain. We are enclosing as Attachment 3 a copy of pages 78 through 83 and 57 through 59 of this report.

These pages supposedly summarize the Test Results (6.2). An examination of the Attachment shows that blind acceptance of LILCO's claimed results is required if this report is to be the verification of the SRV tests. It is reported, for example, on page 80 that the stresses measured in (some) water tests were higher than those measured in the corresponding steam tests. [6] This is discounted by stating that in plant pressurization rates will be "slower" and that the stress levels "are low". We have no way of judging the truth of these claims with the information provided.

8. With regard to suitability of the tests performed to demonstrate ATWS performance capability, Question 3 of Appendix A (NEDO-24988) is significant. That question requests verification that the safety valve qualification shall include qualification of the associated control circuitry. The Owners Group response states that the tests include all associated valve actuation circuity "which might be affected by the dynamic loads imposed on the plant as a result of the valve actuation under the test conditions." [7] No mention or claim is made concerning the environmental condition's effect on the valve circuitry. Such conditions would likely be significantly impacted by ATWS conditions.

9. Despite LILCO's report of completion of this task, it has failed to fully meet the requirements of NUREG-0737

to demonstrate the reliability of Shoreham S/RV's. First, there has been no indication that LILCO has conducted a plant specific analysis comparing the piping configuration, structures, controls and instrumentation used at Shoreham to those used in GE's test program. This is contrary to the NUREG-0737 requirement which provides:

> Since it is not planned to test all valves on all plants, each licensee must submit to NRC a correlation or other evidence to substantiate that the valves tested in the EPRI (Electric Power Research Institute) or other generic test program demonstrate the functionability of as-installed primary relief and safety valves. This correlation must show that the test conditions used are equivalent to expected operating and accident conditions as prescribed in the final safety analysis report (FSAR). The effect of as-built relief and safety valve discharge piping on valve operability must also be accounted for, if it is different from the generic test loop piping. 8/

Second, neither LILCO nor the BWR Owners' Group have taken any steps to conduct S/RV testing under ATWS conditions. In fact LILCO even states that "no ATWS conditions are required" 9/ in the testing of S/RV's.

10. The NUREG-0737 requirements are especially important given their applicability to Shoreham. Indeed the accident at TMI-2, from which this requirement emerged, clearly involved the functionability and reliability of relief valves in the system. Furthermore, BWR's are greatly dependent upon relief valves for pressure relief, ADS, and emergency core cooling

during transients, accidents and ATWS conditions. Because LILCO's response to the NUREG requirements was incomplete, there is no assurance that the Shoreham S/RV's are suitably reliable and that the public health and safety are fully protected.

III.B. CONCLUSION

11. Based on the above, we believe that LILCO has failed to adequately demonstrate at the present time that the S/RV's used at Shoreham fully meet NRC requirements. In our opinion, the only way to fully assure the reliability of Shoreham S/RV's is for LILCO to conduct a detailed plant specific evaluation of Shoreham S/RV's, including their control, instrumentation, piping and supports in full accordance with NUREG-0737 requirements. Additionally, LILCO should test the valves under ATWS conditions or provide justification for not doing so.

REFERENCES

1/ Southwest Research Institute, "An Analysis of the Reliability of Light Water Reactor Power-Actuated Pressure-Relieving Valves and Safety (Relief) Valves and Their Component Parts Using the Nuclear Plant Reliability Data System (NPRDS) - Final Report", November 16, 1981, p. 1.

2/ General Electric, "Analysis of Generic BWR Safety/Relief Valve Operability Test Results", October, 1981.

3/ LILCO Letter to NRC, 7/21/81, SNRC #600.

4/ NEDO-24988, Analysis of Generic BWR Safety/Relief Valve Operability Test Results, October, 1981.

5/ B. R. McCaffrey to Gregory C. Minor, March 5, 1982, Letter 82-9.

6/ Ibid ~~1~~2/, p. 80.

7/ Ibid ~~1~~2/, Appendix A, Justification of Applicability of Test Results to In-Plant S/RV's. (Emphasis Added)

8/ NUREG-0737, "Clarification of TMI Action Plan Requirements", Section II.D.1., p. II.D.1-2.

9/ LILCO Answers to SOC Interrogatories, 3/17/82, p. 11.

ATTACHMENT 1

"AN ANALYSIS OF THE RELIABILITY OF LIGHT
WATER REACTOR POWER-ACTUATED PRESSURE RELIEVING
VALVES AND SAFETY (RELIEF) VALVES AND THEIR
COMPONENT PARTS USING THE NUCLEAR PLANT
RELIABILITY DATA SYSTEM (NPRDS) - Final Report"
pp. 1-4, B11-B18

AN ANALYSIS OF THE RELIABILITY OF LIGHT WATER REACTOR POWER-ACTUATED PRESSURE-RELIEVING VALVES AND SAFETY (RELIEF) VALVES AND THEIR COMPONENT PARTS USING THE NUCLEAR PLANT RELIABILITY DATA SYSTEM (NPRDS)

FINAL REPORT

Prepared for

U. S. Department of Energy
Light Water Reactor Safety Technology Management Center
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1.0 TASK DEFINITION

The basic work effort consisted of abstracting data from the NPRDS on the population and malfunction events (failures) of safety, relief, and power-actuated pressure-relieving valves in nuclear steam supply systems (NSSS) and the statistical analysis of these data.

The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section III, Division 1, Appendix Article O-1000 provides the following definitions of these items:

(1) Safety Valve. An automatic pressure-relieving device actuated by the static pressure upstream of the valve and characterized by full opening pop action. It is used for gas or vapor service.

(2) Relief Valve. An automatic pressure-relieving device actuated by the static pressure upstream of the valve which opens further with the increase in pressure over the opening pressure. It is used primarily for liquid service.

(3) Safety Relief Valve. An automatic pressure-actuated relieving device suitable for use either as a safety valve or relief valve, depending on application.

(4) Power-Actuated Pressure-Relieving Valve. A relieving device whose movements to open or close are fully controlled by a source of power (electricity, air, steam, or hydraulic). The valve may discharge to atmosphere or to a container at lower pressure. The conditions, and such effects, shall be taken into account. If the power-actuated pressure-relieving valves are also positioned in response to other control signals, the control impulse to prevent overpressure shall be responsive only to pressure and shall override any other control function.

Three valves of specific interest are considered herein because their data base is included in NPRDS and they have been identified as causes of unscheduled outages with a frequency high enough to be of concern:

(1) The spring-loaded safety (relief) valve manufactured by Crosby, Dresser, Crane, and others and designated as safety.

(2) The pilot-operated, pressure-relief (safety) valve, which can also be power-actuated, manufactured by Target Rock and designated as Target Rock.

(3) The power-actuated pressure-relief (safety) valve, which can also be actuated in response to a system pressure transducer signal, manufactured by Dresser and designated as Electromatic.

The spring-loaded safety (relief) valves are ubiquitous because they must be installed for overpressure protection in every system (or component) that is or can be isolated while temperature is increased or that may be exposed to overpressure from other causes. These valves are passive, and malfunction is detected only if it is a leak, low pressure actuation, or surveillance test event. This analysis considered only those spring-loaded safety valves in main steam service because there is sufficient data for these valves, and not for others, in NPRDS.

The Target Rock pilot-operated, power-actuated valve is reported only in the boiling water reactor (BWR) main steam system. It may serve as a passive safety valve or be part of the pressure reduction systems and procedures and is actuated automatically or manually.

The Electromatic valve is reported in some BWR main steam systems and on some pressurized water reactor (PWR) pressurizers as part of the pressure reduction systems and procedures and is actuated automatically or manually.

The valves in these three categories compose a significant source of outages and plant extended outage time and maintenance problems according to previous surveys and plant personnel interviewed. Also, these are the valves most likely to be included in NPRDS submittals and most likely to provide an adequate data base for statistical analysis.

2.0 PROGRAM OBJECTIVES

Previous surveys and analyses of NSSS valve failure (malfunction)[1-7] have been performed, which include reliability and failure "root-cause" studies. These were reviewed to obtain information and reduce duplication of effort. It was noted that, while failure data have been tabulated according to failure mode (such as leak) or part failure rate (such as pilot), they had not been correlated with the population and basic functional elements, nor the design, quality control, and preventive maintenance variables of these functional elements.

One objective was to make a comparison of reliability functions and valve modification history to determine if changes in design had any effect on valve reliability and, specifically, if the valve parts involved had relatively high reliability. Part of the effort was to determine if many of the malfunctions attributed to design deficiency were the result of inadequate quality control in manufacture, installation, or maintenance. Another objective was to help increase the time-to-failure, because the cost in both money and radiation exposure during primary coolant system valve maintenance and modification is appreciable. The approach for achieving this objective was the use of reliability functions to choose from among optional valve modifications.

A primary objective of this task was to perform a reliability analysis of the valves considered to identify root causes and remedial actions. Such an analysis considers a valve and its directly associated components as a system. The functions of individual parts are elements of reliability, whose collective reliability constitutes system (valve) reliability. Individual part function can be accomplished by the use of different mechanisms, and part performance is affected by design details, quality control, and preventive maintenance practices. Consequently, reliability comparisons can be made between the different mechanisms used to perform a function and part design details, quality control, and preventive maintenance practice used in the construction and operation of valves to accomplish the required part functions. The shapes of failure rates and also reliability curves are useful in assessing failure cause (random or constant-hazard, wear-out, fabrication quality control, or human factors).

This method of data presentation, in addition to providing information useful to increasing valve reliability by redesign or procedure change, will benefit the NPRDS program as suggested improvements are implemented in reporting procedures, as well as defining supplementary information that needs to be acquired for a complete reliability analysis. Specific differences in manufacturer, unique plant design details, quality control, preventive maintenance practice, and inservice modifications are examples of supplementary information needed to explain differences in failure experience both in time and between plants. Reviews of United States Nuclear Regulatory Commission (NRC) regulatory guides, bulletins, circulars, notices, and NSSS service information letters indicate that unreported valve modifications have occurred that should change failure rates. Valve malfunctions that were detected in bench tests during scheduled outages also generally fall outside the scope of reporting to NPRDS.

According to the Rasmussen Report (WASH-1400),[8] an important missing factor in probability-based safety analyses of nuclear power plants is the actual reliability function for components such as valves. The limited number of nuclear power plants, relatively short service experience, and diversity of designs used limit the statistical sample. However, this effort also can evaluate the usefulness of the reliability analysis approach to obtain component reliability functions with such a limited sample.

In summary, the objectives were:

(1) To perform typical reliability analyses of selected NSSS components.

(2) To learn what the NPRDS data are indicating concerning performance of valves in service.

(3) To determine the adequacy of the NPRDS data base sample for improvement of reliability functions for safety analysis.

(4) To identify reliability critical design details, parts, maintenance practices, etc. ("root causes of valve failures"), to aid in increasing valve reliability by selecting remedial actions to reduce the number of fas due to these most frequent causes.

TABLE B-5. TARGET ROCK THREE-STAGE MODEL 67F FAILURE EVENTS

lassification Category	Reactor	Component Location	Event Date Day/Mo/Yr	EFPY	Cause/Comment
.A.1.a.(2)	Hatch-1	H	20/05/78	0.4	Cracks developed in seat weld
.A.1.c.	Pilgrim	10	23/04/75	1.2	Leak, oxidation cleaned, lapped
.A.1.c.	Pilgrim	133	29/04/75	1.3	Leak, oxidation cleaned, lapped
.A.1.c.	Fitzpatrick	A	31/03/76	0.45	
.A.1.c.	Brown Ferry-1	19	05/74	0.0	Wire drawn main seat
.A.1.c.(2)	Millstone-1	C	22/05/75	2.4	Foreign material under seat
.A.1.c.(2)	Brunswick-2	K	16/07/76	0.4	Light steam cuts on disc, dirt on seat
.B.1.d.(3)	Monticello	A	09/71	0.2	Main disc steam galled
.B.1.d.(3)	Monticello	B	09/71	0.2	Main disc steam galled
.B.1.d.(3)	Monticello	D	09/71	0.2	Main disc steam galled
.D.2.b.(3)	Monticello	A	07/73	0.8	
.D.2.b.(3)	Monticello	B	07/73	1.2	Condensate collection behind main valve piston
.D.2.b.(3)	Monticello	C	07/73	1.7	Condensate collection behind main valve piston
.D.2.b.(3)	Monticello	D	07/73	0.6	Condensate collection behind main valve piston
.D.2.b.(3)	Monticello	E	07/73	1.45	Condensate collection behind main valve piston
.D.2.b.(3)	Monticello	F	07/73	1.45	Condensate collection behind main valve piston
.D.2.b.(3)	Monticello	G	07/73	1.45	Condensate collection behind main valve piston
.D.2.b.(3)	Monticello	H	07/73	1.45	Condensate collection behind main valve piston

TABLE B-5. TARGET ROCK THREE-STAGE MODEL 67F FAILURE EVENTS (Cont'd)

Classification Category	Reactor	Component Location	Event Date Day/Mo/Yr	EFPY	Cause/Comment
II.A.1.c.	Monticello	A	23/02/77	0.6	Crud on second stage disc and seat
II.A.1.c.	Browns Ferry-3	4	28/08/78	1.3	Leakage
II.B.1.b.	Peach Bottom-2	A	12/73	0.1	Galled steam binding in bushing
II.B.1.b.	Peach Bottom-2	D	01/74	0.3	Galled steam binding in bushing
II.C.1.b.(2)	Pilgrim	8	05/77	2.08	Delamination air piston diaphragm
II.C.1.b.(2)	Pilgrim	10	05/77	0.85	Delamination air piston diaphragm
II.C.1.b.(2)	Pilgrim	116	10/05/77	0.75	Delaminated diaphragm
II.D.2.a.(1)	Pilgrim	116	09/73	0.62	Broken air pipe nipple
II.D.2.b.(2)	Monticello	A	07/72	0.45	Rust particles could have plugged orifice
III.A.1.b.	Millstone-1	F	26/02/79	2.05	Disc steam cut
III.A.1.c.	Hatch-1	A	06/10/77	2.2	
III.A.1.c.	Hatch-1	E	02/77	0.1	
III.A.1.c.	Hatch-1	G	09/01/77	1.9	Pilot leak
III.A.1.c.	Hatch-1	K	02/77	0.05	
III.A.1.c.	Hatch-1	L	01/02/77	1.95	
III.A.1.c.	Millstone-1	A	03/78	4.5	Steam cut
III.A.1.c.	Millstone-1	B	20/05/75	0.8	Pilot blowby
III.A.1.c.	Millstone-1	B	01/74	1.6	Worn preload spacer

TABLE B-5. TARGET ROCK THREE-STAGE MODEL 67F FAILURE EVENTS (Cont'd)

Classification Category	Reactor	Component Location	Event Date Day/Mo/Yr	EFPY	Cause/Comment
III.A.1.c.	Millstone-1	D	17/06/77	3.85	Pilot leak, steam cutting
III.A.1.c.	Millstone-1	F	06/76	3.15	Pilot leak
III.A.1.c	Monticello	A	22/11/78	0.6	Pilot did not seat correctly, steam cutting
III.A.1.c.	Monticello	D	04/05/78	3.35	Pilot steam cutting
III.A.1.c.	Monticello	E	05/11/74	0.75	Leaks, foreign material
III.A.1.c.	Monticello	F	23/02/77	2.4	Steam eroded
III.A.1.c.	Monticello	G	11/11/74	0.75	Foreign material on pilot seating surfaces
III.A.1.c.	Monticello	H	23/11/77	2.7	Steam cutting
III.A.1.c.	Monticello	H	01/12/78	1.05	Crud on pilot seat
III.A.1.c.	Pilgrim	9	09/75	1.55	Steam cutting
III.A.1.c.	Pilgrim	9	10/78	1.4	
III.A.1.c.	Pilgrim	10	14/11/77	0.3	Pilot leak
III.A.1.c.	Pilgrim	10	12/72	0.15	
III.A.1.c.	Pilgrim	10	10/78	0.5	
III.A.1.c.	Pilgrim	116	20/07/75	0.83	Pilot valve leakage
II.A.1.c.	Pilgrim	116	09/73	0.62	
II.A.1.c.	Pilgrim	133	17/11/77	1.2	
II.A.1.c.	Brunswick-1	F	13/03/78	0.65	Pilot leak

TABLE B-5. TARGET ROCK THREE-STAGE MODEL 67F FAILURE EVENTS (Cont'd)

Classification Category	Reactor	Component Location	Event Date Day/Mo/Yr	EFPY	Cause/Comment
III.A.1.c.	Brunswick-1	G	01/81	2.0	
III.A.1.c.	Brunswick-1	J	14/04/79	1.2	Pilot leak
III.A.1.c.	Brunswick-2	A	16/07/76	0.4	Steam cuts due to wear and dirty seat
III.A.1.c.	Brunswick-2	B	16/07/76	0.36	Dirty and pitted pilot disc
III.A.1.c.	Brunswick-2	E	07/79	1.8	Leak, steam cutting
III.A.1.c.	Brunswick-2	G	16/07/76	0.4	Steam cuts and some dirt between disc and seat
III.A.1.c.	Peach Bottom-2	D	06/01/77	1.33	Pilot leak
III.A.1.c.	Peach Bottom-2	F	14/11/76	1.6	
III.A.1.c.	Peach Bottom-2	K	06/01/77	0.9	Pilot leak
III.A.1.c.	Peach Bottom-2	K	06/75	0.82	
III.A.1.c.	Peach Bottom-2	L	04/11/74	0.55	Pilot valve disc leakage, machined, lapped
III.A.1.c.	Peach Bottom-3	B	12/07/76	1.05	Pilot leak
III.A.1.c.	Peach Bottom-3	E	07/76	1.05	Pilot leak, open
III.A.1.c.	Peach Bottom-3	E	12/76	0.3	
III.A.1.c.	Peach Bottom-3	F	12/76	1.35	Pilot leak, open
III.A.1.c.	Peach Bottom-3	G	20/07/76	1.05	Pilot leak
III.A.1.c.	Peach Bottom-3	L	13/06/79	2.95	
III.A.1.c.	Fitzpatrick	B	22/11/76	0.9	

lassification Category	Reactor	Component Location	Event Date Day/Mo/Yr	EFPY	Cause/Comment
I.A.1.c.	Fitzpatrick	E	11/76	0.25	
I.A.1.c.	Fitzpatrick	E	07/76	0.65	
I.A.1.c.	Fitzpatrick	F	19/11/76	0.9	
I.A.1.c.	Browns Ferry-1	22	26/02/75	0.05	Leaks, wire drawn
I.A.1.c.	Browns Ferry-1	23	26/02/75	0.05	Leaks, wire drawn
I.A.1.c.	Browns Ferry-1	4	26/02/75	0.05	Leaks, wire drawn
I.A.1.c.	Browns Ferry-1	5	26/02/75	0.05	Leaks, wire drawn
I.A.1.c.	Browns Ferry-1	5	21/04/77	0.3	
I.A.1.c.	Browns Ferry-2	5	13/02/78	1.05	
I.A.1.c.	Browns Ferry-3	30	17/08/78	1.3	
I.A.1.c.	Browns Ferry-3	31	21/04/77	0.35	
I.A.1.c.	Browns Ferry-3	34	17/08/78	1.3	
I.A.1.c.	Browns Ferry-3	41	17/08/78	1.3	
I.A.1.c.(2)	Peach Bottom-2	E	16/10/74	0.55	Pilot valve disc leakage, machined, lapped
I.A.1.g.	Hatch-1	G	01/02/77	0.05	Did not reseat
I.A.1.g.	Browns Ferry-2	41	05/02/78	1.05	Did not reseat
I.A.1.g.	Browns Ferry-3	31	15/04/78	0.75	Did not reseat
I.B.1.d.(3)	Monticello	A	14/06/76	1.8	Overtightening of solenoid plunger

TABLE B-5. TARGET ROCK THREE-STAGE MODEL 67F FAILURE EVENTS (Cont'd)

Classification Category	Reactor	Component Location	Event Date Day/Mo/Yr	EFPY	Cause/Comment
III.C.1	Hatch-1	C	09/08/77	2.2	Setpoint set incorrectly
III.C.1	Hatch-1	D	06/10/77	2.3	Setpoint drift
III.C.1	Hatch-1	E	06/10/77	0.4	Setpoint drift
III.C.1	Hatch-1	G	06/10/77	0.35	Setpoint drift
III.C.1	Hatch-1	H	06/10/77	2.3	Setpoint drift
III.C.1	Hatch-1	J	06/10/77	2.3	Setpoint drift
III.C.1	Hatch-1	K	06/10/77	0.35	Setpoint drift
III.C.1	Hatch-1	K	03/01/77	1.9	Setpoint drift
III.C.1	Monticello	G	20/09/77	2.05	Setpoint drift
III.C.1.b.(3)	Monticello	D	07/72	0.6	
III.C.1.b.(3)	Monticello	E	10/05/77	1.8	Bellows O-ring leak suspected
III.C.1.b.(3)	Peach Bottom-2	C	03/74	0.22	Bellows leaks
III.C.1.b.(3)	Peach Bottom-2	D	03/74	0.1	Bellows leaks
III.C.1.b.(3)	Peach Bottom-2	G	03/74	0.22	Bellows leaks
III.C.1.b.(3)	Peach Bottom-2	H	03/74	0.4	Bellows leaks
III.C.1.b.(3)	Peach Bottom-2	J	26/10/74	0.55	Bellows leaks
III.C.1.b.(3)	Peach Bottom-2	K	10/73	0.03	Bellows leaks
III.C.1.c.(4)	Pilgrim	a	11/72	0.12	Nitrogen setpoint

TABLE B-5. TARGET ROCK THREE-STAGE MODEL 67F FAILURE EVENTS (Cont'd)

assification Category	Reactor	Component Location	Event Date Day/Mo/Yr	EFPY	Cause/Comment
I.C.2.c.(1)	Brunswick-2	B	4 or 5/75	0.04	Dislodged O-ring, burr on plunger, heat
I.C.2.f.	Hatch-1	B	16/05/78	2.7	Sticking solenoid
I.C.2.f.	Hatch-1	C	09/06/78	0.5	Solenoid plunger dirty, out of adjustment, and/or partially damaged during handling
I.C.2.f.	Hatch-1	L	09/06/78	0.75	Solenoids sticking
I.C.2.f.	Pilgrim	116	07/80	2.3	Locktite on plunger
.D.2.a.(1)	Monticello	A	03/02/78	0.7	Pilot inlet filter plug seat cut by steam
.D.3.	Brunswick-2	B	15/07/77	0.35	Electrical
.D.3.a.	Brunswick-2	E	09/80	0.5	Broken solenoid coil wire
.D.3.b.	Peach Bottom-3	J	11/74	0.1	D.C. system grounds
.E.	Hatch-1	E	11/76	1.8	Failed bellows pressure switch
.E.	Millstone-1	A	02/79	0.7	Cracked sensing tube
.E.	Fitzpatrick	J	02/78	1.55	Ground due to moisture on switch

TABLE B-6. TARGET ROCK TWO-STAGE MODEL 7567 FAILURE EVENTS

assification Category	Reactor	Component Location	Event Date Day/Mo/Yr	Cause/Comment
B.1.b.	Pilgrim	D	10/80	Foreign material probably lodged between guide and piston rod
.C.1.	Hatch-1	Seven Locations	04/81	Setpoint drift of valve actuator
I.C.2.f.	Fitzpatrick	G	01/81	Locktite compound in solenoid valve
I.C.2.f.	Millstone-1	One Location	04/81	Particulate contamination in solenoid

ATTACHMENT 2

NUREG-0737
"CLARIFICATION OF TMI ACTION PLAN REQUIREMENTS"
SECTION II.D.1

II.D.1 PERFORMANCE TESTING OF BOILING-WATER REACTOR AND PRESSURIZED-WATER REACTOR RELIEF AND SAFETY VALVES (NUREG-0578, SECTION 2.1.2)

Position

Pressurized-water reactor and boiling-water reactor licensees and applicants shall conduct testing to qualify the reactor coolant system relief and safety valves under expected operating conditions for design-basis transients and accidents.

Changes to Previous Requirements and Guidance

A. Safety and Relief Valves and Piping--The types of documentation required for safety and relief valves and piping and the specific submittal dates are considered to be a clarification of item II.D.1 as described in NUREG-0660. The submittal of information was implied but not explicitly discussed in that report.

B. Block Valves--Qualification of PWR block valves is a new requirement. Since block valves must be qualified to ensure that a stuck-open relief valve can be isolated, thereby terminating a small loss-of-coolant accident due to a stuck-open relief valve. Isolation of a stuck-open power-operated relief valve (PORV) is not required to ensure safe plant shutdown. However isolation capability under all fluid conditions that could be experienced under operating and accident conditions will result in a reduction in the number of challenges to the emergency core-cooling system. Repeated unnecessary challenges to these system are undesirable.

C. ATWS Testing--Testing of anticipated transients without scram (ATWS) for later phases of the valve qualification program was noted in item II.D.1 of NUREG-0660. The clarification below provides updated information on PWR ATWS temperature and pressure conditions and clarifies that ATWS testing need not be accomplished by July 1981.

Clarification

Licensees and applicants shall determine the expected valve operating conditions through the use of analyses of accidents and anticipated operational occurrences referenced in Regulatory Guide 1.70, Revision 2. The single failures applied to these analyses shall be chosen so that the dynamic forces on the safety and relief valves are maximized. Test pressures shall be the highest predicted by conventional safety analysis procedures. Reactor coolant system relief and safety valve qualification shall include qualification of associated control circuitry, piping, and supports, as well as the valves themselves.

A. Performance Testing of Relief and Safety Valves--The following information must be provided in report form by October 1, 1981:

(1) Evidence supported by test of safety and relief valve functionability for expected operating and accident (non-ATWS) conditions must be provided to NRC. The testing should demonstrate that the valves will open and reclose under the expected flow conditions.

(2) Since it is not planned to test all valves on all plants, each licensee must submit to NRC a correlation or other evidence to substantiate that the valves tested in the EPRI (Electric Power Research Institute) or other generic test program demonstrate the functionability of as-installed primary relief and safety valves. This correlation must show that the test conditions used are equivalent to expected operating and accident conditions as prescribed in the final safety analysis report (FSAR). The effect of as-built relief and safety valve discharge piping on valve operability must also be accounted for, if it is different from the generic test loop piping.

(3) Test data including criteria for success and failure of valves tested must be provided for NRC staff review and evaluation. These test data should include data that would permit plant-specific evaluation of discharge piping and supports that are not directly tested.

B. Qualification of PWR Block Valves--Although not specifically listed as a short-term lessons-learned requirement in NUREG-0578, qualification of PWR block valves is required by the NRC Task Action Plan NUREG-0660 under task item II.D.1. It is the understanding of the NRC that testing of several commonly used block valve designs is already included in the generic EPRI PWR safety and relief valve testing program to be completed by July 1, 1981. By means of this letter, NRC is establishing July 1, 1982 as the date for verification of block valve functionability. By July 1, 1982, each PWR licensee, for plants so equipped, should provide evidence supported by test that the block or isolation valves between the pressurizer and each power-operated relief valve can be operated, closed, and opened for all fluid conditions expected under operating and accident conditions.

C. ATWS Testing--Although ATWS testing need not be completed by July 1, 1981, the test facility should be designed to accommodate ATWS conditions of approximately 3200 to 3500 (Service Level C pressure limit) psi and 700°F with sufficient capacity to enable testing of relief and safety valves of the size and type used on operating pressurized-water reactors.

Applicability

This requirement applies to all operating reactors and operating license applicants.

Implementation

See implementation schedules in the "Documentation Required" section.

Type of Review

Preimplementation review will be performed for EPRI and BWR test programs with respect to qualification of relief and safety valves. Also, the applicants' proposal for functional testing or qualification of PWR valves will be reviewed.

Postimplementation review will also be performed of the test data and test results as applied to plant-specific situations.

Documentation Required

Preimplementation review will be based on EPRI, BWR, and applicant submittals with regard to the various test programs. These submittals should be made on a timely basis as noted below, to allow for adequate review and to ensure that the following valve qualification dates can be met:

Final PWR (EPRI) Test Program--July 1, 1980
Final BWR Test Program--October 1, 1980
Block Valve Qualification Program--January 1, 1981

Postimplementation review will be based on the applicants' plant-specific submittals for qualification of safety relief valves and block valves. To properly evaluate these plant-specific applications, the test data and results of the various programs will also be required by the following dates:

PWR (EPRI)/BWR Generic Test Program Results--July 1, 1981
Plant-specific submittals confirming adequacy of safety and relief valves based on licensee/applicant preliminary review of generic test program results--July 1, 1981
Plant-specific reports for safety and relief valve qualification--October 1, 1981
Plant-specific submittals for piping and support evaluations--January 1, 1982
Plant-specific submittals for block valve qualification--July 1, 1982

Technical Specification Changes Required

No technical specification changes are required.

References

NUREG-0578

NUREG-0660, Item II.D.1

ATTACHMENT 3

"ANALYSIS OF GENERIC BWR SAFETY-RELIEF
VALVE OPERABILITY TEST RESULTS"
pp. 57-59, 78-83

NEDO-24988
CLASS I
OCTOBER 1981

ANALYSIS OF GENERIC BWR SAFETY/RELIEF VALVE OPERABILITY TEST RESULTS

GENERAL ELECTRIC

TABLE 4.2-1

SUMMARY OF REDUCED DATA
TARGET ROCK 6X10-2 STAGE S/RV WITH LOADS I SUPPORTS

Test Parameter		Test Data		
Description	Units	Steam, Saturated Run 301	Water, 15°F Subcooling Run 303	Water, 50°F Subcooling Run 307

TABLE 4.2-1
SUMMARY OF REDUCED DATA
TARGET ROCK 6X10-2 STAGE S/RV WITH LOADS I SUPPORTS

Test Parameter		Test Data, Maximum Dynamic Values		
		Steam, Saturated	Water, 15°F Subcooling	Water, 50°F Subcooling
Description	Units	Run 301	Run 303	Run 307

TABLE 4.2-1

SUMMARY OF REDUCED DATA

TARGET ROCK 6X10-2 STAGE S/RV WITH LOADS I SUPPORTS

Test Parameter		Test Data, Maximum Dynamic Values		
		Steam, Saturated	Water, 15°F Subcooling	Water, 50°F Subcooling
Description	Units	Run 301	Run 303	Run 307

represents the stress component due to pipe temperature effects. Deviations of the actual trace above and below the mean value line represent the stress component due to dynamic loading.

6.2 Test Results

6.2.1 Description of Discharge Phenomena

Following S/RV actuation for steam discharge, the pressure within the S/RVDL increased. Pressurization continues until the water and air initially in the S/RVDL have cleared.

The sequence of the events for Run 17 (steam discharge, Crosby 8X10), also shown in Figures 6.1-9 and 10, is as follows:

Time (msec)

6.2.2 Pressure Sensors Data Summary

Six pressure transducers (sensors P1, P2, P3, P4, P5 and P10) were installed on the S/RVDL to measure pipe pressure during line clearing and subsequent flow. There were also two pressure transducers (P0 and P6) installed on the sweepolet and steam chest respectively. Locations of the sensors are shown in Figures 6.1-1 and 6.1-2.

The average back pressure for each steam run reported is tabulated in Table 4.2-1.

The steady state backpressures for the water runs were inconsequential

6.2.3 Strain Gage Data Summary

Thirty five strain gages were installed on the S/RVDL, steam chest and sweepolet outlet. The locations of the gages are shown in Figures 6.1-1 and 6.1-2.

The strain measurements were converted to stresses by multiplying by the modulus of elasticity. The stresses obtained from each sensor are tabulated in Table 4.2-1.

For some strain gage locations, stresses measured in water tests were higher than those measured in the corresponding steam test. This is due to the extremely fast pressurization rate used in these tests (0-250 psig in less than one second) which was necessitated due to facility constraints. Actual in-plant pressurization rates for initiation of alternate shutdown cooling will be much slower. In all cases, however, the measured stress levels are low.

6.2.4 S/RVDL Pipe Support Load Data Summary

The support loads obtained from each load cell are tabulated in Table 4.2-1. Examples of load time history plots for steam and water discharge are shown in Figures 6.1-10 and 6.2-1 respectively. The maximum loads acting on each support structure from all Load I tests are tabulated below.

Crosby 8R10

Steam Discharge		Water Discharge		
Run	Load (Kips)	Run	Load (Kips)	$\frac{\text{Water}}{\text{Steam}}$ X 100%

Dikkers 8R10

Steam Discharge		Water Discharge		
Run	Load (Kips)	Run	Load (Kips)	$\frac{\text{Water}}{\text{Steam}}$ X 100%

Crosby 6R10

Steam Discharge		Water Discharge			
Run	Load (Kips)	Run	Load (Kips)	$\frac{\text{Water}}{\text{Steam}}$	X 100%

Target Rock 6X10 3-Stage

Steam Discharge		Water Discharge			
Run	Load (Kips)	Run	Load (Kips)	$\frac{\text{Water}}{\text{Steam}}$	X 100%

Target Rock 6X10 2-Stage

Steam Discharge		Water Discharge			
Run	Load (Kips)	Run	Load (Kips)	$\frac{\text{Water}}{\text{Steam}}$	X 100%

Dresser Electromatic 6X8

Steam Discharge		Water Discharge			
Run	Load (Kips)	Run	Load (Kips)	$\frac{\text{Water}}{\text{Steam}}$	X 100%

The maximum loads acting on each support structure from Load II tests are tabulated below.

Steam Discharge			Water Discharge			
Run	Valve Type	Load (kips)	Run	Valve Type	Load (Kips)	Water/Steam X 100%

6.2.5 Pipe Thrust Load Data Summary

The pipe thrust loads were calculated by equation (1) by combining the measured support loads and pipe acceleration. The calculations are for Load II test only. The maximum calculated loads are tabulated below.

Steam Discharge			Water Discharge			
Run	Valve Type	Load (kips)	Run	Valve Type	Load (kips)	Water/Steam X 100%

6.3 Pipe Load Evaluation Conclusion

As described in the foregoing sections, the water discharge loads were far less than the steam discharge loads in all cases.

This ratio

is applicable to all other S/RV piping arrangements.

The response of the S/RVDL for steam S/RV inlet flows were analytically predicted. In general, the analytically predicted piping and support response was comparable to the measured responses for steam.

Therefore, the test and analysis demonstrated that the current S/RV discharge pipe design is adequate for the alternate shutdown cooling conditions.

MS. LETSCHE: At this time, Judge Brenner, I believe Mr. Minor is prepared to give a brief summary of the testimony pertaining to Suffolk County Contention 22, and then I will move on to 28.A.6.

JUDGE BRENNER: Fine.

WITNESS MINOR: Suffolk County contends that LILCO has not adequately demonstrated the reliability of the safety relief valves used at Shoreham. This is a safety concern, because faulty SRV's could create or extend a loss of coolant accident or LOCA. It is also possible that an SRV failure could occur in a non-detectable mode leading to upset conditions and safety system challenges when the valve later was called upon to operate.

A long history of safety relief valve reliability problems combined with the events of the accident at Three Mile Island prompted the NRC in NUREG-0737 Section II.D.1 to require all operating reactors and license applicants to investigate the reliability of the SRV's to assure that the valves performed adequately.

To comply with this requirement, LILCO joined the BWR owners' group, which appointed GE, that is, General Electric, to coordinate one generic test program for BWR safety relief valves that would be applicable to all BWR plants. GE's program included testing of the target rock two-stage 6R10 type of safety relief valve, Model Number 7567F, which is employed at Shoreham, and found the valve to be operable and able to maintain structural and pressure integrity under the conditions of the GE program. Thus, LILCO reported that it had met the requirements of NUREG-0737.

Despite LILCO's position, however, it has failed to fully meet the NUREG-0737 requirement demonstrating the reliability of Shoreham's safety relief valves. There has been no indication that LILCO has conducted a plant specific analysis comparing the piping configuration structures, controls, and instrumentation used at Shoreham to those used in GE's test program.

Such an analysis is the only way to fully assure the reliability of the Shoreham safety relief valves. Therefore, we believe LILCO should conduct a detailed plant specific evaluation of Shoreham's safety relief valves, piping, and supports in full accordance with the NUREG-0737 requirements to verify their reliability and assure the health and safety of the public.

BY MS. LETSCHE: (Resuming)

Q Thank you. Gentlemen, do you have before you another document entitled Prepared Direct Testimony of Dale G. Bridenbaugh and Gregory C. Minor on Behalf of Suffolk County Regarding Suffolk County Contention 28.A.6 and SOC Contention 7.A.6, Reduction of SRV Challenges?

A (WITNESS BRIDENBAUGH) Yes.

A (WITNESS MINOR) Yes.

Q And does that testimony consist of a two-page summary, seven pages of testimony, and one attachment?

A (WITNESS BRIDENBAUGH) Yes, it does.

A (WITNESS MINOR) Yes.

Q Do you have any additions or corrections to be made in the prepared direct testimony?

A (WITNESS BRIDENBAUGH) Yes, we do. There are a couple of typographical corrections on this testimony. The first one is found on Page 5 of the testimony. The fourth line from the end of the first answer in the testimony as written reads, "They provide only a challenge reduction factor of 0.22." The word "challenge" should not have been included in the text there, and so that word should be struck from the written version. It got, unfortunately, left in there, and should not have been.

The second correction is on Page 7. The next to the last answer on that page had several words left out in the correction that was made. The phrase following "The NRC indicated that", there were three words left out, and the words "they do not" should be inserted in that sentence, so that it reads, "The NRC indicated that they do not expect to complete the generic review of this issue until the end of the year."

MS. LETSCHE: Judge Brenner, I'll again note that these changes have been made on the copy of the testimony that has been provided to the reporter.

BY MS. LETSCHE: (Resuming)

Q Gentlemen, is your prepared direct testimony regarding Suffolk County contention 28(a)(vi) and SOC contention 7.A.6 true and correct to the best of your knowledge?

A (WITNESS BRIDENBAUGH) Yes.

A (WITNESS MINOR) Yes.

MS. LETSCHE: At this time, Judge Brenner, I would like to move the prepared direct testimony of Messrs. Bridenbaugh and Minor on behalf of Suffolk County regarding Suffolk County contention 28(a)(vi) and SOC contention 7.A.6 into evidence as if read.

JUDGE BRENNER: In the absence of objection, it will be admitted into evidence and bound in the record as if read.

(The document referred to, received in evidence, follows:)

Lay-in #2

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of LONG ISLAND LIGHT COMPANY (Shoreham Nuclear Power Station Unit 1)	Docket No. 50-322 (O.L.)

PREPARED DIRECT TESTIMONY OF
DALE G. BRIDENBAUGH AND GREGORY C. MINOR
ON BEHALF OF SUFFOLK COUNTY

REGARDING

SUFFOLK COUNTY CONTENTION 28(a)(vi)

AND

SOC CONTENTION 7A(6)

REDUCTION OF SRV CHALLENGES

JUNE 14, 1982

SUMMARY OF TESTIMONY ON REDUCTION OF SRV CHALLENGES

LILCO has failed to adequately resolve the issue of reduction of SRV Challenges, addressed in NUREG-0737, Clarification of TMI Action Plan Requirements. NUREG-0737 directed all licensees and applicants to consider ways by which challenges and failures of relief valves could be reduced. It also required implementation of those improvements that reduced relief valve challenges without compromising performance of relief valves or other systems. In response to this requirement, LILCO joined in a collective effort with the BWR Owners Group to produce a generic evaluation of this issue and claimed individually to have made several additional changes and improvements at Shoreham to fulfill the requirement.

LILCO's response to NUREG-0737 does not adequately satisfy the NRC's SRV challenge directive. First, while LILCO has pursued improved reliability of SRV's, it has not complied with the specific action item requirements which state that improvements should be made by the reduction of challenges. Second, because Shoreham's Target Rock valves were selected before this task was identified and cannot be considered an improvement resulting from the NRC order, LILCO has attempted to justify the existing equipment despite the NRC's directive that improvements rather than justifications be made. And third, the specific improvements that LILCO claims for Shoreham, along with the challenge and failure reductions listed in the FSAR, do not meet requirements and do not appear to be substantiated.

Finally, LILCO has not met the requirements of the TMI Action Plan in that it has only made an improvement by a factor of 3 over the worst case BWR, as opposed to an improvement factor of 10, presumably over the whole population of BWR's. Accordingly, additional improvements should be identified and implemented.

Attachments

1. NUREG-0737, Clarification of TMI Action Plan Requirements pp. II.K.3.16-1 thru 3.

PREPARED DIRECT TESTIMONY OF
DALE G. BRIDENBAUGH AND GREGORY C. MINOR
REGARDING SUFFOLK COUNTY CONTENTION 28(a)(vi) AND SOC 7A(6)

REDUCTION OF SRV CHALLENGES

Q: Please state the names and positions of the authors of this testimony.

A: This testimony was co-authored by Dale G. Bridenbaugh and Gregory C. Minor. Both are employees of MHB Technical Associates and consultants to Suffolk County (SC). Our qualifications have previously been submitted to the Board.

Q: What is the purpose of this testimony?

A: The purpose of this testimony is to address the issues raised by SC Contention 28(a)(vi) and the same concerns raised by SOC 7A(6). Suffolk County Contention 28(a)(vi) states:

> Suffolk County contends that the NRC Staff has not adequately assessed and LILCO has not adequately resolved, both singularly and cumulatively, the generic unresolved issues applicable to a BWR of the Shoreham design. As a result, the Staff has not required the Shoreham structures, systems, and components to be backfit to current regulatory practices as required by 10 CFR 50.55(a), 50.57, and 50.109, with regard to the following:
>
> (a) LILCO has failed to resolve adequately certain generic safety items identified as a result of the TMI-2 accident and contained in NUREG-0737, Clarification of TMI Action Plan Requirements (1980.

(vi) LILCO hopes to accomplish a reduction in challenges to safety/relief valves (NUREG-0737, Item II.K.3.16) by procedural techniques, rather than by system modifications. But the reliability of the SRV's chosen for Shoreham has been historically poor. Thus, LILCO has not demonstrated SRV compliance with 10 CFR Part 50, Appendix A, Criterion 30.

Q: What is the origin of this concern?

A: In response to the TMI-2 accident investigation, the NRC directed all licensees and applicants to consider ways by which challenges and failures of relief valves could be reduced. This direction was documented in NUREG-0737, Clarification of TMI Action Plan Requirements.

Q: What specifically does NUREG-0737 require in this regard?

A: Task II.K.3.16 suggests that challenge and failure rate reduction can be accomplished through consideration of 13 different changes. It further directs that:

> "those changes which are shown to reduce relief-valve challenges without compromising the performance of the relief valves or other systems should be implemented."

and that:

> "Challenges to the relief valves should be reduced substantially (by an order of magnitude)." 1/

A copy of the NUREG-0737 section relevant to this issue is appended as Attachment 1.

1/ NUREG-0737, p. 3-156, emphasis added.

Q: What has been LILCO's response to this requirement?

A: LILCO joined with a BWR Owners Group for a generic evaluation of this issue. As reported in the FSAR (page II.K.3.16-2 & 3), LILCO has adopted this generic evaluation. Changes claimed for Shoreham are the use of 2-stage Target Rock valves, operator training to limit second and subsequent SRV openings during a transient and commitment to an improved pneumatic supply control system.

Q: Does this action satisfy the intent of the NRC's SRV challenge directive?

A: In our opinion it does not.

Q: Why not?

A: For the following reasons:

(1) First, the action plan directed that improvements should be made by the reduction of challenges. All of the 13 changes suggested in NUREG-0737 were aimed at reducing the duty on the valves, not towards improved reliability of the SRV's. While valve reliability is important and desirable, it alone does not comply with the specific words of the action item.

(2) Second, the use of the 2-stage Target Rock valve at Shoreham was not a change resulting from this

evaluation but rather was intended for use at Shoreham since before this task was identified. Additionally, the NRC recognized the limited value of this type of unproven modification by stating that:

> "The operating history of the SRV has been poor. A new design is used in some plants but the operational history is too brief to evaluate the effectiveness of the new design." 2/

The NRC directive says that improvement should be made, rather than justification for existing equipment. What LILCO has done is compare Shoreham with the worst BWR plant design. Just because Shoreham is expected to be better than the worst does not mean it has complied with the directive which requires reduction of challenges.

Q: How has LILCO's dependence on a valve of unproven reliability affected the quality of Shoreham's reactor coolant pressure boundary?

A: Target-Rock valve performance has been historically poor. Since LILCO has relied so heavily on reliability improvements, we conclude that the quality of the reactor coolant pressure boundary has not been assured as required by 10 C.F.R. 50, Appendix A, GDC 30. Further, LILCO's failure to demonstrate compliance with the NUREG-0737 item is additional evidence of its failure to comply with GDC 30.

Q: Do you find any other discrepancies, including those relating to NUREG-0737, with the action proposed at Shoreham?

2/ Page II.K.3.16-2, Attachment 1.

A: Yes we do. L CO claims three improveme s exist (or will exist) at Shoreham. These, along with the challenge and failure reductions listed in the FSAR, are:

Modification	Reduction Factor
2-Stage Target Rock	0.5
"Low-Low set" equivalent action	0.44
Pneumatic control improvement	0.98

Even assuming that the reduction factors are correct, since these factors are additive (equal to the product of the three) they provide only a [redacted] reduction factor of 0.22. This is twice as large as (or only one-half as effective as) the order of magnitude improvement required (reduction factor of 0.1).

Q: Do you agree with the reduction factors claimed?

A: No, they do not appear to be substantiated. The improvement to be gained by use of the 2-stage valve, for example, has yet to be verified through operating experience and it may not be as effective as hoped. A recent study (published February 1982) of relief valve performance conducted by Southwest Research states:

> "At the present time, the two-stage modification has been installed at the Browns Ferry Plant which, as would be indicated by the reliability function evaluation of dominant failure cause, does not appear to have increased valve reliability." 3/

Therefore it may be premature to claim a 50% reduction for the use of this valve. Since the Owners Group evaluation suggested a reduction factor of 0.4 to 0.6,

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3/ An Analysis of the Reliability of Light Water Reactor Power-Actuated Pressure Relieving Valves and Safety (Relief) Valves and Their Component Parts Using the Nuclear Plant Reliability Data System (NPRDS) - Final Report, pp. 27-28.

it would seem more appropriate to use a factor in the 0.6 range; a conservative assumption in view of the lack of data supporting a reduction factor of 0.5.

Q: What about the operator action required to reduce subsequent valve operations?

A: This also appears to be non-conservatively assessed. Since such action would have to be taken in a relatively short time (a few minutes) and under stressful conditions, it does not seem appropriate to equate a required operator action with an automated modification. LILCO takes credit for a reduction of 0.44 for this modification, from a possible improvement range of 0.23 to 0.62 for either automated or manual fix. It would seem more fitting to use a factor closer to the upper end of the range.

Q: What total reduction factor do you believe might be better used in describing the Shoreham plant when compared to the reference BWR 4 design used in the Owners Group evaluation?

A: Assuming a 2-stage valve factor of 0.6, an operator manual action factor of 0.6, and a pneumatic control factor of 0.98, it would appear a stuck open relief valve at Shoreham might occur at a rate of 0.35 when compared to the reference BWR-4. This is only an improvement by a factor of three over the worst case BWR. The TMI action plan calls for an improvement of a factor of ten, presumably over the whole population of BWR's.

Q: Has LILCO then demonstrated compliance with the SRV challenge reduction requirement?

A: No, LILCO has not and the requirements of GDC-30, quality of reactor coolant pressure boundary, have accordingly not been met. Additional improvements should be identified and implemented. For example, each of the thirteen potential changes listed in NUREG-0737 should be uniquely evaluated for Shoreham and modifications should be made where challenge reductions are appropriate.

Q: Has the NRC accepted LILCO's proposed response to II.K.3.16?

A: No, it has not. At the June 8, 1982 SER open item review meeting, the NRC indicated that they do not expect to complete the generic review of this issue until the end of the year.

Q: Does that complete your testimony?

A: Yes it does.

ATTACHMENT 1

NUREG-0737

PP. II.K.3.16-1, 2 & 3

II.K.3.16 REDUCTION OF CHALLENGES AND FAILURES OF RELIEF VALVES--FEASIBILITY STUDY AND SYSTEM MODIFICATION

Position

The record of relief-valve failures to close for all boiling-water reactors (BWRs) in the past 3 years of plant operation is approximately 30 in 73 reactor-years (0.41 failures per reactor-year). This has demonstrated that the failure of a relief valve to close would be the most likely cause of a small-break loss-of-coolant accident (LOCA). The high failure rate is the result of a high relief-valve challenge rate and a relatively high failure rate per challenge (0.16 failures per challenge). Typically, five valves are challenged in each event. This results in an equivalent failure rate per challenge of 0.03. The challenge and failure rates can be reduced in the following ways:

(1) Additional anticipatory scram on loss of feedwater,

(2) Revised relief-valve actuation setpoints,

(3) Increased emergency core cooling (ECC) flow,

(4) Lower operating pressures,

(5) Earlier initiation of ECC systems

(6) Heat removal through emergency condensers,

(7) Offset valve setpoints to open fewer valves per challenge,

(8) Installation of additional relief vales with a block- or isolation-valve feature to eliminate opening of the safety/relief valves (SRVs), consistent with the ASME Code,

(9) Increasing the high steam line flow setpoint for main steam line isolation valve (MSIV) closure,

(10) Lowering the pressure setpoint for MSIV closure,

(11) Reducing the testing frequency of the MSIVs,

(12) More-stringent valve leakage criteria, and

(13) Early removal of leaking valves.

An investigation of the feasibility and contraindications of reducing challenges to the relief valves by use of the aforementioned methods should be conducted. Other methods should also be included in the feasibility study. Those changes which are shown to reduce relief-valve challenges without compromising the performance of the relief valves or other systems should be implemented. Challenges to the relief valves should be reduced substantially (by an order of magnitude).

Changes to Previous Requirements and Guidance

The schedule for plant modifications has been changed to allow time for staff review of evaluation and purchase of required hardware.

Clarification

Failure of the power-operated relief valve (PORV) to reclose during the TMI-2 accident resulted in damage to the reactor core. As a consequence, relief valves in all plants, including BWRs, are being examined with a view toward their possible role in a small-break LOCA.

The safety/relief valves (SRV) are dual-function pilot-operated relief valves that use a spring-actuated pilot for the safety function and an external air-diaphragm-actuated pilot for the relief function.

The operating history of the SRV has been poor. A new design is used in some plants but the operational history is too brief to evaluate the effectiveness of the new design. Another way of improving the performance of the valves is to reduce the number of challenges to the valves. This may be done by the methods described above or by other means. The feasibility and contraindications of reducing the number of challenges to the valves by the various methods should be studied. Those changes which are shown to decrease the number of challenges without compromising the performance of the valves or other systems should be implemented.

The failure of an SRV to reclose will be the most probable cause of a small-break LOCA. Based on the above guidance and clarification, results of a detailed evaluation should be submitted to the staff. The licensee shall document the proposed system changes for staff approval before implementation.

Applicability

This requirement applies to all operating BWRs and BWR operating license applicants.

Implementation

Results of the evaluation shall be submitted by April 1, 1981 for staff review. The actual modification shall be accomplished during the next scheduled refueling outage following staff approval or no later than 1 year following staff approval. Modification to be implemented should be documented at the time of implementation.

Type of Review

A preimplementation review will be performed.

Documentation Required

By April 1, 1981, licensees must submit the results of the feasibility study for reducing SRV challenges and propose any necessary modifications for reducing SRV challenges.

Technical Specification Changes Required

Modification may include testing frequency or leakage criteria which may require technical specification changes.

Reference

NUREG-0625, Recommendations A-2.8, F-3.4

MS. LETSCHE: At this point, Judge Brenner, Mr. Minor will provide a summary of the witnesses' testimony concerning Suffolk County contention 28(a)(vi).

WITNESS MINOR: LILCO has failed to adequately resolve the issue of reduction of SRV challenges addresseed in 0737, clarification of TMI action plan requirements. NUREG-0737 directed all licensees and applicants to consider wans by which challenges and failures of relief valves could be reduced. It also required implementation of those improvements that reduced relief valve challenges without compromising performance of safety relief valves or other systems.

In response to this requirement, LILCO joined in a collective effort with the BWR owners group to produce a generic evaluation of this issue and claimed individually to have made several additional changes and improvements at Shoreham to fulfil the requirement.

LILCO's response to NUREG-0737 does not adequately satisfy the NRC's SRV challenge directive. First, while LILCO has pursued improved reliability of SRV's, it has not complied with the specific action requirements which state that improvements should be made by the reduction of challenges.

Second, because Shoreham's Target Rock valves were selected before this task was identified and cannot be considered an improvement resulting from the NRC order. LILCO has attempted to justify the existing equipment despite the NRC's directive that improvements rather than justifications be made.

And third, the specific improvements, that LILCO claims for Shoreham, along with the challenge and failure reductions listed in the FSAR, do not meet requirements and do not appear to be substantiated.

Finally, LILCO has not met the requirement of the TMI action plan in that it has only made an improvement by a factor of three over the worst case BWR, as opposed to an improvement factor of ten presumably over the whole population of BWR's. Accordingly, additional improvements should be identified and implemented.

MS. LETSCHE: Judge Brenner, at this point I would like to ask the witnesses if, in light of the additional direct testimony provided last week by LILCO and the NRC Staff on these two contentions and in light of the statements made on the record by the witnesses for those two parties during cross-examination concerning those issues, they have any comments to supplement their prefiled testimony in the form of rebuttal testimony or something of that nature.

JUDGE BRENNER: Yes, I think that is appropriate. If their comments are going to be lengthy, it would have been better to have been punctuated by a question or two here and there. But I can't judge because I don't know how lengthy the comments are.

MS. LETSCHE: Judge Brenner, I don't think that at this point they will be that lengthy. They could very well be flashed out during cross-examination, and if they are not then I will take it up on redirect.

WITNESS BRIDENBAUGH: We have several comments to make, and let me start first with the issue of SRV testing, which relates to Suffolk County contention 22. I think during the course of last week's testimony and cross-examination it became quite apparent to us that LILCO has relied almost totally, if not totally, on the BWR owners group test program to satisfy the SRV testing requirement.

That in itself is okay, except that it appears to us that LILCO has adopted the generic test results without benefit of a Shoreham-specific comparative analysis. And a good example of that deficiency I think came out in the response of LILCO to the NRC's request for additional information, where it was determined that LILCO had failed to analyze the safety relief valve discharge line support, for example, for the water-filled condition in the test program.

We also think it is important to point out that we still feel that a limited consideration of ATWS testing was performed by LILCO, in spite of the claims that it was not applicable to a BWR. Specifically, we feel that ATWS considerations are important with regard to the short duration blowdown testing that was performed on the generic program, only a five-second duration.

The fact that the test program considered or performed only low-pressure steam tests, and when I say low pressure I mean graded pressure steam tests, the 1080 psig. There were no higher steam tests apparently done. And the limitation of the program to low pressure water tests, the concern about this is based on the fact that we do not feel that they have adequately justified the basis for assuming that the ATWS conditions were bounded by the generic tests.

With regard to the issue of SRV challenges, again we are somewhat concerned by the fact that LILCO has apparently relied totally on the BWR owners group analysis and hasn't conducted a plant unique analysis. I think that Mr. Smith acknowledged that that was in fact the case.

We are further concerned by the fact that the owners group analysis takes credit, if that is the right term, for design and procedural changes that were identified and initiated years ago, and that LILCO has done little or nothing to improve the design of Shoreham with regard to the NUREG requirement.

Additionally, the owners group report utilizes a reduction of about .5 in the SORV's for the reduction of spurious openings of SRV's, and the basis for this particular reduction factor is not documented in any way in the report, nor detailed. But instead, the basis stated is that it is engineering judgment, as stated on page 23 of the owners group report.

There is some concern that the methodology appears to be double counting, because there is no relationship given between the difference between spurious openings and whether or not this is just another failure to close. There is no information in the report concerning the frequency of spurious openings that have been experienced with the two-stage Target Rock valve and no information on what spurious openings is forecast for the two-stage Target Rock valves.

I have some general comments basically on this whole area, and I think we looked at 22 and 28(a)(vi) as a combined subject. We find that the actions taken by LILCO are not responsive to the words of the NUREG-0737 requirements, and we are concerned by the fact that post facto changing of the interpretation of the requirements is a paper response to what we consider to be a hardware-oriented problem.

This approach, the analyzing it away method, is typical in our experience to many responses to new problems and requirements. The fixes, if that is what you want to call them, described in the owners group report have been on the drawing board for many years before this reanalysis order was issued, and claiming them as fixes is really an optical solution to a real problem.

The concern -- the result is that the hypothetical improvement from an artificial base, namely the BWR-4 with a three-stage Target Rock valve, may actually have precluded consideration of real improvements that might really have been made to the Shoreham plant.

I think a good example of this is the consideration of the MSIV trip change that is being looked at, but it isn't being looked at in any real time basis, since LILCO has stated that there is no way that any implementation of that fix could be made before operation. Therefore, we are concerned that the response has been an analytic justification that the plant as originally designed was okay and that they really didn't give active consideration to the improvements that the NUREG requirement seemed to indicate to us.

JUDGE BRENNER: Just so I can make sure I understand, Mr. Bridenbaugh, in talking about your view of the after the fact reinterpretation, you are addressing the fact of Mr. Hodges' testimony where he said he didn't in fact mean to restrict it to reduction of challenges, but rather to total reduction of the occurrence of spurious openings or stuck-open relief valves, including reduction of challenges, and also better response of the valves.

Is that the reinterpretation in your view that you are addressing?

WITNESS BRIDENBAUGH: That is correct. Our reading of the 0737 requirements really seems to focus on challenge reductions and the interpretation certainly in the owners group report. And as you just paraphrased, the interpretation of Mr. Hodges last week was that the emphasis should not be on challenges or did not need to be on challenges.

JUDGE BRENNER: Okay. I don't want to get into this now, and it may be that cross-examination will. But one thing that was important to the Board, and we asked at least one or two questions about it of LILCO and the Staff's witnesses, was that in addition to just a number reduction were there other things that reasonably could be done which were being ignored because of some sort of complacency based upon their present view of the reduction. And we got some answers on that point, and whether or not there are other feasible things in addition to that which has been done and that which is still being looked at, such as the MSIV trip, we would be interested in knowing about that.

And as I read your testimony, I don't see any other such things suggested.

WITNESS BRIDENBAUGH: We have not identified any others in the testimony.

JUDGE BRENNER: So what I'm suggesting is, when we consider this after we put the record together, as we must for all of these issues, we may or may not agree with the number reduction, we may or may not agree whether that is the real goal, as distinguished from some sort of guideline towards the real goal of seeing whether there are other things that reasonably could be done, and that is why we were very interested in Mr. Hodges' answer, which I think it is fair to paraphrase that he wasn't hung up on the number reduction as a goal, but also looking towards what reasonably could be done.

Another reason I mentioned it now is if you focus all of your thinking solely on the number goal -- and I'm not suggesting you should exclude that, but there is this other area that we want to consider also, and therefore you should consider it too as part of your answers here today in order to assist us in that consideration.

WITNESS BRIDENBAUGH: What I attempted to explain in my general comments, Judge Brenner, was that very concern, that if you go through an analytical justification which portrays the plant as having succeeded in the factor of ten, then the concern that I have is that they may really have overlooked or not looked seriously at the implementations of things that could be done relatively easily, perhaps, to reduce the challenges prior to plant operation.

JUDGE BRENNER: Yes, I appreciate it very much that that was part of your concern. I wanted to remind you that that very point occurred to the Board, and that is why we explored it a little bit. And it apparently occurred to the Staff also. After we asked a question, it did, and we got an answer on it. And I don't recall anything in the record that indicates that the Staff was hung up, to use the vernacular, on focusing solely on the number goal and then saying, okay, that's it, stop.

And as long as we have that preliminary review, I wanted you to have that in mind so you don't focus just on that point. I'm not suggesting you abandon it by any means, but don't ignore other possibilities that may assist us if we move beyond that point in our deliberations.

WITNESS BRIDENBAUGH: Certainly. We recognize that the Staff has indicated that they haven't completed their review of this, and so I think that certainly applies, that they intend to look at these other factors.

MS. LETSCHE: Judge Brenner, if I might ask one follow-up question here to clarify.

BY MS. LETSCHE: (Resuming)

Q Gentlemen, in response to Judge Brenner's question about whether or not you have identified particular fixes or particular items to be considered, you indicated that you had not. In your opinion, though, have additional considerations been identified that possibly should be considered by LILCO in furthering the goal of reducing the number of challenges which you think is important?

(Panel of witnesses conferring.)

A (WITNESS MINOR) Part of our concern expressed here earlier was the lack of a plant specific review for Shoreham. That lack of a documentation for Shoreham leads us to believe that there may be additional items which could and should be implemented for Shoreham that may not have been given consideration because they had "met" some numerical goal that they felt was satisfactory.

The reference to the owners group position does not assure us that other factors which could have been considered have all really been considered in that context, that there may be additional things that could be done beyond what has been implemented so far. We have not attempted to go through each of these ourselves and identify those which we feel should be implemented at this time.

However, we didn't find satisfaction in the results presented in either the owners group report or in Shoreham's interpretation of it in their testimony.

Q And are the items and the other considerations that you are referencing in your answer, are you referring to those stated in the NUREG-0737, item II.K.3.16, in addition to others identified by the owners group?

(Panel of witnesses conferring.)

A (WITNESS MINOR) Yes, in general that is true. And in addition, there are other items mentioned in the owners group report which are variations of the items listed and may also be slightly different if you looked at these items specifically for Shoreham. Certainly, some of these items do not apply to Shoreham. There are others which may apply to Shoreham with variations.

MS. LETSCHE: Judge Brenner, at this point the panel is ready for cross-examination.

JUDGE BRENNER: Mr. Irwin.

MR. IRWIN: Thank you, Judge Brenner. Let me just note at the start that we may want to come back to some of these items that were offered in redirect, and I may need to ask for a little time for consultation on them. But with that qualification, we are ready to proceed.

JUDGE BRENNER: Can you orient me as to whether you are going to challenges first or testing, or whether things will be intertwined?

MR. IRWIN: We will go primarily to challenges first, although -- and this is probably -- I promised the witnesses last week my cross-examination would not be very lengthy. It will not be. There will be some admixture, but we will be primarily concentrating on challenges at the start.

CROSS EXAMINATION ON BEHALF OF APPLICANT

BY MR. IRWIN:

Q I have a few introductory questions for the panel, and the first few are for Mr. Bridenbaugh.

Mr. Bridenbaugh, have you ever designed a large BWR safety relief valve on reactor coolant boundary?

A (WITNESS BRIDENBAUGH) No, I haven't.

Q Have you ever performed a BWR system design from the standpoint of the mechanical integrity of the system?

A (WITNESS BRIDENBAUGH) I am not sure, Mr. Irwin, what you mean by performed a design. Do you mean performed an analysis?

(Whereupon, counsel for LILCO conferred.)

Q Have you ever actually performed the design of a mechanical system or analyzed that system from the standpoint of its mechanical integrity?

A (WITNESS BRIDENBAUGH) I have not ever worked in an original mechanical design function, if that is your question. As far as analyzed designs, yes, I have, in terms of, I have performed a lot of analysis of and troubleshooting of design malfunctions, and in fact that is what my primary duties were most of the time that I was at GE in the nuclear energy division, was to perform operational analysis of problems experienced at operating plants, and that got into the analysis of the design failure rates, causes, et cetera.

Q But from the standpoint of doing or being responsible for original design work, that is something which you have not been involved in. Is that correct?

A (WITNESS BRIDENBAUGH) Generally that is true. I was not ever in original design of BWR systems, although in the construction work and in the development of test facilities and so on, I had worked in the fringes of that, but that was not my major responsibility.

Q Have you ever performed analyses of fluid dynamic loads produced within a nuclear piping system?

A (WITNESS BRIDENBAUGH) I have not performed personally such analyses. I have been responsible as a project manager for the coordination of the performance of such analyses.

Q Was that primarily an administrative responsibility, or were you substantively responsible for their content and the analytical methods used in them?

A (WITNESS BRIDENBAUGH) Well, I would describe it as the normal duties that you would describe to a project manager. A good bit of it is administrative, schedule, interfaces, but it also included a review of the results of the analyses of which you speak.

Q But not necessarily the underlying logic or the research that went into them?

A (WITNESS BRIDENBAUGH) Generally speaking, that is true.

Q Have you ever performed a stress analysis of the effect of dynamic loads on safety relief valve operability for a BWR?

A (WITNESS BRIDENBAUGH) No, I haven't.

Q Have you ever performed a stress analysis of the effect of dynamic loads on nuclear piping systems for a BWR?

A (WITNESS BRIDENBAUGH) Not as the term is generally thought of, no.

Q Have you ever performed reliability analyses for safety relief valves used on BWR's?

(Whereupon, the witnesses conferred.)

A (WITNESS BRIDENBAUGH) I haven't performed reliability analyses in terms of setting goals for designs. However, a good bit of my work and my responsibility in the nuclear business that I was in was in -- I think I indicated this earlier -- performing assessment of valve reliability, identifying the reasons for failures, and trying to define or proportion the responsibility for those failures, and in one sense that is a reliability analysis.

JUDGE BRENNER: Mr. Irwin, excuse me. I wonder if I could back up one, in the context of Mr. Irwin's questions of you as to your experience with respect to stress analysis and dynamic stress analysis, and you indicated you had none essentially. As I understand your complaint, if I could term it that, you are not criticizing the methodology of any stress analysis performed. Rather, your complaint was that a stress analysis applying the generic work to Shoreham in your view at the time of your testimony had not been performed.

WITNESS BRIDENBAUGH: That is correct.

JUDGE BRENNER: Well, just to state the obvious, you don't feel you have to possess expertise in how that stress analysis would be performed to observe that one had not been performed if that is the case.

WITNESS BRIDENBAUGH: That is certainly true, Judge Brenner. I have performed, as I said, in a project management function the overview of a lot of things like that, and I certainly am conversant and knowledgeable with the methodology. It is just that I haven't ever personally had to do that type of work.

JUDGE BRENNER: Well, but in any event, here you are not criticizing the methodology of the stress analysis as distinguished from the absence of one that you felt would be necessary to apply the generic work to Shoreham.

WITNESS BRIDENBAUGH: That is correct. If no stress analysis has been performed, it is hard to criticize the methodology, so it does not appear to us that a unique -- a Shoreham unique analysis has been done to compare the generic results.

(Whereupon, counsel for LILCO conferred.)

JUDGE CARPENTER: Mr. Irwin, since we have interrupted you, may I ask one question along the same general line?

Mr. Bridenbaugh, continuing in the vein of your experience in looking at valve failures, what percentage of valve failures did you find that were caused by stresses?

WITNESS BRIDENBAUGH: By stresses?

JUDGE CARPENTER: Yes, mechanical stresses. Is this a common reason for valve failures, particularly the stresses applied to the valve body by piping?

WITNESS BRIDENBAUGH: Let me just make sure that I am not representing something that I don't mean to be. I haven't performed recently an analysis of valve failures, so I don't have any new data that isn't already in some of the reports that we have been talking about, but in my experience at GE, I would say that the reasons for valve failures predominantly are not due to stress problems, in terms of stresses imposed by the attached piping.

There may be some few cases where that is true, but I think that those types of problems generally result in leaks rather than failure of a valve to operate. I think that the valve failures to open or failures to close for the most part are a result of foreign material, improper assembly, failures of internal locking devices, seal rings, that sort of thing, rather than external forces that are applied to the valve.

JUDGE CARPENTER: Thank you for helping me with that perspective. That was kind of my suspicion, and as I look at the test program under question here vis-a-vis the reliability of valves in terms of working on their causes. Your testimony is very interesting to me. Thank you.

BY MR. IRWIN: (Resuming)

Q Mr. Bridenbaugh, in your statement of professional qualifications, I have noticed what appear to be two documents dealing with either safety valves or safety relief valves, and those would be Item Number 43, consisting of testimony which you and Mr. Minor sponsored in the Diablo Canyon proceeding concerning, I guess, Contention 12 there, concerning block in pilot operated relief valves, submitted January 11th, 1982, and a second item which, I believe, was -- I will find the number in a second, but it was an article in Electrical World dated October 15, 1974, entitled Nuclear Valve Testing Cuts Costs, and Time. Are those the only two items or the only two publications in your statement of qualifications which deal explicitly with safety and relief valves, or safety valves?

A (WITNESS BRIDENBAUGH) Other than the testimony that we are dealing with here today, I think those are probably the only two that I can think of that are exclusively limited to safety relief valves or that sort of subject. I think, however, if I went back through the list of documents and other projects that I have worked on, I certainly have addressed valve problems from time to time and valve considerations and many others. Certainly one that I can think of that comes to mind and which is also involved in this case is work that I did with GE on the Mark I containment program, and one of the problems that was very much involved there was the safety relief valve discharge loads on the containment structure itself, so there is a whole range of other documents that deal with those issues, but not exclusively.

Q And those did not make it into your statement of qualifications, I take it.

A (WITNESS BRIDENBAUGH) Well, yes, I believe they did, although they may not have "Valve" in the title.

Q The valves that you and Mr. Minor reviewed in your testimony for Diablo Canyon, those are for a PWR, not a BWR, is that correct?

A (WITNESS BRIDENBAUGH) Yes, sir.

Q Mr. Minor, have you ever been responsible for the design of a large BWR safety relief valve on a reactor coolant pressure boundary?

A (WITNESS MINOR) No, I have not.

Q Have you ever performed a BWR system design from the standpoint of analyzing the mechanical integrity of the system?

A (WITNESS MINOR) I have not personally done that, but I have been responsible for mechanical design groups who were performing that type of analysis on BWR systems.

Q Were you personally involved in the substantive review of the analyses so performed?

A (WITNESS MINOR) Yes, I was. You stated this rather generally when you talked about BWR systems, and I am probably not talking about the same BWR systems you may be interested in, but I had --

Q What systems, just so we are sure which systems you were talking about, which systems were you talking about?

A (WITNESS MINOR) These were mechanical components that would be used in BWR's, the mechanical design of components, but they were more of the structures of control components than of pressure boundary components.

Q Have you ever performed dynamic analyses of fluid dynamic loads produced within a nuclear piping system?

A (WITNESS MINOR) No, I have not.

Q Have you ever performed stress analyses of the effect of dynamic loads on safety relief valve operability for a BWR?

A (WITNESS MINOR) No, I have not.

Q Have you ever performed stress analyses of the effect of dynamic loads on nuclear piping systems for a BWR?

A (WITNESS MINOR) No, I have not.

Q Again, let me just ask the same general bibliographic question I asked Mr. Bridenbaugh. As I went through your statement of professional qualifications, I understand that the only document whose title disclosed any explicit consideration of valves was the testimony which you and Mr. Bridenbaugh sponsored in Diablo Canyon. Am I correct in inferring that that is the only document listed in your resume which has dealt substantially with safety valve or relief valve performance?

A (WITNESS MINOR) Yes, that is correct.

(Whereupon, counsel for LILCO conferred.)

Q Let me ask this to the panel at large. Can you summarize for me what change or changes is or are involved in the transition from a three-stage target rock valve to a two-stage target rock valve?

(Whereupon, the witnesses conferred.)

A (WITNESS BRIDENBAUGH) Mr. Irwin, I assume you are asking about physically how is the valve changed. Is that your question? Or what was the effect of the change?

Q Well, let's talk about the physical differences at this point.

A (WITNESS BRIDENBAUGH) My understanding of the change from the three-stage to the two-stage is, as the title implies, there was an elimination of the second pilot stage in the operating chain.

JUDGE BRENNER: Could you describe how the three-stage worked, and include in that description what each stage did? And if you then want to relate that to how that would tend to reduce SORV events, that would be helpful also. Going from that to two-stage.

WITNESS BRIDENBAUGH: It would be helpful if we had a drawing that we could refer to.

MR. IRWIN: If you have the LILCO testimony, I think Attachments 6 and 7 illustrate the two valves. I am sorry, that is Attachments 6 and 7 to the challenges, 28.A.6.

JUDGE BRENNER: Mr. Irwin, was it attached to the challenge testimony, or the test testimony?

MR. IRWIN: It is attached to the challenge testimony, Judge Brenner.

(Pause.)

WITNESS BRIDENBAUGH: The attachments that have been referenced, the Attachment 6, Figure C, shows a schematic view of the two-stage valve which is the one that is utilized at Shoreham, and Attachment 7 is a schematic of the three-stage valve which was the precursor of that particular valve.

(Whereupon, the witnesses conferred.)

WITNESS BRIDENBAUGH: Mr. Minor points out to me maybe it would be better if we used Attachment 6,

Figure A, of the LILCO testimony, because both those drawings, Figure A and the Attachment 7 drawing, both show the valve in the closed position, so perhaps it might be a little better to use that particular set of drawings.

(Whereupon, the witnesses conferred.)

WITNESS BRIDENBAUGH: If you look at the two drawings, the Attachment 6, Figure A, which is the two-stage valve, and the Attachment 7, which is the three-stage valve, the most significant difference between the two is the component which is identified on Attachment 7 as the main pilot valve stage, and that particular set of equipment, if you will, has been eliminated, and its function has been incorporated into the single pilot valve stage which is present on this two-stage valve.

JUDGE BRENNER: Well, I guess as a layman could you describe for me what the function was of that, of each stage in the three-stage and how they performed that function, and then how it was subsumed within the two stages of the two-stage valve?

WITNESS BRIDENBAUGH: I will try to do that, Judge Brenner. First of all, we need to understand what the function of the valve is itself, and so if we look at the lower part of the valve, if you will, you will see that each has an inlet and each has an outlet, and the valve is shown in the closed position. And so in order to open the valve you have to cause in both cases the main disc, which is sort of the central component there, to move off of the seat of the valve. And that is done basically by changing the balance of steam forces that operate on the valve, on that valve disc.

And basically, they operate on the component that is called in the three-stage valve diagram the main valve piston. There is an orifice through the main valve piston which basically equalizes the pressure on both sides of that piston in the steady state closed condition.

That orifice will only allow a certain amount, a predetermined amount of steam, to flow past that piston. And if you cause -- if you open that side of the piston chamber to the downstream portion of the valve, that will cause more steam to bleed off from the closing side of the piston than the orifice will pass, and therefore the valve disc becomes unbalanced and it will open due to the fact that you've got high pressure on the open side of the piston and low pressure on the closing side of the piston.

And there is a main valve preload spring there in both cases which biases the valve and enables you to adjust or to provide the additional closing force when there is no steam present.

Now, in looking again at the three-stage valve, we are looking yet at the three-stage valve. If you are going to cause the valve to open in the relieving mode, that is you are going to actuate the valve with the external control system, what you are doing is you are applying air pressure to the thing that is caused the electropneumatic operator, and solenoid valves are opened -- solenoid valves are opened in response to a control signal, either a manual signal by the operator or a pressure switch signal which causes air or nitrogen to flow on the upper portion of that remote air actuator.

That causes that actuator to move down and it causes then the second stage piston and the second stage disc to be moved in a downward direction. That second stage disc is unseated, then, and then that allows the steam on the closing side of the main valve piston to be discharged into the outlet of the valve there, and that unbalances the piston and causes the main disc to come open.

You actually have, then, another function very similar to that encompassed in the main pilot valve stage. If you notice that midway between the second stage disc and the electropneumatic operator, you have a thing that is called a second stage piston. And the way that that functions is, the component that is called the main pilot valve stage has another pilot valve on it which controls the steam pressure on the upstream portion of the second-stage disc. And then if that main pilot valve stage, if it sees the steam pressure at the inlet that is equivalent to its set point for safety functions, it will then move to cause that second stage disc to be operated automatically without benefit of the electropneumatic operator, and the operation of the valve is basically the same.

Okay. Then if we move over to attachment 6, figure A, and we look through the function of these valves, of these two valves, as far as the electropneumatic operator is concerned, if you are calling for the valve to open by means of an external signal, basically the system operates the same.

That is, air is admitted to the electropneumatic operator, that whole chain of rods or that whole chain of rod and pilot valves pushes downward on the assembly, and the pilot valve stage then opens and unports or unloads the steam pressure on the closing side of the main piston, and then the valve comes open because you still have the inlet steam pressure on the other side of that piston. So the valve snaps open.

JUDGE CARPENTER: Excuse me. Is there a detail shown? I don't see how steam gets to the under side of that piston.

WITNESS BRIDENBAUGH: It doesn't show there. I am not sure whether there is a passageway in the three-stage valve. You can see the passageway --

JUDGE CARPENTER: Inadvertently, the cross-hatching is drawn across it.

WITNESS BRIDENBAUGH: It appears that that passageway doesn't show up in this particular drawing, but it is there, or they are dependent on the clearance leakage past the valve stem. I'm not sure whether there is a passageway drilled in there or not, but I suspect -- I'm reasonably certain that there is.

On that passageway is shown on attachment 6, figure C, that shows the passageway between the inlet side of the disc and the underside of the main piston.

JUDGE CARPENTER: So it is those three parallel lines just above the main piston?

WITNESS BRIDENBAUGH: Yes, sir. That is what i interpret that to mean. I assume the center line is the center line of the hole and isn't really there. There has got to be a hole through there.

I think I may have not been too clear in exactly how the two-stage electropneumatic operator operates there, and if you look at the way the air supply to the electropneumatic operator is shown, actually the air comes in on the underside of -- I'm not sure exactly what you call it. It is a diaphragm type piston attached to that valve stem or the pilot valve stem.

And what happens when you apply the air pressure to the under side of that particular piston, it counterbalances the spring force which is tending to keep the pilot valve closed there, and then causes the pilot valve to go through its actuation at a pressure which is less than the normal safety setting of the pilot valve, when the pilot valve would come open.

The ports of interest are the two that are shown at an angle of about 45 degrees from the horizontal, one coming off from the space above the main piston area, and that goes to the pilot valve, and then the discharge port is the one that is just above that, which discharges the steam that is bled off through the pilot valve into the discharge line of the valve.

The part that is at the lower end of the pilot valve stage, which looks like -- well, it looks like a half a dollar laying on its side, I guess, with the little knob on top of it -- is the filter assembly to keep the foreign material out of the pilot valve chain there.

JUDGE BRENNER: Mr. Bridenbaugh, I'm looking at attachment 6, figure A, of the two-stage. This is the valve in closed position?

WITNESS BRIDENBAUGH: Yes, sir.

JUDGE BRENNER: Now, as I understand your description, the steam pressure on the main piston --

WITNESS BRIDENBAUGH: Yes.

JUDGE BRENNER: -- has to be relieved in order for the main valve to open.

WITNESS BRIDENBAUGH: That's correct, yes, sir. That's on the right-hand side of it in that particular figure.

JUDGE BRENNER: Correct.

WITNESS BRIDENBAUGH: Yes.

JUDGE BRENNER: Does the pilot valve piston have to move down or up in order to achieve that relief?

WITNESS BRIDENBAUGH: The pilot valve piston has to move up in that particular case. If you look at attachment 6, figure B, it may be a little more clear. The parts are a little larger there. That shows only the pilot valve assembly. And the passageway there -- well, you can see the point of the pilot disc, and that is actually the seat there.

(Pause.)

WITNESS BRIDENBAUGH: I was just going to add, looking at attachment 6, figure B, you also see what is called the blowdown disc in that lower end, which is the device which is used to determine when the valve is going to reseat.

JUDGE CARPENTER: Looking at the three-stage, in your experience were changes in setpoint or valves sticking open associated with that main pilot stage that is now eliminated?

WITNESS BRIDENBAUGH: My recollection of the problems that occurred were that the main pilot stage was the area that was the most susceptible to foreign materials. My recollection is that a number of the problems also had to do with the main valve piston area. As I recall, I think there was -- water was building up in that area, too. But I don't recall for sure.

I think there was -- I believe there was a problem with the water building up in that area, though, so that when the valve was called upon to operate the main piston was not free to travel the extent that it needed to. But I may be wrong on that. I don't know that for sure.

JUDGE CARPENTER: Well, I'm asking the question because we're looking at the two-stage design as being a strategy for reducing the stuck-open characteristic of the three-stage, and certainly your comment that in your experience most of the problems had been with failure not of the design, but of the care and feeding of these valves by people engaged in maintenance that didn't understand the importance of the cleanliness -- is that a fair reaction?

WITNESS BRIDENBAUGH: Certainly, that is what my experience has been and what I think I said, Judge Carpenter. If I may just expand on that a little bit, I think the obvious advantages between the two-stage and the three-stage are that -- well, at the two-stage you've got fewer parts, the clearances -- the parts that you do have are larger, basically. You have eliminated that smaller pilot valve stage.

And I think you are also dealing with larger opening and closing forces on the pilot valve assembly. So it tends to be less sensitive or susceptible to binding and sticking in the pilot valve area.

JUDGE CARPENTER: Last week I believe Mr. Boseman testified that the typical simmer values were on the order of 100 to 125 psig. What were they with the three-stage, do you know?

WITNESS BRIDENBAUGH: I don't know.

JUDGE CARPENTER: Is your sense that they were smaller?

WITNESS BRIDENBAUGH: My sense is that they were probably about a third of that, but I don't have those numbers.

JUDGE CARPENTER: Looking at the two-stage, where would you look for problems which might cause the setpoint to drift high or the valve to stick open?

WITNESS BRIDENBAUGH: I think any time you are looking for setpoint drift, you are looking for friction. If you are concerned about the setpoint going up, you are looking for friction, and so you would look at the region of the thing that is labeled on figure B "pilot disc," because that is the part that is exposed to the steam environment. And so I would assume that

that probably is the piece that might give you the problem.

You then, of course, have the pilot stem which travels up through the other components there and is attached to or is contained by that spring housing, or where it is tied into the electropneumatic operator. If you notice, if you will, that unfortunately it doesn't have a label on this particular drawing, but the part inside of the pilot disc which looks sort of like an arrow pointing down, that is the part that has to move and that is the part that is holding the pilot disc closed, in the closed direction.

JUDGE BRENNER: Mr. Bridenbaugh, I wonder if I could interject for just a moment because I am confused by your answer as to where the problem might be with respect to setpoint drift. Now, I am not sure setpoint drift is part of what we are focusing on, but since it came up -- and I do not intend to dwell on it very much, but -- my understanding is the concern for setpoint drift is when the valve is operating in the safety mode. Is that correct?

WITNESS BRIDENBAUGH: That is correct, because I would assume that the drift of the other function would probably not appear in this part of the valve. It would be in the control circuit.

JUDGE BRENNER: Now, if I am concerned about setpoint drift and the safety function, I thought, maybe incorrectly, that the valve opens in the safety function not by the relief of pressure through the pilot stage as you have just previously described at great length in looking at the diagrams, but rather, by an excess of pressure coming in through the main stage; that is, through the inlet side. And the pressure over there becoming excess over the pressure behind the piston; and, therefore, opening tha way.

And I will give you an opportunity to tell me if I am right or wrong in a moment, but if I am right, then you shouldn't be worried about the friction in the pilot stage with respect to setpoint drift in the safety mode.

WITNESS BRIDENBAUGH: Just a second. Let me make sure that I am looking at this right, here. Well, I think you are wrong, Judge Brenner.

JUDGE BRENNER: That is very possible, and maybe probable. Can you tell me where?

WITNESS BRIDENBAUGH: The adjustment on the safety function opening of the valve is performed up there at this large looking spring, which is shown in the electro-pneumatic operator at the top of figure B. And in order for the valve to open, the pilot disc does have to unseat. At least, that is my understanding of how the valve works.

And really, what you are doing is, in either function, you are causing that one pilot disc to move and to unseat. In one case it is done by the pressure of steam beneath it which is causing it to move upward and unseat. And in the second case, in the relief function, you impose an additional unbalancing force on the electro-pneumatic operator by opening a solenoid and causing the downward force on that pilot disc to be lessened at the opening point of the valve.

(Board conferring.)

JUDGE BRENNER: Now that we have completely disrupted you, Mr. Irwin, should we break for lunch and promise that we will let you do your thing when we come back?

MR. IRWIN: Fine.

JUDGE CARPENTER: I didn't promise anything.

(Laughter.)

JUDGE BRENNER: Let's break until 1:35.

(Whereupon, at 12:20 p.m., the hearing in the above-entitled matter was recessed for lunch, to reconvene at 1:35 p.m. the same day.)

AFTERNOON SESSION

(1:34 p.m.)

JUDGE BRENNER: Okay, we are ready to proceed, Mr. Irwin.

Whereupon,

DALE G. BRIDENBAUGH

and GREGORY C. MINOR,

the witnesses on the stand at the time of recess, having been previously duly sworn, were further examined and testified as follows:

CROSS-EXAMINATION -- Resumed

BY MR. IRWIN:

Q MR. IRWIN: I believe that before Mr. Bridenbaugh got sidetracked onto a detailed study of the life history of two- and three-stage valves, I had what I thought was a fairly simple question; and that was, analytically what were the principal changes in the design of the Trget Rock safety relief valve when one went from a three-stage to a two-stage design and what were the principal operational effects of that design change. And I would just like to try to get a brief answer to that question, if we can.

(The panel of witnesses conferred.)

A (WITNESS BRIDENBAUGH) I think the discussion that we had before the lunch break was addressing all of those issues. But to try and summarize in response to your question, the main difference between the three-stage and the two-stage safety relief valve is the elimination of --

JUDGE BRENNER: Excuse me, sir. I am distracted very easily. That is my problem, but it is going to become your problem in a minute. I will give you a minute to set up, if you want.

VOICE: That is okay. I am sorry.

JUDGE BRENNER: I am sorry, Mr. Bridenbaugh.

WITNESS BRIDENBAUGH: Summarizing the main differences between the two- and three-stage valves is that in the two-stage valve you have eliminated -- I am trying to find a better word for "stage" -- but obviously you have eliminated one stage. And what that means is that you have eliminated one set of amplifying mechanisms in the valve operator. And you have therefore simplified the valve and reduced to some degree the points in the valve where malfunction can occur.

The secondary benefit, I think, that is derived from that is that the mechanism that is called upon to move when the valve opens, in my opinion, tends to have larger forces associated with it, and therefore it is also less sensitive to friction and foreign material.

BY MR. IRWIN: (Resuming)

Q This morning I recall your testimony being that the stage which was eliminated, as it were, were the main pilot valve stage. Do you recall stating that?

A (WITNESS BRIDENBAUGH) Yes, sir. That is how it is identified by added words, I believe, on the attachment 7 to the LILCO testimony. And I am using those same words, which is the component on the upper left-hand side.

Q The change that you are describing is not a simple removal of one stage, as it were, just plucking one set of components out of a valve and simply plunking the remaining two stages together, is it?

A (WITNESS BRIDENBAUGH) No, sir. You have to change. And if you compare the two drawings, you have to change the other stage so as to incorporate some of the functions that that main pilot valve stage performed.

Q In fact, let me try a characterization of the design change and see if it more or less comports with your ability to review that drawing. Would it be a fair characterization to say that if any one single stage were removed, it was not the main pilot valve stage but the second stage with a resulting integration of the functions of the main pilot valve stage and the electromatic operator?

A (WITNESS BRIDENBAUGH) That may be a better way of putting it. You do eliminate the second stage piston, which is, I think, what you are saying, and you incorporate a pilot valve in that same area, which is used to unload the operating piston, the main piston.

(Counsel for LILCO conferred.)

Q If we can turn to your testimony on challenges, your testimony, if I can summarize it, criticizes the BWR Owners Group response to NUREG items 0737, item II.K.3.16 for what, as I understand it, is an insufficient focus on challenge, on reduction in challenges to safety relief valves. Is that a fair, if over, generalization of the thrust of it?

(The panel of witnesses conferred.)

A (WITNESS BRIDENBAUGH) I think that is, in general, I would agree with your characterization. We are concerned that the challenges were not seriously addressed.

Q On page 3 of that testimony you state in your discussion of -- you state that the Action Plan directed that improvements should be made to the reduction of challenges, all of the 13 changes suggested in NUREG-0737 were aimed at reducing the duty on valves, not towards improved reliability of safety relief valves or SRVs. Do you see that?

A (WITNESS BRIDENBAUGH) Yes.

Q Are the 13 changes which you are referring to there those which are outlined in attachment 1 to your testimony, the excerpt from item II.K.3.16?

A (WITNESS BRIDENBAUGH) Yes.

Q Do you intend the phrase "duty on the valves" in the excerpt which I just read to be limited solely to reduction in the number of real challenges to safety relief valves?

A (WITNESS BRIDENBAUGH) I am sorry, would you repeat that, Mr. Irwin? Did you say "solely?"

Q Yes. Solely.

A (WITNESS BRIDENBAUGH) Well, I don't know that I have thought of it that explicitly. If not solely, certainly primarliy. I think that perhaps what you may be wondering about is whether items 12 and 13 would be reductions to challenges. In my view, they are because they are really addressed at the problem, the potential problem of spurious valve operation. And one way of thinking of spurious valve operation is that if you can eliminate spurious operation, it also reduces the number of challenges.

Q Is another way of looking at spurious valve operations that when the valve is open it fails to close?

A (WITNESS BRIDENBAUGH) That is a possibility. But I think if you also look at the discussion of the two-stage Target Rock valves in the BWR Owners Group, it says that basically the two-stage valve is not greatly affected by pilot valve leakage. And I think this is mainly what you are talking about here.

(Counsel for LILCO conferred.)

Q What about item 8 on the II.K.3.16, installation of additional relief valves, that block or isolation valve feature to eliminate opening of safety relief valves, consistent with the ASME code? Is that, in your mind, directed solely toward reduction in challenges?

A (WITNESS BRIDENBAUGH) I think I would view item 8 as perhaps a combination of things. I think that one way that you could operate if you had extra relief valves with block valves its that you could operate with some of them closed if you did not need them per the code.

The other way of looking at block valves is that they could be a mitigating device. In other words, if a valve were to stick open, you could use the block valve on the BWR as intended to use it on a PWR, to close off and take that valve out of service.

I didn't really look at that as a valve reliability improvement, but rather as a mitigating device.

Q Right. In other words, if a safety relief valve sticks open and if one adds a block valve to it, one can close the line using a block valve; is that right?

A (WITNESS BRIDENBAUGH) That is correct, yes, you could do that.

Q Is it not true also that the sentence immediately preceding the list of 13 items refers to the list as providing ways to reduce both challenges and failure rates of safety relief valves?

A (WITNESS BRIDENBAUGH) Yes, sir, that is what that sentence says. And I think we quote that earlier in our testimony. I don't know exactly where, but it is in there somewhere.

Q On page 4 of your testimony you refer to -- and I am quoting here -- "an historically poor" level of valve performance for Target Relief safety relief valves. What are the documents or other studies that you base that characterization on? That is in on page 4 -- I am sorry, this is in the answer beginning a little bit below the middle of the page.

(The panel of witnesses conferred.)

A (WITNESS BRIDENBAUGH) Well, there are a number of places where you can determine that that is true. One of the most obvious ones is page 2 of II.K.3.16, which states at the fourth paragraph that the operating history of the SRV has been poor. And that is perhaps a paraphrase of that particular sentence. But we also have reference in our testimony, the Southwest Research Institute study of SRVs, and certainly, if you go through the LERs, there are many occasions of problems with SRVs. And I guess I would also say that a good bit of my basis for making that statement is my experience at GE in the early 1970s when the SRV problems, opening and sticking open and not closing and so on, were a very significant factor at operating plants.

Q Let us see if we can cut straight to something. The time period in which you were having your experience with SRVs at GE and the discussion in NUREG-0737 and the discussion in the Southwest Research Institute report to which you are referring as providing the evidence of historically poor performance of SRVs, those all relate to three-stage Target Relief relief valves, do they not?

A (WITNESS BRIDENBAUGH) Most of them do, yes.

The -- certainly, the Southwest Research report addresses, it identifies a number of plants where two-stage valves have been installed and are operating; specifically, I think, Browns Ferry 1, 2, and 3, Pilgrim, Millstone, Hatch, and I think Monticello had some experience on the two-stage Target Rocks, too. But at the time that that report was written, they identified that the experience was quite limited.

Q But the thrust of both of those observations was a comment on the historically poor performance of the three-stage valves and not the historic performance of two-stage valves; is that not correct?

A (WITNESS BRIDENBAUGH) Well, since the data base on which they were commenting was to a larger degree three-stage valves, that would be true. Not 100 percent, but it would be more fitting to the three-stage valves or more appropriate to the three-stage valves.

Q Just so we draw the proper characterization, I am not asking you to suggest that the two-stage valves received a ringing endorsement from either of these documents, but neither that they were unable to, on the basis of the operating experience they had to date, draw any kinds of judgments about them to the extent they could, the three-stage valves? Is that again a fair summary? We can go down more specifically, if you like.

A (WITNESS BRIDENBAUGH) I think that is a fair statement. I think my recollection, and I am looking for it right now, is that the Southwest Research document stated that the improvements or the improved reliability hoped for with the two-stage valve has not yet been demonstrated in operation.

Q Nor disproved? In response to my last question, I said "nor disproven?" And what was your answer?

A (WITNESS BRIDENBAUGH) Yes, I think that's right.

Q Did the Southwest Research Institute report talk about the reliability of the Target Rock two-stage valve?

A (WITNESS BRIDENBAUGH) Yes, they did.

Q Would you show me where?

(The panel of witnesses conferred.)

A (WITNESS BRIDENBAUGH) The Target Rock safety relief valve is discussed in the Southwest Research report on page 20 and following that they present some figures showing the reliability characteristics of the three-stage valve. In the discussion that follows that they talk about the causes of unreliability, if you will, of the valves, and they talk about improvements that would be expected with the two-stage valves. The conclusory statement in the report is found on page 27-28, which talks about the two-stage modification at the Browns Ferry plant.

Q Right. I was asking about reliability studies in this connection. Would you refer to page A9-A10 and read me the first sentence on that page?

A (WITNESS BRIDENBAUGH) It says, "The three-stage Target Rock valve is the only one of these designs with sufficient service-years to be used for reliability analysis."

Q Thank you. Was any kind of statistical analysis performed on two-stage target rock valves in the Southwest Research Institute study?

(Whereupon, the witnesses conferred.)

JUDGE BRENNER: Mr. Irwin, let me back you up for a minute. What page in the study did you ask Mr. Bridenbaugh to refer to before?

MR. IRWIN: Page A8/A9, and I realize today that the pages which were excerpted and attached to the county's testimony may not have included the pages to which I am referring. I will make copies of them and distribute them. I don't see any need to introduce the entire report as an exhibit.

WITNESS BRIDENBAUGH: I would conclude from that sentence that there are no rigid statistical studies included in the Southwest report on the two-stage valve. They seem to say there that there is not enough experience to make a statistical study.

BY MR. IRWIN: (Resuming)

Q In fact, doesn't the sentence simply say, "Statistical analysis was not performed, but these two-stage failure reports are tabulated in Table B-6," that being in the middle of Page 20 of the first paragraph of Section 4.3?

A (WITNESS BRIDENBAUGH) Could you direct my attention to where you are quoting from, Mr. Irwin? I don't see that on my page.

Q I am sorry. Perhaps we are looking at different pages. On Page 20, in Paragraph 4.3, about the tenth line of the first paragraph.

A (WITNESS BRIDENBAUGH) Yes, yes, I see it now. That is correct. That is what it says.

Q Do you know which plant or plants were contacted with reference to the use of two-stage target rock valves by Southwest Research Institute?

)Whereupon, the witnesses conferred.)

A (WITNESS BRIDENBAUGH) It is not totally clear from the report whether they contacted plants or whether they took data out of the data reporting system, but as indicated on Page 20 there, they do identify what is called the "reporting reactors", and they mention there Dresden 2 and 3, Hatch 1, Millstone, Monticello, Pilgrim, Brunswick 1 and 2, Peach Bottom 2 and 3, Fitzpatrick, and Brown's Ferry 1, 2, and 3, and then if you look back on Table B-6, they do report failure events from four different reactors, Pilgrim, Hatch 1, Fitzpatrick, and Millstone 1.

I would presume that they either contacted those utilities or certainly had access to data or were provided data by those utilities.

Q In terms of communication with any utility to obtain information on the two-stage valve, given that there was no statistical or reliability analysis performed, do you know which utility was contacted? Or utilities?

A (WITNESS BRIDENBAUGH) I don't have any information available to me other than what I just indicated in response to your last question.

Q Would you look on Page 24 of the report, in the second paragraph?

A (WITNESS BRIDENBAUGH) Yes.

Q In the sentence, do you know what the first utility to make a changeover to a two-stage valve is?

(Whereupon, the witnesses conferred.)

A (WITNESS BRIDENBAUGH) I don't know for sure. I had thought it was Brown's Ferry, but there may have been another one before that. I am not positive of that.

Q Coming back to your observation concerning the list of reporting reactors on Page 20 of this report, is it your belief that each of these reactors uses two-stage target rock valves?

A (WITNESS BRIDENBAUGH) I don't think so, no. I think that that list is a list of boiling water reactors that reported failures through the NPRDS, and I think that was the data base that they were using. It probably is a combination of both three-stage and two-stage.

Q And perhaps even Dresser valves?

A (WITNESS BRIDENBAUGH) Yes, I am sure that there were those, too, although because it falls under Paragraph 4.3, target rock safety relief valves, one would assume that they are limiting their comment there to the target rocks.

JUDGE BRENNER: Mr. Irwin, I want to point out to you that perhaps the answer is more than the questions, but the combination of the two are getting into details as to what listing and what page some of the things fall under. We don't have that page before us, so if you intend to go any further, you had better get it for us.

MR. IRWIN: I have gone as far as I wanted to, but it occurred to me looking over the information during the day that some of these pages should be provided, and I will do so. Again, I apologize. I had not realized that the full report had not been excerpted.

JUDGE BRENNER: Well, the problem is not solely a matter of courtesy. I didn't follow everything you were doing very well because of it, and so if you think it was important to you, you may have missed exciting our interest on something. Let's go off the record.

(Whereupon, a discussion was held off the record.)

JUDGE BRENNER: Let's go back on the record.

BY MR. IRWIN: (Resuming)

Q I thought I had finished with the report, but this question does involve a page of the report which was provided to the Board as an attachment to Suffolk County's testimony on the SRV testing, Attachment 1. You state on Page 3 of your testimony on SRV testing, Lines 6 through 9, that, "Target rock valves were the subject of specific consideration in the SRI study, because they have been identified as causes of unscheduled outages with a frequency high enough to be of concern." Have you got that excerpt there?

A (WITNESS BRIDENBAUGH) Yes, I have.

Q Again, historically, in a historical context, that related primarily to three-stage valves, did it not?

A (WITNESS BRIDENBAUGH) Yes. I think we have agreed upon that. The predominant data base for the Southwest study was the three-stage as compared to the two-stage.

Q The source for your statement in your

testimony is an excerpt from the SRI study on Page 1 of that study, is it not?

MS. LETSCHE: I am sorry. What testimony are you referring to?

BY MR. IRWIN: (Resuming)

Q I am sorry. The excerpt on Page 3 of the SRV testing testimony, Lines 6 through 9, that I just quoted. It is, I believe, at the bottom of Page 1 of the SRI report.

A (WITNESS BRIDENBAUGH) Yes, that is the source.

Q It is true, is it not, that target rock valves are not the only kind of valve identified as giving rise to these concerns, isn't it?

MS. LETSCHE: Are you referring to having been identified by the Southwest study?

MR. IRWIN: That is correct. I am just trying to put this quotation into context.

(Whereupon, the witnesses conferred.)

WITNESS BRIDENBAUGH: I am sorry, Mr. Irwin. Could you repeat your question?

BY MR. IRWIN: (Resuming)

Q Sure. To come back, perhaps, with where I should have started, your testimony cites Southwest Research Institute's study for the proposition that target rock valves have been identified as causes of unscheduled outages with a frequency high enough to be of concern.

A (WITNESS BRIDENBAUGH) Yes, sir.

Q And I believe we had agreed that the context of that citation to the Southwest Research Institute study was the passage which begins in the bottom paragraph of Page 1.

A (WITNESS BRIDENBAUGH) That's correct, yes.

Q My question to you was that target rock valves were not the only type of valve specified as being the source of this concern. Is that not correct?

A (WITNESS BRIDENBAUGH) That is correct. On the top of Page 2 it references the three classes of valves or types of valves that that particular statement applies to, and target rock is one of those three classes of valves.

Q Just so the record is complete, are you referring also to spring loaded safety relief valves manufactured by Crosby and those manufactured by Dresser and those manufactured by Crane as well as others designated as safety valves? Is that not correct?

A (WITNESS BRIDENBAUGH) That is one of the other three items, yes.

Q And then the third category of items was power actuated pressure relief safety valves, which can also be actuated in response to a system pressure transducer signal manufactured by Dresser and designated as electromatic? Is that correct?

A (WITNESS BRIDENBAUGH) That is correct, yes.

(Whereupon, counsel for LILCO conferred.)

Q In your oral redirect rebuttal testimony this morning, you stated, as my notes indicate, and correct me if my notes are incorrect, that you were concerned about the absence in your view of analyses comparing the BWR owners' group test facility results or test program specified in Item II.D.1 of NUREG-0737 to Shoreham specific conditions. Do you remember that statement or a statement to that effect?

A (WITNESS BRIDENBAUGH) Yes.

Q Is it your contention that no analysis has been performed of the applicability of the BWR owners' group test to Shoreham with respect to the definition of bounding transient conditions?

(Whereupon, the witnesses conferred.)

A (WITNESS BRIDENBAUGH) I think we have to probably define what we mean by analysis. Certainly the bounding conditions of different plants were considered by the people who were performing the owners' group work and it is my assumption and understanding that they attempted to do that. However, the endorsement of the test by LILCO was a very simple kind of endorsement, and to the best of my knowledge, did not include what I would consider to be an analysis of the stresses, the loading conditions, the configuration, and didn't address on an item by item basis the different transients that might be experienced at Shoreham.

A (WITNESS MINOR) I would like to add to that that one of the other problem areas that in our opinion relates to the item you are questioning on was that the evaluation as done by LILCO had insufficient information to judge the adequacy of the comparison against the generic test results and against the bounding analyses and so forth. Clearly, that type of problem is enumerated in the NRC's request for additional information to complete their review.

Q In other words, it is not your contention that no analysis was performed? What you are questioning is -- I am sorry. You are not contending then that there was no analysis performed. You are questioning either the sufficiency or disclosure of its contents? You are questioning the sufficiency of the disclosure of its contents? Is that correct?

A (WITNESS BRIDENBAUGH) I think that is true. I think obviously LILCO may have conducted an analysis, and if it was not disclosed, we don't really have any basis for evaluating whether that was adequate or not, but judging from the information that was presented, and made available in the record, and the flow of documents between LILCO and NRC, it did not appear to us that adequate plant specific analysis was conducted.

(Whereupon, counsel for LILCO conferred.)

Q Again, with reference to your statement of concern this morning, is it your contention that no analysis has been performed of the applicability of the BWR owners' group test to Shoreham with respect to loads on safety relief valves due to piping configuration?

(Whereupon, the witnesses conferred.)

A (WITNESS BRIDENBAUGH) I don't think that we said or I said this morning no analysis has been performed. I think analysis is a pretty vague kind of a term, but what I think I said this morning is that a plant unique complete analysis had not apparently been performed, and I used as an example the NRC's -- one of the six NRC questions, which asked about the SRV discharge line analysis and what assumptions had been used and whether an analysis had been performed for the water filled condition of that line, and in response to that question, my understanding is that LILCO agreed that they had not performed that type of analysis.

Q I am sorry. You were saying that LILCO agreed that they had not performed any analysis for a water-filled condition of the discharge pipe?

A (WITNESS BRIDENBAUGH) Did you say "any," or did you say"a?"

Q Is there any meaningful distinction?

A (WITNESS BRIDENBAUGH) Well, I am not sure what you said. That isn't what I said. I said "that analysis" when I was responding to your previous question.

Q I am sorry. I guess I am now the one that is confused. Which analysis were you referring to, Mr. Bridenbaugh? And I don't mean to debate you. I just lost track.

JUDGE BRENNER: Wait a minute. Let me see if I can cut through some of this, because I am not sure how pertinent it still is.

If I heard you right, Mr. Bridenbaugh, your concern was, or your complaint was that before the response to the staff question, you believe LILCO was not going to do either any or a proper type of stress analysis, including, for example, the water loaded condition, correct?

WITNESS BRIDENBAUGH: That is correct, yes.

JUDGE BRENNER: Without regard to whether or not the only reason they are doing it is the staff question. Now that you have seen the staff question and LILCO's answer, has that problem gone away, provided they do the analysis along the lines indicated by LILCO and by the staff?

WITNESS BRIDENBAUGH: That particular problem for that particular line appears to be resolved and if it is adequately demonstrated that that was the worst case line or the bounding line, I believe that that problem would probably be resolved. I think, however, it is my understanding that there really wasn't any plant unique analysis done in comparing the specific configuration of the pipe and the piping configuration at the test facility to the Shoreham case. I think that drawings were looked at. The general layout of the piping was examined, and it was engineering judgment that they were probably bounded, but it did not appear to me to be a disciplined, adequate analysis for either the steam or the water condition.

JUDGE BRENNER: Why do you limit your comment to an analysis for a particular line?

MR. LANPHER: You mean a particular steam line. I do not see question 2 and answer 2 limited to one particular line, do you?

WITNESS BRIDENBAUGH: Well, no. I certainly don't mean to limit it to only one line, Judge Brenner. I was addressing just the one line because it is my understanding that the analysis that LILCO is now performing in response to the NRC supplemental question 2 is to look at one line.

JUDGE MORRIS: But do you agree that using such a line could bound the others?

WITNESS BRIDENBAUGH: Yes, it could, if it is properly done.

JUDGE MORRIS: And how would that decision be made?

WITNESS BRIDENBAUGH: It would haveto be done by looking at the piping configurations and understanding the way the methodology works and picking the one that would be the worst-case situation. It would, I think, in some cases, it might require some partial analysis in order to make sure that you have te right one.

JUDGE MORRIS: So you would not characterize it as fully engineering judgment?

WITNESS BRIDENBAUGH: It may not be when ultimately LILCO submits that analysis. I would hope that they would justify their choice of the line.

JUDGE MORRIS: But it could be engineering judgment?

WITNESS BRIDENBAUGH: It could be. And as I heard it discussed last week, that seemed to me to be the basis upon which they chose the line.

JUDGE MORRIS: All right. Thank you.

JUDGE BRENNER: What I am trying to do, Mr. Bridenbaugh, is not dwell on history, because we have got a lot to do here, and I understand your complaint before the answer to that question, and I thought I heard you reiterate that complaint -- that is, they are doing no analysis. We are past that, and I want you to keep the context in mind of adjusting to the testimony we heard last week.

That does not mean you may not still have disagreements, but I do not want to dwell on what your disagreements were before that testimony. I want to get to what disagreements may remain since that testimony.

MS. LETSCHE: Judge Brenner, I think in at least partial or total defense of Mr. Bridenbaugh, he was responding to questions from Mr. Irwin which were a little unclear as to whether he was referring to this recent LILCO statements that were made last week or what the earlier condition was and what analysis everybody was talking about.

JUDGE BRENNER: Well, that is a general comment. We have got a record that we are building on. That is the way it works. I do not want to reinvent the wheel after every weekend.

BY MR. IRWIN: (Resuming)

Q In light of Ms. Letsche's observation, Mr. Bridenbaugh, I take it you were answering my questions in light of all of the information you possessed as of today, including that information presented last week by LILCO in its supplemental testimony on SRV testing?

A (WITNESS BRIDENBAUGH) Well, that is true, I was. But keep in mind, as far as I know, the analysis has still not been performed. The only response to that question by LILCO was a commitment to perform the analysis. I don't know if it has been done yet or not.

Q I just wanted to make sure of the baseline information.

MR. IRWIN: Judge Brenner, I think we are about done. No further questions.

BOARD EXAMINATION

BY JUDGE CARPENTER:

Q Mr. Bridenbaugh, you start out today by remarking on the failure to analyze for the water-filled condition. In response to my question last week, I believe either Mr. Smith or one of the other witnesses testified that he did not feel the water-filled -- that is, water-filled beyond the valve -- was credible because of the presence of two vacuum breakers. And I would like to get your reaction to that opinion which they expressed.

A (WITNESS BRIDENBAUGH) Yes, Judge Carpenter. I would like to make two comments on that. I was here, of course, during that cross-examination, and it was an area that interested me because I wanted to find out what kind of assumptions had been made in doing the test screening.

I think that it is unlikely, or a very low probability event, that both of the vacuum breakers would fail closed simultaneously that would prevent the water from draining out of the line rapidly.

However, I think the most likely scenario that you might put together where that particular event could happen would be not a failure of the vacuum breakers but a human error where the operator is opening the valve manually and then for some reason he closes it and then within a matter of a second or two he reopens it again, so that you would have a situation where the tailpipe of the SRV would essentially be full of water because, I think the LILCO witnesses last week estimated that it would take 5 or 10 seconds probably for the line to drain out.

And therefore, recognizing that quite often, or it is not unusual, for an operator to open a valve and then close it and then reopen it again while he is in the process of changing over to a new configuration, that that is a fairly high probability event.

The other thing that I would say to that, too, is that if you look at the piping configuration of the SRV discharge lines, you will find that -- well, the discharge line is in total, probably -- well, it has been testified, I guess, to the fact that the longest one is 137 feet or something like that. The vacuum breaker line -- I am sorry, the vacuum breakers are tied into that discharge line down at the drywell floor and, in effect, they come in about halfway up the line.

So I think what will probably happen when that line drains is the lower half of it, or the lower two-thirds of it, will drain quite rapidly, and then after that part of the line clears, the upper 50 feet or so will clear. So I would suspect that there would be a time delay in the draining of the line with the upper end of it being the last to drain. And so therefore, it could affect the load condition that the line would see.

Q You are testifying the column of fluid would separate at the vacuum breaker and the part above the vacuum breaker would sit there while the lower half would drain?

A (WITNESS BRIDENBAUGH) No, sir, I am not suggesting that it would happen completely like that. But what is going to have to happen for the upper half of that line to drain is that you are going to have to have water coming down the line while air is going up the line.

And so the drainage of the upper portion of the line is going to be impeded while the drainage of the lower end of the line is essentially not going to be impeded because the air is coming in right at that point.

BY JUDGE MORRIS:

Q I am sorry, I think you lost me on some of the dimensions. What is the linear dimension between the SRV and the vacuum breaker?

A (WITNESS BRIDENBAUGH) We looked at the as-built drawings that LILCO brought in last week. On two or three of the ones that we looked at, we added up the line lengths betweeen the SRVs and the location of the vacuum breakers, and they averaged somewhere between 40 and 50 feet. And so if you say that the average SRV discharge line is maybe 120 feet or something like that, it is about one-third, two-thirds.

Q So you are saying that the SRV is tight enough so that if the vacuum breaker opens, you would draw a vacuum in the upper part of that pipe so that the water column would hang on somewhat?

A (WITNESS BRIDENBAUGH) If the valve was closed, I would expect that to be the case, yes, sir.

JUDGE MORRIS: Right..

BY JUDGE CARPENTER:

Q Mr. Bridenbaugh, I am still having trouble visualizing a very large force applied to the valve. To come back to the scenario we are talking about, or rapid cycling, where this is certainly very pertinent on a 1-second time scale, that that fluid, I mean that is just almost normal backpressure, if you will. I still do not quite get your sensitivity is what I am groping for.

A (WITNESS BRIDENBAUGH) I don't claim that it is a force that is going to fail that line. I guess my concern is more have all of the possibilities really been considered when they were running through the screening of what conditions you should test for. I think that if the system works the way it is anticipated, that it would not probably be a significant load.

But I guess I am not convinced that they seriously considered overfilling accidents. And I know that those have happened in operating plants. I think certainly Dresden 2 and 3 events were; it is believed that the vessel was overfilled and that is what caused the safety valves to open.

BY JUDGE BRENNER:

Q Well, Mr. Bridenbaugh, as you know, we explored this, I think, a fair amount with LILCO and Staff witnesses and have some testimony on the many things that would have to occur on Shoreham, given the Shoreham-specific equipment, in order to get into a situation like Dresden. And do you disagree with that testimony? I am thinking particularly of Mr. Hodges' description of the sequence. Do you recall that?

A (WITNESS BRIDENBAUGH) I don't recall the full details of his sequence, but I guess I would agree that improvements have been made. I would not expect that the Dresden 2 and 3 thing to happen on Shoreham, because there have been high-level trips added and there is operator training that hasn't been done in the past. I mean now there is operator training to guard against that particular problem.

So, in answer to your question, I don't disagree with Mr. Hodges. I guess I am not convinced that the Owners Group really seriously wanted to consider this issue. I think my concern may stem from having been in a lot of those closed rooms, and when you are talking about these kind of issues that come up -- and unfortunately, it often seems to be a discussion about how do you demonstrate that what we already have is okay, instead of seriously looking at what is posed as a possible event.

Q Let me tell you what the problem is from our perspective. Even if I impugned that motive to them -- that is, gee, if we have to account for this particular occurrence at these particular loads, that may be a problem, so let's take a very hard look to see if we can avoid doing that -- even if I impugn all of that to their thinking, if they have come up with a good analysis or good explanation, in the Staff view at least they have, as to why you need not consider the Dresden-type sequence -- and I emphasize "type" -- as applied to Shoreham, I want to get directly at the explanation, and you are talking about, well, this makes them happy.

Of course, it makes them happy, but the real question is are they right in their reasons?

BY JUDGE MORRIS:

Q Let me carry that one step further. It is sort of like you are saying they may not have done this adequately. And they may, or they may not have. But what we would like to hear from you is some specific deficiencies that are causes for you to make a statement like this, that their analysis is not adequate.

Now, what is adequate? What is wrong with what they have done that you know, other than speculation that they may not have done it adequately?

MS. LETSCHE: Judge Morris, if I might say one thing here --

JUDGE BRENNER: Well, let us see if we can get the answer, and then we will let you talk, because we have a very broad, I think one can characterize it as a charge, even, that there are things that we are not being told or things that we are missing. And if that is the case, we want to know about it. But if it is not the case, I want to put the context back in the remark and then we will let you say what you want to say.

WITNESS BRIDENBAUGH: Well, let me say that I don't have any information that tells me that they didn't look at something that they should have or that they intentionally covered up anything. I am not making that charge at all. I am just saying that based upon my experience, I know there is a mind-set, if you will -- that word has been used by a lot of different people -- that a good job was done in the original analysis and what are you bothering us with these things for?

I think that had a better job been done in the generic report or in the plant-specific adoption of it, to say that these are the conditions that we looked at, the reason we didn't look at the others is because of this and this and this, not just to say because they weren't applicable.

That is the basis for my concern or for my being unconvinced, I guess, if that is the way I would describe it. Apparently, there is some basis for the Staff to believe that in terms of the high-pressure water discharge question because apparently that hadn't been resolved yet. Well, I don't know of any particular load condition that I am asking need to be tested for or analyzed. I am just asking that a full explanation be given of the reasons for discounting other loading conditions that might be higher than those that were tested for.

WITNESS MINOR: May I add to that briefly? One of the comments that was made in the testimony last week, in the cross-examination, rather, related to the scram discharge lines -- excuse me -- the SRV discharge lines, and there was a comment that the breakers, the vacuum breakers, were quite close to the valves. And therefore, they felt that the time to drain that leg of the line would be quite brief.

When we looked at the drawings and found that they weren't really very close was where we began to wonder whether they had taken that into proper consideration. I think this is a somewhat different question. Maybe it's not totally different than the discussion that you were having a minute ago about the Dresden problem, whether the Dresden problem would reoccur and whether that would be related to that. This could even be a problem on a Shoreham-specific case compared with a generic case, depending upon how the vacuum breakers were located on the test case and how that configuration compared with Shoreham.

BY JUDGE BRENNER:

Q But just to make sure we are all speaking the same language when we say a "Dresden-type problem," and I do not think any of us, at least the Board, does not mean to key necessarily to the particulars of that event. And for one thing, I at least am not familiar with all of the particulars, but I think we have begun to use that as a kind of a code in the context of examining whether there could be a high-pressure liquid load on the SRVs. Is that in the same context that the two of you were using it?

A (WITNESS MINOR) Yes. I was speaking of the June 1970 Dresden blowdown at the Unit 2 and subsequent one on Unit 3. Both of those were high-pressure events, yes.

JUDGE BRENNER: Ms. Letsche, did you want to make your comment now?

MS. LETSCHE: Yes, I do, Judge Brenner. I think an important thing to keep sight of here is the whole point of what is being litigated. When the Suffolk County witnesses are being asked to state what they believe was wrong with what LILCO or the Owners Group did, I think that misses the point of the Suffolk County testimony and the point of the contention that we are litigating here.

The point is -- and what these gentlemen have been saying -- is that even with the additional testimony that we got last week and that they sat here and listened to, that LILCO has not demonstrated that they have complied with these NUREG-0737 items which specifically require a plant-specific correlation and comparison between the generic test results and the actual plant configuration.

And their point is that even the Staff has indicated by requesting even supplemental information over what they got last week during their conferences after the hearing, that that has not been provided, that all that LILCO has provided are conclusory statements that a comparison has been made and that they have not provided that detail.

And I think that it is important to remember that that is what these gentlemen are up here concerned about, and the burden of proof in this case is on the Applicant and not on them. And their point is that that has not, that specific comparison, has not been provided by LILCO. I think their testimony is supported by the Staff.

And I am not sure that it is fair to ask them to sit up here and be specific in talking about what was wrong when they do not know what was done. And that was my point.

JUDGE BRENNER: Well, I think you are confusing a few things, and let me see if I can do it very concisely, and then we will get back to the testimony. We are well aware of who has the burden of proof. We are also well aware of the fact that as an intervenor the County has the luxury of sitting back and stating the party with the burden of proof, typically the utility, has not done an adequate job.

However, that does not mean that we should not probe witnesses to find out why they believe that. Now, they may believe that along the lines of what you just argued; that is, simply, the utility has not demonstrated that they have done what they are supposed to do as to each thing for which they are supposed to do it. And we will look at that.

But there is also another possible case in addition, and not in derogation of the first argument, that here are some particulars that they should be doing, that the utility should be doing, and they have not done it. That is a different case, and it is arguably more helpful and certainly worthy of consideration if such be the case, and that is why we want to probe that.

It does not mean that where the County's case on a particular contention is along the lines of what you indicated that we have lost sight of who has the burden of proof. But we are still entitled, and I think obligated, to probe each and every witness quite thoroughly. And I do not think we have picked any sides in doing that throughout this hearing, particularly when witnesses make what sound to us like broad statements.

We are eager to follow up and find out what the basis for those statements are because we may hear them differently from what the witness intended them, and it is important to find out what is going on. And I thought I heard some potentially very serious charges, some of Mr. Bridenbaugh's statements, and he has explained what he meant now. Andit is another instance where what the hearer heard is not what the speaker intended. And I do not have to tell you that is the name of the game in Board questions or cross-examination.

So we are entitled to and obligated to probe very thoroughly, and we intend to do that with everybody's witness. That does not mean that we will forget at the end who has the burden of proof. But it is very pertinent when we put the findings together as to whether we are to look at whether what the utility has done is adequate or whether we have got some specific proposals against which benchmarks, if you will, in the view of the County's witnesses, against which we should weigh the utility's case.

And to the extent the County has such things, and properly so, the County has not been shy about including that in the testimony, and that is helpful, too, in terms of grappling with the issue.

MS. LETSCHE: Judge Brenner, I think that these witnesses would be glad to talk to you about specific concerns they have in both of these areas. The point of my comment was I was not sure if that was being requested, that they were asked to provide specifics with respect to information that they just did not have. And my point was that that, I do not think, is proper if their contention is they do not know because LILCO has not done it as far as they know.

They cannot very well be specific in identifying things that were wrong in what, as far as they know, has not been done. That is a separate issue from whether or not they have specific concerns and specific things that they think LILCO should have done. And I sure that they can address that as a separate issue.

JUDGE MORRIS: Ms. Letsche, that was just the point of my question. It was to determine whether it was a lack of information in the record that led them to doubts or whether because of their extended experience at GE and in other areas they had some knowledge which would be helpful in understanding that, by golly, there are real problems here and here is why. So it is just a matter of understanding.

BY JUDGE CARPENTER:

Q One last question with respect to the testing program. Earlier this morning I asked you in your experience, Mr. Bridenbaugh, what the principal points of failure were, whether they had to do with the kind of things that this generic test program was supposed to look at. And I believe you said in your experience that was not the main thing that was causing valve failures, but it had more to do with unexpected sources of friction, dirt, misassembly, et cetera.

If I look in your prefiled testimony at the information in Table B-6, the only information on the Target Rock two-stage model is the last page of that table, which, based upon field observations now, the performance of this valve, it all seems to be focused on dirt or malfunctioning of the solenoids, which has little to do with whether it is a three-stage or a two-stage, I think, but rather the control systems for the valve.

So it is not clear to me whether the test program's deficiencies lie entirely with whether it is appropriate for Shoreham in terms of force on the valve body that might be experienced at Shoreham vis-a-vis the whole pattern of problems with the safety relief valves, which do not seem to be so strongly focused on the thing that was the priority in the test program, but rather than has the valve redesign been in some way, as you say, more tolerant of dirt, more tolerant of mishandling.

But certainly, I have not seen any attention given on this last question. Do you not think some attention should be given to the reliability of the solenoid?

A (WITNESS BRIDENBAUGH) I am not sure whether I got all of your question.

Q Well, that was a speech. I was relieving myself.

(Laughter.)

A (WITNESS BRIDENBAUGH) But I think I would certainly agree with you, Judge Carpenter. I think it is easier to test the valve for the piping configuration than it is to test for the things that you mentioned and for the things that we have, I think, generally agreed caused the most problems. And I suspect that is why you have the American Society for Mechanical Engineers' very explicit directions on how to calculate stresses, but you do not have very many to tell you how to be on the guard for foreign material in the system because it is hard to predict what really can happen.

I think that that is exactly the thrust of one of the statements or one of the concerns expressed in our testimony, that when you are going to set up a test program to verify the operability of these valves, you need to really test as many of the environmental conditions that the valve is going to see as possible. And that should not be limited, in my opinion, to the valve body temperature and the dynamic loads, but that perhaps you should give consideration to trying to model the pipe scale ahead of the valve and what it is going to look like after the valve has sat there and cooked for 18 months and then finally the valve lifts, how much crud do you shake off of the inside of the line, and does it take five seconds to get that crud into the operating mechanism, into the pilot valve works, or can it sit there and blow down for half a minute or two minutes without causing some kind of a malfunction of the valve.

All things considered, it would be best if you could model the whole circumstance and make certain that the valve is reliable under those conditions.

Q But just in the spirit of the comments we heard from Ms. Letsche, you see there you were very specific that the lines had to age for 18 months before you had enough crud to shove them in the valve to cause the thing that is happening in the plants. So that sort of comment I think is very useful criticism of the testing program.

The testing of a valve that has just been assembled with fresh lubricant in it is not really very instructive about a valve that has been in service for 18 or 24 or 36 months in the field. I do not think that speaks very well towards operability.

And the reason I wanted to pursue this a little bit, it seemed like this test program was perhaps diverting our attention from the kinds of things that are described in Table B-6 when so many of those are not related to what was tested in the test program at all.

A (WITNESS BRIDENBAUGH) I wholeheartedly agree.

A (WITNESS MINOR) Could I add something to that? As a designer of components and systems, not valves necessarily, as I testified earlier, but I know that one of the most meaningful feedbacks on a design is not the qualification data that comes out of the more or less idealized conditions of a test configuration, but the field feedback data that it shows how things actually perform and actually fail and actually are maintained.

And although we heard in the testimony the other day that there is an attempt made to design a valve with that in mind, it is not very easy to do; and unfortunately, it is the field feedback that generally results in the changes later that might correct the problems if they show up early enough.

The data we are looking at on Table B-6 is only a six-month period of data collection, the first event being 10-80 and the last one being 4-81. That is not very much time to discover all of the possible problems that may exist that may not have been discovered by a valve test configuration of the type we are dealing with here.

JUDGE BRENNER: We are going to go to the staff in a moment, right after this comment, in fact. Some of the testimony we just heard in response to Board questions earlier and not the immediate last series with the County's witnesses raised the postulation of operator error cycling the valve under a liquid event.

Now, the Board at least has some questions, and I think it came out through the questions of the County and perhaps other parties of LILCO and staff witnesses on that event. I think it would be useful for the Board, for LILCO and the staff to ask the County witnesses about that and the assumptions that need to take place and what pressure might be under those scenarios and so on. Since you have your experts sitting with you, I think the staff and LILCO in further examination probably are in as good a position, if not better, than the Board to come back to that.

MR. IRWIN: Let me see what we can do, Judge Brenner. Clearly, this was not an event that was within the scope of their testimony, and it is hard to think of questions right off the top of one's head. Let me see what we can do.

JUDGE BRENNER: Well, go back to the testimony we heard on it -- and hopefully we will have probably a quick break before it is all over -- and ask them whether they agree or disagree with the assumptions voiced by the witnesses as to why you, in those witnesses' view -- that is, LILCO's and the staff's -- you would not have a problem, either because you would not get to that cycling-type situation or because the facility would be in certain modes at the time of that type of liquid cycling -- at the time of that type of liquid entering being in the steam lines during a potential cycling error.

I do not have to spell it out for you, but whether you would be in the ultimate shutdown mode or some other mode and so on.

MR. IRWIN: We will do what we can by way of cross examination. There may be types of items as to which our experts, six or seven of whom have gone home but the one who is here is plenty good, can address better themselves directly.

JUDGE BRENNER: Well, Mr. Hodges is here, and he had quite a bit to say about it last week, as I recall.

MR. IRWIN: That is true. All I am suggesting, Judge Brenner, if we may be able to put facts in better through our own witnesses rather than by cross examination if the Board has questions they would like clarified.

JUDGE BRENNER: I want to get these experts' views on some of the things here the witnesses said.

MS. LETSCHE: Judge Brenner, can I just ask, are you requesting that there be additional LILCO and staff testimony?

JUDGE BRENNER: No. I am suggesting that it would be helpful if they included a certain area in their cross examination instead of us jumping in without the benefit of the person who gave that testimony next to us, whereas in at least the staff's case they have that benefit.

Okay. Let's go to the staff.

MR. REPKA: Thank you, Judge Brenner.

Exclusive of that last area I have a few brief questions in the area of challenges.

JUDGE BRENNER: I am sorry. In the area of?

MR. REPKA: Challenges.

CROSS EXAMINATION ON BEHALF OF THE STAFF

BY MR. REPKA:

Q Mr. Bridenbaugh and Mr. Minor, I will direct my questions to either or both of you.

You have testified both in your prefiled testimony and today that you interpret NUREG-0737, item

II.K.316 to require a reduction of challenges as opposed to a reduction of challenges or failures. Would you say that there is a contribution to safety from a reduction of challenges independent from a reduction of failures?

(Panel of witnesses conferring.)

A (WITNESS BRIDENBAUGH) I want to make sure that you stated the question the way that you wanted to. You are asking if we believe there is an improvement or a contribution to safety if you reduce the challenges, but that the number of SORVs remains the same?

Q I am assuming if you reduced the number of challenges and the rate of SORVs remains the same, you will be reducing the number of SORVs because the number of challenges is reducing. It just seems to me the two are tied together.

A (WITNESS BRIDENBAUGH) I thought you were asking for a hypothetical situation. I think I understand.

JUDGE BRENNER: Let me just try it. He wants to know if it would be narrow-minded and therefore not as consistent with safety to just focus on a reduction of challenges rather than including the total picture focusing on the reduction of events.

Is that fair, Mr. Repka?

MR. REPKA: That is fair.

WITNESS BRIDENBAUGH: Well, I think you could get to where you want probably, where you want to be by either route, theoretically you could. Obviously, if you could reduce the challenges to zero, why, you do not have to worry about SORVs; but I do not think that is possible.

I think that there is an improvement to be gained from reducing challenges if you do not --

JUDGE BRENNER: Mr. Bridenbaugh, just to shorten it up, that is not the question. Mr. Repka -- we are not asking would it not be helpful if you just did one. The question is would it not be narrow-minded to only, and therefore not as consistent with safety, to only focus on one instead of considering the total picture of everything leading to a reduction in SORV events; that is, both challenges and failure rates?

WITNESS BRIDENBAUGH: Well, I think it is logical that you would want to consider both, yes.

BY MR. REPKA: (Resuming)

Q Do you have any idea how item II.K.316 has been applied to other plants?

(Panel of witnesses conferring.)

A (WITNESS BRIDENBAUGH) We do not have any specific knowledge of that, Mr. Repka, no.

Q Thank you.

In your testimony, Attachment 1, you have attached --

A (WITNESS BRIDENBAUGH) Which one?

Q Your testimony on challenges. You have attached the body of II.K.316.

A (WITNESS BRIDENBAUGH) Yes.

Q The first sentence under "Position" states that the record of relief valve failures to close for all boiling water reactors in the past three years of plant operation is approximately 30 in 73 reactor years, .41 failures per reactor year.

Do you know what valve was the primary contributor to that failure rate?

(Panel of witnesses conferring.)

A (WITNESS BRIDENBAUGH) Could you repeat your question, Mr. Repka? I am sorry.

Q Let me rephrase it. One of the bases of item II.K.316 is the failure rate of .41 failures per reactor year. That history is based on the performance of a particular valve, and I was just inquiring as to your knowledge of what valve that was.

A (WITNESS BRIDENBAUGH) I believe that has been discussed last week as primarily the three-stage target rock.

Q If II.K.316 is based upon the performance of the three-stage design and the three-stage design was the primary contributor to all of these failures, why would not an improved valve such as the two-stage design be one acceptable approach to reducing failures?

A (WITNESS BRIDENBAUGH) I think that it may be an acceptable approach to reducing failures, but that, of course, is not the way the requirement is stated.

Q Mr. Minor, earlier this morning, I believe in response to a question from Judge Brenner, you testified that you were not aware of anything that was not being done that could reasonably be done at Shoreham to improve the rate of challenges and failures; but you suggested that a Shoreham plant-specific review might identify some new factors to help reduce SRV challenges. Do you remember that testimony?

A (WITNESS MINOR) I do not believe those are the words I used. We did discuss possible additional factors, and I talked about extensions or modifications of the list that is presented in II.K.316, variations of those that may be applicable to Shoreham. But I did not in that identify any specific item that I said this one should be done. Is that what you mean?

Q Did you identify any concrete suggestions?

A (WITNESS MINOR) No, I did not, but I have some that I could suggest, if that would be helpful.

Q Feel free.

A (WITNESS MINOR) One thing that we have discussed and been concerned about is that the low-low set point manual operation that is discussed in the LILCO response is basically a procedural approach to a modification of the low set point for the valves. And it did not appear that there had been adequate consideration given to the actual implementation of the mechanical change in the valve set point rather than reliance on a manual action to achieve the same effect. In other words, if you want to ensure that that action will accomplish a lower number of challenges or a lower number of incorrect operations of the valve, it seems the way to do it is to integrate it into the valve design rather than into operator actions.

JUDGE MORRIS: Do I understand you to mean by that incorporate into reactor design, make it automatic?

WITNESS MINOR: Yes. It would be effectively automating the set point, the low set point action that the manual set point procedure now incorporates.

JUDGE BRENNER: Well, as you may recall, you are not unique in having thought of that. And as I recall, the Board had some questions along those lines, and LILCO's testimony was that they thought it would be detrimental to lose the flexibility and would add little.

Do you disagree with that? They were worried about being locked into an automatic low set point when there might be situations where they would not want the set point to be that low, and they would want the operator to have greater flexibility to respond to particular events.

WITNESS MINOR: I recall them making comments of that nature, but I did not recall that they had done any thorough analysis of it. It is mainly that they have a predisposition to want to keep their options open. And I think if that were the basis, it would seem to me to be worthwhile to flesh that out with some analysis that really shows in which cases they do need that flexibility and are they really saving flexibility for some event which may not either be very likely or may not have any serious results if they did not have that flexibility versus their opportunity to actually ensure the reduction of challenges to the valve.

MR. REPKA: I have no further questions at this time.

BOARD EXAMINATION

BY JUDGE MORRIS:

Q Let me follow up on that one.

I take it, Mr. Minor, that you have not done any analysis either?

A (WITNESS MINOR) No, sir.

JUDGE MORRIS: Thank you.

BY JUDGE BRENNER:

Q Well, granted what you said as to the lack of any particulars presented in their answer -- and, in fact, I think your characterization of what they said was fair, for what it is worth -- does it intuitively strike you as falling in the reasonable range to want to maintain that type of flexibility, or do you think it is kind of an unreasonable attitude that it is so unlikely that that flexibility would be useful?

It strikes me, as a layman obviously, that is the kind of thing that is hard to analyze because you do not know the situations in which you would need that flexibility; and it is that low-low probability type event where you do not want to give up that kind of flexibility.

And I guess I would like your comment to my combination question comment. How do you analyze that?

A (WITNESS MINOR) Well, in discussing it, other situations in this hearing regarding automation, the operators have expressed a strong desire to have override capability of automatic functions where they do want flexibility.

MR. IRWIN: Judge Brenner, excuse me. I object to this. This is relating to the subject of settlement discussions, and material and settlement discussions is not appropriate in the specific context for use in the hearing.

JUDGE BRENNER: I do not think he is going too far into settlement. He is certainly in the context of information that would be helpful to us, and we are relating it to the context of this issue. We are not applying it to any other areas. And he has not given us any details yet either, and I did not hear anything that indicated he planned to.

WITNESS MINOR: I did not mean to tie it to any particular issue in this hearing at all. I think in general this is an operator or an operations trend, that they like to maintain control of their options as much as possible.

On the other hand, if you were to automate this function and then have a manual override capability, you would achieve a lot of the same end result and eliminate the operator from having to devote his attention to that type of a set point monitoring and actuation during an event or a transient of this nature when he has other things to be concerned with.

BY JUDGE BRENNER:

Q I do not know enough about the operation of these valves, but I guess my question is do you know enough about the operation of these valves to know whether it is feasible to have an automatic low-low set and then be able to override it the other way? Again, as a layman that sounds like a much more complex logic to build into a plant than the ability to manually keep it open and then close it manually.

(Panel of witnesses conferring.)

A (WITNESS MINOR) Judge Brenner, I am not certain of the exact design that would be required. I have not really tried to look at it from that respect; whether it would be external controls or that would be required in total to accomplish that end or whether it would take some modification of the valve to have that capability. I have not looked at that.

Q I am suggesting that the idea sounds certainly like a reasonable counterproposal; that is, instead of the way LILCO plans to do it, have it automatic with the option for override. It sounds nice. But thinking about introducing other control logics, you have now got a system where you wanted to be on a low-low set point automatically, and then you are going to introduce a logic whereby the operator can presumably remove the mechanisms for opening it, the nitrogen or air-type flow.

And bearing in mind everything we have thought about with systems interactions and that type of thing, you have suddenly got a logic that could cut off the mechanism, which you do not want cut off on automatic.

I just suggest it may not be as simple as it sounds, and I wonder if you would agree with that observation?

A (WITNESS MINOR) I would agree with you. There may be possible implications to this that have not been looked at, but that is part of the problem. I do not believe it has been looked at in that respect. I think it was discarded rather quickly in light of the desire to maintain options.

Q Okay. In assessing that problem we will have to consider what we think of the proposed approach, whether it has some problems of its own because it depends on manual action.

A (WITNESS BRIDENBAUGH) If I could add, I would just like to add I think that design exists for the BWRs, and I think the BWR owners group report indicates that it does exist on some plants. And I further am led to that belief by the fact that the standard GE tech spec wording describes the low-low set function as an automated type function, and in the Shoreham markup of the standard tech spec, that has been deleted from the

Shoreham tech specs.

Q I think we know the automated low-low set function exists. The question is does it exist with a manual override.

A (WITNESS BRIDENBAUGH) That I do not know.

Q That is the question, and even if it existed, similar to some other county positions which the Board somewhat shared in this context, just because another reactor has it, that doesn't mean it is good. It depends upon the analysis and whether they thought of the problem.

A (WITNESS BRIDENBAUGH) That is why we say that you need to do a plant specific analysis. Yes, sir.

JUDGE BRENNER: I will add one other comment. If you were seriously considering at the difference between LILCO's manual low-low set and the option, if it exists, of an automatic low-low set in combination with a manual override was reasonably important, it certainly would have been helpful to have that in the testimony. I am not saying you are required to do it. But the parties would have perhaps been able to consider it and better focus the issue on it.

Instead of going back to either of the parties immediately, maybe this would be a good time for the break, and since the staff technically -- well, if you come up with what we suggested over the break, we can go right back to you, Mr. Repka, and the reason I suggest you in the first instance is, my recollection is, it was Mr. Hodges's testimony, and perhaps not exclusively, but which importantly discussed that matter. If I had a transcript site, I would give it to you. I just know it occurred last week.

MR. REPKA: That is fine. We will try to follow up on it.

JUDGE BRENNER: Let's break until 3:30.

(Whereupon, a brief recess was taken.)

JUDGE BRENNER: Mr. Repka, do you want to take a shot at that subject now?

MR. REPKA: I will take a shot right now.

FURTHER CROSS-EXAMINATION ON BEHALF OF THE STAFF

BY MR. REPKA:

Q Mr. Bridenbaugh and Mr. Minor, we are postulating --?

A (WITNESS MINOR) Excuse me. Would it be possible that we could, before we go into another question, answer a statement that was made just before the break, that we didn't really get a chance to respond to?

MS. LETSCHE: Judge Brenner, I have to apologize. I was supposed to do that, before Mr. Repka started, to ask if Mr. Bridenbaugh could respond to a comment you made that he didn't have an opportunity to respond to before the break.

WITNESS BRIDENBAUGH: Yes, Judge Brenner. I don't remember exactly how your question or statement was worded, but it had to do with the discussion of the automation of the low low set equipment. And if I could characterize it, you said, why didn't you put that into your testimony.

And the point that I was trying to make when we went on the break, or I wanted to make, is that we in fact did do that. It is located on page 6 of our testimony. While we don't specifically recommend that the automation be -- that the modification be made automated, we do point out that in our view it wasn't appropriate, it did not seem appropriate, to equate a required operator action with an automated modification.

And therefore, by implication we are suggesting that automation should be considered.

JUDGE BRENNER: Yes, I know. I don't think we're on the same wavelength. I'm well aware of the alternative and the possibility that it is an area worthy of some inquiry. In fact, we made the inquiry last week of the comparison between an automatic low low set relief and the ability to manually keep the valve open for low settings.

The point we are focusing on now is the combination of automatic low low set relief with the manual override. I certainly know that automatic low low set relief has been discussed, but we are at a bit of a finer point than that.

WITNESS BRIDENBAUGH: I though you had overlooked the fact that we had addressed automating the modification.

JUDGE BRENNER: You're right. I did not have in mind the fact that that too was included in your testimony. However, that was not the focus of my comment, since that subject had been raised and discussed with all of the witnesses, including the two of you.

BY MR. REPKA: (Resuming)

Q MR. Bridenbaugh and Mr. Minor, we wanted to get to this question of the problem of cycling of the valves, and we want to postulate an alternate shutdown cooling mode. And the question is, are you familiar with the procedures, the operating procedures in that alternate shutdown cooling mode?

A (WITNESS BRIDENBAUGH) I have not reviewed the procedures.

A (WITNESS MINOR) I have not reviewed them, either, in detail. I have looked at that procedure, I believe, but I don't recall studying it. So I am not familiar with the details of it.

(Counsel for Staff conferring.)

Q I have in front of me a copy of Shoreham emergency procedure, cooldown procedure. The number is SP No. 29.023.02, and in the alternate shutdown cooling mode it states at 3.10.3 that you position the SRV so that only one SRV is open.

Now, assuming this procedure were followed, how likely do you believe it would be that an operator would cycle the valves rather than just open one valve?

(Panel of witnesses conferring.)

MS. LETSCHE: Judge Brenner, it might be helpful, if we're going to have questions about a particular procedure, for the witnesses to have the entire procedure in front of them instead of having one line read to them.

JUDGE BRENNER: Okay. Mr. Hodges is doing that now.

(Document handed to witnesses.)

(Panel of witnesses conferring.)

WITNESS BRIDENBAUGH: Mr. Repka, in response to your question, we have not done a probability analysis, so it is not -- we can't give you a number in response to your question. I would like to make a couple of comments on this procedure, though.

I think the main point that is being made here in this section 3.10.3, that only one SRV is to be opened, that really is addressing the subject of how much flow do you need through the core. And as I think we heard last week, some BWR's require two valves to be open, some require one to be open. Shoreham is a plant that has been analyzed for one valve to be open, and I think that is really all that that reflects.

The other thing that I recall from the discussion of this procedure -- and this is specified in 3.10.7 is that the reactor pressure vessel is to be maintained between 100 psig and 184 psig. My recollection is that that pressure control is accomplished by throttling the inlet flow from the core spray pump, as it calls for here, or the LPCI pump, so as to maintain that pressure.

I think it is, however, fairly likely that if the operator loses control of that throttling mechanism and if he loses control of the pressure on the system, he may very well mistakenly go to opening another valve or to cycling the valve that is already open. So I can't quantify how likely it is, but I think it is a fairly likely event that he would cycle a valve.

BY MR. REPKA: (Resuming)

Q What kind of time frame do you estimate would cause a problem in cycling the valve?

A (WITNESS BRIDENBAUGH) Well, first of all, let me respond to that and say, I am not saying that even doing it would be a problem. We really have said that that is a situation that ought to be looked at for the potential for a problem.

I think, however, along the lines that we were discussing earlier this afternoon, the kind of a time frame that you would have to postulate for a problem would be that it would be cycled in something less than ten seconds or thereabouts. It would probably have to be done in less time than it would take the line to drain out, if the concern is opening the valve with the line still full of water.

A (WITNESS MINOR) I would like to add to what we said earlier, that this procedure in a subsequent section actually calls for the possibility of opening additional SRV's, where it says under 3.10.7.2, "If the RPV pressure does not stabilize below 184 psig, then open an additional SRV." It doesn't give you any indication of what low set point you would go down to before you let that one close again.

So there is no indication of what cycling time you might use on that valve to bring pressure down.

Q Just to clarify one point, even if the procedure is not followed, so more than one valve is open, just opening a second valve is not going to cause the problem. You still have to cycle that valve.

A (WITNESS BRIDENBAUGH) That is correct. But the point is that the more valves the operator has to manipulate, the greater the possibility is that he might do it wrong.

(Counsel for Staff conferring.)

Q You are talking purely hypothetically here, though. You have done no analyses or have any data to support or any instances where operators have done this sort of thing?

A (WITNESS MINOR) We are not citing any particular incidents where this has happened, nor do we necessarily know of any. It is mainly the fact that we are talking about a test which is supposed to bound conditions which may happen. This test should include the possibility of things which are within reason, I believe, which could happen under these conditions, rather than do the most simplified test and say that includes all possibilities.

The same concerns expressed with high pressure testing, that you can't say necessarily you've bounded all conditions because some are low probability when you aren't sure how things would operate under the high pressure water conditions.

MR. REPKA: Judge Brenner, I don't think we can go any further on this right now. I think we have the different witnesses' positions.

JUDGE BRENNER: Let me go to LILCO before we jump in.

MR. IRWIN: We have just a couple of additional questions.

FURTHER CROSS-EXAMINATION ON BEHALF OF LILCO

BY MR. IRWIN:

Q The circumstances we are postulating occur, do they not, in the alternate shutdown cooling mode; is that not correct?

A (WITNESS BRIDENBAUGH) That is correct.

Q And that cooling mode is encountered on the way to a normal shutdown, correct, a normal reactor shutdown?

A (WITNESS BRIDENBAUGH) You are on your way to a cold shutdown, but it is described as an emergency procedure. I'm not sure what your term "normal" refers to.

MS. LETSCHE: Excuse me, Mr. Irwin. Maybe just so the record is clear we should find out if we are talking, when you say, circumstances we are postulating, if you're talking about the ones Mr. Repka postulated or some which I think maybe the witnesses were referring to, or some other conditions you are talking about.

JUDGE BRENNER: He is postulating the alternate shutdown cooling mode. That is his whole starting postulation, correct, Mr. Irwin?

MR. IRWIN: That is correct.

MS. LETSCHE: I just wasn't sure that the witnesses understood what he meant.

BY MR. IRWIN: (Resuming)

Q Well, what conditions do we go into in an alternate shutdown cooling mode, then?

(Panel of witnesses conferring.)

Q Do you know without being able to consult?

A (WITNESS BRIDENBAUGH) The conditions that you are talking about is if your normal shutdown cooling mode could not be followed, and normally you would cool down by passing steam to the condenser and getting down on RHR. So the conditions we are talking about would be if those systems were not available.

Q Is alternate shutdown a mode into which the operator must immediately go when those conditions are confronted? In other words, I'm trying to get a feeling for the relative time frame in which one is operating in going to alternate shutdown.

A (WITNESS BRIDENBAUGH) I think in general the answer to your question is, no, it is not an immediate transition that you would have to make. It would be something that you would expect to have some time in order to get into it and it would take some time in order to get into that mode.

Q This is not what is conventionally referred to as a stressful situation, is it?

A (WITNESS BRIDENBAUGH) Well, no, I don't think it is a stressful situation. It is a situation where the operator is dealing with equipment in a configuration that is probably unusual to him and to the operating condition. But I would not describe it as a stressful situation.

(Counsel for LILCO conferring.)

A (WITNESS BRIDENBAUGH) If I might just add, to make sure there isn't any misunderstanding, in our testimony we do talk about stressful condition, and we are not talking there about alternate shutdown. We're talking about low low set modifications.

So your question, I assume, was limited to alternate shutdown.

Q That is correct. That is the context in which we're dealing.

Mr. Minor indicated that in the context of a depressurization of the reactor in the alternate shutdown cooling mode, if pressure were not being maintained below the level of 184 psig, then operating procedures call for opening a second safety relief valve. Mr. Minor, would there be any water in that line for the second safety relief valve when the operator opened it?

(Panel of witnesses conferring.)

A (WITNESS MINOR) The second line, because it has a separate discharge line, should have no water downstream from the first opening. There should be water upstream. In other words, we're talking about the cycling of that valve where the second opening may actually have water in the line.

Q That is correct. So the operator would have again, with respect to the second valve, the same independent error that you were postulating for him to make on the first valve?

A (WITNESS MINOR) No, I'm not calling that an independent error. What I'm saying is the procedure calls for, if the pressure -- it says, if the RTD pressure does not stabilize below 184 psig, then open an additional safety relief valve. In opening that second relief valve, he may open it for a while and the pressure may go back up. He may open it again.

I don't think that would be an additional error, the way you defined it.

Q When he opens up the valve the first time, though, there is no water downstream of that valve; that is correct, is it not?

A (WITNESS MINOR) If that is the first time the second valve has been opened, there should be no water, assuming it hasn't been opened briefly before that.

(Counsel for LILCO conferring.)

Q Mr. Minor, do you know where the operating procedures would call for him to close that second valve, at what pressure? It would be at 100 psig, wouldn't it?

A (WITNESS MINOR) He's trying to maintain the range of 100 to 184 psig, yes.

Q So presumably he would take the reactor down to approximately 100 psig before closing the second valve, wouldn't he?

A (WITNESS MINOR) It is hard to assume what he would do. He may.

(Counsel for LILCO conferring.)

Q Mr. Minor, would you expect the pressure in the reactor to drop from 184 psig to the neighborhood of 100 psig within the framework of approximately ten seconds, as little as ten seconds, with two safety relief valves open in the alternate shutdown cooling mode?

(Whereupon, the witnesses conferred.)

A (WITNESS MINOR) I think you are asking me to make the assumption first that the operator will go all the way down to the lowest pressure of this range. That is an assumption I would have to make to even answer your question, and I don't necessarily accept that as a valid assumption, because basically all he has to do is get below 184 psig, and he meets his requirement.

Second, it would depend a lot, I guess, on your filled condition in the vessel. If you were filled entirely, so that all of the steam lines and all of the air volume was filled, you would have a more rapid pressurization rate capability with the core spray pumps.

(Whereupon, counsel for LILCO conferred.)

Q Mr. Minor, are there any operating parameters which would lead you to conclude that an operator would rationally, and I am not talking about blind, irrational mistakes, because I think -- let's carve that out of the question, but are there operating parameters which would lead the operator rationally to cycle that second valve you are talking about within the space of a very few seconds, given all of the operating parameters we have been talking about? And by cycling, I mean cycling it closed and then opening it again rapidly.

(Whereupon, the witnesses conferred.)

A (WITNESS MINOR) I have to take a great deal of liberty with your expression of rational reason, because I don't know what that means exactly in terms of what the operator might or might not be doing. For instance, the step just before this called for the pressure, if the pressure went down too low, he might turn on an additional core spray pump or an additional LPCI pump, and if he had done that, he may be in a mode where pressure changes would occur more rapidly, because he is putting in a faster volume flow rate of fluid into the vessel.

But let's assume now that the operator found the system at 180 something psi higher than the value he desired, and he opened the valve and reduced it down below 180, let's say, or some range not too far from the set point, but decided his other actions led him to believe that that would be a point where he could stabilize his pressure and get it to remain stable.

If the pressure rate increase was fairly rapid because of the pump combination he had on at that time, he could come back up to pressure fairly quickly and have to cycle that same valve again, this time deciding that it would be better to leave it on longer and let it go to a lower point, in which case it would be opening a second valve in a short period of time.

Q Does the operating procedures call for starting a second pump after you have closed that second valve hypothetically?

A (WITNESS MINOR) In Step 3.10.7.1 it says, if you are at a lowe pressure -- excuse me -- if it does not stabilize above 100 psig, then start a second pump. If he did that and took the system instead to a high pressure condition, he may try to correct that condition with an SRV.

Q Doesn't he have one valve open at that time?

A (WITNESS MINOR) Yes, he does, or he should have. I don't know if he does. A rational operator would have, I think.

Q In short, is there anything in those operating instructions that instructs the operator to cycle the safety relief valves?

A (WITNESS MINOR) No, there is nothing that requires him to cycle it except that there is an instruction here which says, if you go above a certain pressure, another SRV opening is the way to resolve it. There is nothing that prevents him from doing that repeatedly if the condition recurs.

JUDGE BRENNER: Let me see if I can understand this in context. Mr. Minor, you have got him possibly cycling the SRV at around this 184 psig, as I understand it, because it may not be perfectly clear as to what pressure cycle he should open or close, but around that number, correct?

WITNESS MINOR: That's correct.

JUDGE BRENNER: Is that the kind of pressure you are worried about in terms of the lack of consideration of a high pressure liquid force on the SRV? I thought we were talking about much higher pressures.

WITNESS MINOR: We are talking about the problem of water in the discharge line. The tests were run at a somewhat higher pressure than that, not a great deal higher, 250 psi, I believe. And that difference I don't consider to be so large that it wouldn't be worthwhile testing for this condition.

JUDGE BRENNER: Okay. The idea of the alternate shutdown cooling mode is part and parcel of bringing the pressure down in the reactor and establishing an alternate flow path, correct?

WITNESS MINOR: An alternate cooling mode, yes.

JUDGE BRENNER: Could you be at close to normal reactor pressure when you start opening the SRV in order to begin getting into this alternate shutdown cooling mode, or do you get down to lower pressures before you begin trying to establish it by opening an SRV?

WITNESS MINOR: The same procedure calls for opening the SRV's in a fixed sequence. In fact, it is instruction 3.7.5 here. Or 3.7.5.1, subpart calls for open SRV's in the following sequence, if possible, and it gives the sequence of SRV opening. Subsequent to that, it says position SRV so that only one SRV is open and then raise reactor pressure vessel water level to establish a flow path through the open SRV back to the suppression pool, and then we are talking about the sequence of events we were discussing here.

JUDGE BRENNER: All right. So before you get into that sequence, you will have depressurized the reactor, correct?

WITNESS MINOR: Yes. I don't think we were discussing a high pressure condition. We were discussing a low pressure condition.

JUDGE BRENNER: According to LILCO, they believe the low pressure forces had been tested for, and you are stating that there is a higher liquid force that was not tested for, and I am groping for what force has not been tested for in the liquid.

WITNESS BRIDENBAUGH: May I add my comment? I was under the impression that this whole discussion was predicated on the possibility that the alternate shutdown cooling mode could get the operator in the position where he was opening the SRV with water in the discharge line, and that it wasn't really related to high pressure discharge of water.

JUDGE BRENNER: I wanted to establish that, if that is the case, and now I want to find out what the concern is, what happens if the operator does that in the alternate shutdown cooling mode.

WITNESS BRIDENBAUGH: The concern is merely that that was not a condition that was bounded by the liquid test in the generic test program, and it wasn't considered as a possibility.

JUDGE BRENNER: Well, here is where I am confused again. In what sense wasn't it bounded that it will be at forces beyond that which was tested?

WITNESS BRIDENBAUGH: It may be.

JUDGE BRENNER: Okay, not because of the

pressure reactor.

WITNESS BRIDENBAUGH: Because of the water in the discharge line. Yes, sir.

JUDGE BRENNER: And the dynamic water hammer type effect?

WITNESS BRIDENBAUGH: That's correct.

JUDGE BRENNER: What happens if that occurs?

WITNESS BRIDENBAUGH: The thing that -- I guess the worst case that could happen is, the line could rupture and the valve refuse to open or refuse to close.

JUDGE BRENNER: The line would rupture or the valve would open?

WITNESS BRIDENBAUGH: They are basically the same.

JUDGE BRENNER: What would that be, a small break loss of coolant accident?

WITNESS BRIDENBAUGH: Well, it is a small break loss of coolant with the reactor shutdown in the nearly cold condition. It is probably not a very serious event.

JUDGE BRENNER: I am going back to Dr. Crawford's testimony in my mind as to that, some of the things that they didn't consider, they chose not to consider in part because the analyses of other events such as the design basis accident well bounded this type of concern. Do you recall that testimony?

WITNESS BRIDENBAUGH: Approximately. Yes, sir.

JUDGE BRENNER: Do you think that testimony applies to this situation?

WITNESS BRIDENBAUGH: Well, I think that it applies to this. It may apply to this testimony for the LOCA condition. I guess that is what you are asking.

JUDGE BRENNER: Well, let me try to paraphrase this.

WITNESS MINOR: Could I comment on that?

JUDGE BRENNER: Let me just try to paraphrase Dr. Crawford's testimony. It will be right along the same line, and then I will let you comment. I believe you testified that, yes, there may be certain conditions that they did not include in the testing program, and let's limit it now to this water condition that we have been discussing, and he said, as to such conditions, that there were such conditions that were not considered because they were both low probability events, low in comparison to the design basis accident, and also, even if they occurred, of lesser consequence than the design basis accident, and for those two reasons, there were events that they did not test for.

That is, admittedly, there are events that were not tested for because -- not because a combination of the probability and the consequences were lower, but because each of those parameters were lower, the probability of occurrence as well as the consequences. So, he wasn't just talking about a risk equation. He was talking about each of the parameters, and do you think this is such an event, and if so, do you think that is a rational basis not to include it in the testing program?

(Whereupon, the witnesses conferred.)

WITNESS MINOR: Judge Brenner, I don't recall all of the testimony from the last week, and I don't recall the specific statement you are making which you are attributing to one of the LILCO witnesses. I do recall them discussing LOCA events in terms of the environment that you would have to subject control equipment to, that the LOCA environment would be more severe, and therefore it would be a bounding case as far as subjecting control and instrumentation and other related auxiliary equipment to the valve, and what requirements it would have to meet in the test environment.

Putting that aside, I believe your question is now, do I consider that or do we consider that a low probability event with low consequences, taking those two subjects independently and not in a risk context. And therefore one which is reasonably left out of the testing configuration. I think my response is, if I were setting out to test a valve which was to be a fairly definitive test of the operability of the valve under a range of conditions, I would want to test that val. for as wide a range of conditions as I could within reason, to make sure that I knew how it would operate under not just a specific defined transient, but under other conditions which may not be the most probable events, but are possible to happen, and therefore may affect the valve operation, its operability, and how it would perform in these situations.

So, I don't believe I would come to the same conclusion about all of these possibly low probability, possibly low consequence events that were left out of the valve test configuration.

JUDGE BRENNER: I do not know if this is a fair question, but let me try this. Let us assume that you have got a testing program, and you test a valve under the postulated conditions that you are talking about; that is, forget about all of the things that have to happen to get there, including the operator error that you are concerned with, but you have got that dynamic condition of the water hammer-type effect and the alternate shutdown cooling mode. And the forces exhibited there cause the valve to fail enough times so that there is concern as to whether the valve would reliably function properly in those conditions.

And I want to further postulate -- and this is getting very hypothetical, I admit -- that that is it, SRVs just do not work under those dynamic forces. They present a peculiar design problem in this valve; they just do not function under that type of water hammer effect sufficiently frequently so as to be reliable. They will fail open.

What do you do? Do you decide that knowing what you know about how you have to get into that situation and knowing -- that is, the probability of getting into that situation -- and knowing that the consequences are bounded by the design-basis accident, is that a reason to say that this design is unsuitable because there are no SRVs that would withstand that particular situation reliably?

WITNESS MINOR: I am not sure I remember all the hypotheses in there. But I find a difficulty with the general rationalization that it is bounded by a large LOCA, in that if you really believe that, you would probably not bother testing because an SRV is just a LOCA if it fails. Or it may shift the load to another SRV if it doesn't open.

JUDGE BRENNER: Well, I want you to assume that it is bounded by a large LOCA. I thought it would be the equivalent of a small-break LOCA, and we have got -- LILCO claims to have performed that type of analysis.

WITNESS MINOR: I guess I need to have you redefine the conditions.

JUDGE BRENNER: Well, I want you to make the assumption because it seems to me when you are planning a testing program you have to game out what you learn from the testing program. And when you are in what I think we all agree is a low-probability event, we can add other descriptive words to the word "low," and there may be some disagreement as to how low, but I think when we are in a low-probability event -- and we have got testimony that states the consequences of the event are lower than those consequences assumed for other design-basis events.

And given that, I am wondering what would be gained by a requirement which I infer you would seek us to impose; that is, that there could be no operation until the valve was tested under a condition that simulated that dynamic water hammer-type effect in the alternate shutdown cooling mode.

So I am jumping ahead. That is, assume we have required the testing and it shows the worst: from the point of view of the utility, the valve will not reliably withstand those forces. What then, considering the probability and consequences? I said that was maybe an unfair question, and if you do not want to answer it, that is okay. But if you want to take a shot at it, you are welcome to.

WITNESS MINOR: Well, it sounds like a hearing board decision rather than a technical decision.

JUDGE BRENNER: Well, we seek help whenever we can.

(Laughter.)

WITNESS MINOR: I would rather not answer that. I am glad I am here and you are there.

(The Board conferred.)

JUDGE BRENNER: As a result of having shifted the sequence, we never got back to the County for redirect. But since we have already altered the sequence, as we frequently do here, in terms of the efficiency of the County's redirect, perhaps I should ask LILCO if they have any follow-up questions based upon questions by other parties or the Board.

MR. IRWIN: No, Judge Brenner.

JUDGE BRENNER: What about the Staff?

MR. REPKA: No, Judge Brenner.

JUDGE BRENNER: Any redirect?

MS. LETSCHE: Yes, Judge Brenner, I do.

REDIRECT EXAMINATION

BY MS. LETSCHE:

Q Mr. Minor, with respect to the last discussion you have been having with Judge Brenner, in your opinion is one of the purposes of a plant-specific comparison of plant configurations to a generic test program, is one of the purposes of that comparison to determine whether or not conditions actually do bound those that would be present in a plant?

A (WITNESS MINOR) Yes, very definitely. The Owners Group conclusion was that they have set out a series of test requirements which they feel bounded different plants, and one of the reasons you would have to make that comparison against your own design is to make sure that there isn't something unique about it either in its original design or in its as-built configuration that would in any way preclude those results from being applied to the Shoreham plant.

And that is the type of plant-specific analysis that we are really seeking be done in more detail. And in some cases, we are even questioning whether the assumptions were right in the original test.

Q So that if you were asked to assume that a particular condition did bound another condition, you would basically be assuming the applicability of the test program rather than doing an evaluation of the test program; is that right?

JUDGE BRENNER: Ms. Letsche, let me jump in because I fear we are beginning to mix apples and oranges, to overuse a phrase we have heard a lot of times in this hearing.

Depending on, you know, you said one condition bounding another condition, it depends upon what you are talking about. If you are talking about the assumption I asked the witnesses to make of the design-basis accident bounding the safety relief valve failing such that there is an open pathway in the steam line, that is not something the testing program -- the testing program is for the purpose of how the valve would act. There is nothing in that testing program that performs the LOCA analysis that I know of.

Now, if you meant some other bounding, then that is different. But it was because you keyed your questions to stay in line with my questions that I am concerned that you may be going off the track in assuming that that test program is going to perform your LOCA analysis, because it is not.

MS. LETSCHE: I do not think that is what I was assuming, and I do not think that is what Mr. Minor was assuming either, Judge Brenner.

WITNESS MINOR: No, it was not.

JUDGE BRENNER: What are you bounding your question, what condition, bounding what condition?

MS. LETSCHE: My question was referring to a determination as to whether or not a test program bounds or the conditions in the test program bound the conditions that would be present in a particular plant. And my last question to Mr. Minor was: assuming you are evaluating the validity or the applicability of a test program, if you are asked to assume the conclusion that the test program configuration bounds the configuration in the plant, are you not assuming the conclusion that you would be trying to reach by evaluating the test program?

JUDGE BRENNER: Okay. And he said yes, which is certainly not a very difficult answer, given that question. Did you think one of my questions asked him to do that?

MS. LETSCHE: I just wanted to clear up for the record, Judge Brenner, what Mr. Minor's answer to my question was.

JUDGE BRENNER: Okay.

BY MS. LETSCHE: (Resuming)

Q Mr. Bridenbaugh, in response to a question fropm Mr. Repka, which I believe Judge Brenner rephrased at one point, I am not sure you ever really answered the question that was asked by Mr. Repka. In your opinion, is there a value in terms of improving plant safety to reducing the number of challenges to a safety relief valve?

A (WITNESS BRIDENBAUGH) Yes, there is. I think that you can draw a comparison to other serious accidents. I can remember in the olden days there were a lot of discussions about whether it is better to prevent a core melt or is it better to -- is it better to prevent a loss-of-coolant accident or is it better to mitigate a loss-of-coolant accident, et cetera? I think, in general terms, if you can minimize or avoid the transients, you are better off than you are trying to design the equipment to withstand them.

Now, I would agree that you have to do both. But in terms of the reduction of challenges to SRVs, I think the first step that I would take would be to reduce the challenges, because not only does it minimize or reduce the probability of a stuck-open relief valve, it also reduces the thermal cycles that the reactor coolant pressure boundary is going to see, it reduces the duty on the fuel, and, in general, it has other benefits other than just minimizing the possibility of a stuck-open relief valve.

Q Do you agree -- and this is addressed to both of you -- with the reduction in SRV challenges that LILCO claim to have achieved in their testimony through the use of a manual low-low set-point modification?

MR. IRWIN: Objection. I think that is entirely outside the scope of any cross-examination that Mr. Bridenbaugh received.

JUDGE BRENNER: I did not hear you at the end, Mr. Irwin. I heard your "beyond the scope" part.

MR. IRWIN: I have a difficult time relating that to any cross-examination of Mr. Bridenbaugh.

MS. LETSCHE: Judge Brenner, there has been extensive discussion here about the modification to the low-low set-point and various methods of achieving it.

JUDGE BRENNER: Let me hear the question again.

MS. LETSCHE: Do they agree with the reduction in SRV challenges claimed by LILCO through the use, in their testimony, through the use of the manual low-low set-point modification?

JUDGE BRENNER: It is not really related to the questioning because the questioning, whatever benefit you get from it, there is no discussion as to the benefit. Are you more likely to implement the action through automatic action or manual action. And you want to go towards the mathematical number presented in the Owners Group and through LILCO's analysis, which was not the question at all.

MS. LETSCHE: Let me rephrase the question, Judge Brenner, unless you are going to let me keep it there.

JUDGE BRENNER: Tell me where you want to go. I might let you do it anyway if it is not too long. But I am confused by your argument because it does not sound like you are going in the same direction that your argument would apply.

MS. LETSCHE: Let me rephrase the question.

BY MS. LETSCHE: (Resuming)

Q In your opinion, gentlemen, is the manual low-low set-point modification which LILCO intends to implement the best modification that they could make in order to achieve an improvement in plant safety? And when I am talking about "best," I am talking about with respect to a modification of the low-low set-point.

MR. IRWIN: Same objection.

JUDGE BRENNER: That question was related.

(The panel of witnesses conferred.)

JUDGE BRENNER: Now, if somebody had said asked and answered, I might have come up with something different. But let us let it go. I cannot imagine getting anything different than we have got ad infinitum on that. But let us see.

WITNESS BRIDENBAUGH: Let me just respond very quickly to that. In our testimony we questioned the assessment of that number, and I still question the assessment of that number.

JUDGE BRENNER: Wait a minute. You are misunderstanding the question. You are answering the question that your counsel withdrew in response to the objection. The question is do you think it is better to have the automatic low-low set or the manual low-low set, that is, holding the valve open below the normal resetting point?

WITNESS BRIDENBAUGH: I think it is impossible to answer that question without doing a plant-specific analysis, and I don't believe that that has been done.

JUDGE BRENNER: Really? You think you need a plant-specific analysis to compare the benefits of an automatic low-low set versus a manual approach of holding the valve open?

WITNESS BRIDENBAUGH: I think that it is, given the guidelines that you just gave me before in answering the question. What I was going to say was that my judgment is that the automatic low-low set is more reliable and therefore you can depend upon it. But I think you also have to look at the disadvantage of it for a specific plant.

JUDGE BRENNER: What disadvantage do you have in mind other than the fact that the operator might forget to do it if it is manual?

WITNESS BRIDENBAUGH: Well, the one disadvantage, of course, LILCO has addressed is the loss of flexibility and the need to be able to override it under some circumstances, which haven't been identified.

WITNESS MINOR: If I might add to that comment, I think the question is probably directed to both of us, and maybe my view is from a little bit different perspective than Mr. Bridenbaugh's.

I feel that the number which was presented in the table of the reduction that can be achieved from the manual low-low set-point actuation hasn't been properly developed to show us what credit they are taking for an operator's action in that situation.

And indeed, there may not be as much credit as you can take from that action if it were really analyzed as to what the conditions might be, you would be asked to perform that function, and what other things would be going on at that time when he is exercising his low-low set-point actuation.

MR. IRWIN: I think this is just belaboring a point, but I would move to strike that answer.

JUDGE BRENNER: Well, wait a minute. I do not think he finished the answer.

MS. LETSCHE: I do not think he did either, Judge Brenner.

JUDGE BRENNER: Did you finish the answer? I just couldn't tell. Mr. Irwin was very quick this time.

WITNESS MINOR: That is the reason I feel that the manual setpoint has disadvantages compared to automation of that same function and indeed, there may be extenuating circumstances, as I stated.

JUDGE BRENNER: Okay. The motion to strike is denied. The witness did a much better job relating that number to the comparison than the witness' counsel did in trying to ask the question. You've got the witness' use of the number was in the context of the comparison of the validity of the number for the situation at Shoreham, that is the manual set as distinguished possibly from the automatic situation.

BY MS. LETSCHE: (Resuming)

Q Mr. Bridenbaugh or Mr. Minor, in response to some questions from Judge Carpenter in which you were talking about problems to valves caused by foreign materials or other care and feeding problems, in your opinion could such problems be identified through some sort of qualification and testing program?

A (WITNESS BRIDENBAUGH) Yes, I think certainly you could identify some of them. And the question has to do with how accurately can you model the actual operating conditions. And one way that you could -- an example of one way that you could do that, for example, is you could test a range of different valves with different operating experience and different cleanliness conditions and try and determine how sensitive they were to these different factors.

That can be done. You can't do it perfectly, obviously.

MS. LETSCHE: Judge Brenner, that is all of the redirect I have at this time.

BOARD EXAMINATION

BY JUDGE MORRIS:

Q Mr. Bridenbaugh, semi-humorously, when you were all done with those tests would you then have to do a plant-specific analysis to see if the tests applied?

A (WITNESS BRIDENBAUGH) I'm sure you would, yes, because you may have different materials and different factors to consider.

Q So really, the best test is extensive operating experience under actual conditions?

A (WITNESS BRIDENBAUGH) I think there is no doubt about that, Judge Morris, that is correct.

Q And I assume that you would also include a well thought out surveillance and testing program, the care and feeding of the valves?

A (WITNESS BRIDENBAUGH) Yes, sir, I would do that, too.

Q Mr. Minor, I think you started to list some items which you thought may not have been considered beyond the 13 that were called out. Did you have some others you wanted to mention?

BY JUDGE BRENNER:

Q Actually, let me also interject. I didn't hear any items that were in addition to the ones included in the 0737 list of items. I heard you focus on some of those items. So if you've got any in addition that I missed, you can repeat them, as well as any that you have given to us now.

A (WITNESS MINOR) Well, one additional item that we have discussed amongst ourselves and not made any conclusions about -- and I'm not necessarily saying this was a great omission by not having it on the list of 13. It is just one that occurred as a possible reduction of challenges to the relief valves, and that has to do with the relief function that would be offered by using RPT under more circumstances than just the ATWS-type events that it is set up for.

If RPT were exercised as a power reduction, a quick power reduction technique under scram conditions, it would help to lower the pressure spike that occurs under isolation valve closure and things of that nature. And if it were put in under more extensive conditions, let's say, there may be a reduction of challenges available through that path.

I certainly don't claim that I have analyzed all of the possible places where that may be applied and how it may ultimately affect the number of challenges. But I know there is -- well, there has always been a concern about the pressure spikes in BWR's from transients, and various techniques have been applied to the measuring systems and so forth to try and not scram on them.

But when you do, it may be helpful to also do something with the RPT.

BY JUDGE MORRIS: (Resuming)

Q Did you have any others?

(Panel of witnesses conferring.)

A (WITNESS MINOR) I don't have any others in mind at this time.

Q All right, gentlemen. Coming back to the possible use of a block valve in the safety lines, is this permitted by ASME code?

A (WITNESS BRIDENBAUGH) You can't. You would have to provide the code relief necessary for pressure vessel without the block valve. But there are potentially ways, I guess, that you might get around it. I haven't really looked into this. But the old BWR-2's, for example, had code safeties which were not piped to drywell, which basically carried a higher pressure rating.

So you had a separate valve for the relief function and for the safety function. And my understanding is that they went to the dual function Target Rocks for space considerations and also for cost considerations. Whether you would want to go back to the old, the other method, and put block valves and relief valves, I guess you could do that, and the code would probably allow it as long as you had adequate relieving capability for the safety function of the different set of valves.

Q For a Shoreham configuration, would that require additional valves or valves of higher capacity?

A (WITNESS BRIDENBAUGH) I think it would require one or the other, yes.

Q You also alluded, I believe, to the fact that the five-second steam flow during the test was not appropriate, but I am not sure that your reasons for reaching that conclusion were adequately spelled out on the record. Could you elaborate on that?

A (WITNESS BRIDENBAUGH) Well, I think the reasons that I have for that have to do a little bit with some of the questions that Judge Carpenter asked, and that is that if you are going to test to see if the valve is going to function and go closed under the normal circumstances you need to get -- you need to make sure that all of the internals get up to a steady state temperature, or at least the temperature that they may achieve during the normal transients that they might go through.

Plus, there is this question of foreign material and how long it takes for that to get blown into the valve or into the inner workings of the valve. My understanding, my recollection of the length of time that the valves would be open under ATWS conditions, if everything works properly, I think someone said that was 25 seconds last week. If everything doesn't work properly, why, it would be somewhat longer than that.

So it seemed to me that the five-second test was a pretty short duration of time to verify the functionability of the valve. The temperature effect -- I think the importance there is I think that there would be a different temperature buildup in the Target Rock valve actuator when you have flow going through those internal passageways than there is in the normal steady state operation of the valve.

Q Am I correct, you are concerned about subsequent performance of the valve and not during its initial relief?

A (WITNESS BRIDENBAUGH) That would not affect the ability of the valve to initially open, but it could affect the ability of the valve to close subsequent to that.

Q There was considerable discussion about whether or not the reduction in challenge to the specific valves at Shoreham should be reduced by a factor of ten or whether a challenge rate one-tenth of that observed for three-stage valves should be achieved. I believe your position is that 0737 calls for a reduction of ten at Shoreham; is that correct?

A (WITNESS BRIDENBAUGH) Our position was that 0737 called for a reduction of ten.

Q An order of magnitude?

A (WITNESS BRIDENBAUGH) Or an order of magnitude. But it wasn't clear on what base or from what base. And I think our testimony suggests that maybe you should look for a reduction of ten from the average of the BWR's, rather than from the worst case, in which the worst case apparently is the BWR-4 with the three-stage Target Rocks.

But it certainly is not clear from the NUREG requirement what the starting point is.

Q So it is a matter of interpretation of what 0737 means?

A (WITNESS BRIDENBAUGH) I think it is a matter of interpretation. But I think, as has been discussed a couple of times in th past, I think if you -- even if you are a factor of 20 better and you found there was a way of getting another 10 without too much difficulty, why, you want to make as much improvement as you could.

Q In your final qualifying clause there, "as you could," what factors would you take into account in deciding how far to go?

A (WITNESS BRIDENBAUGH) Well, I think certainly if you were degrading safety otherwise, you certainly wouldn't want to -- that would be a requirement. You certainly wouldn't want to take -- make any changes that would have detrimental effects overall. We haven't suggested that an emergency condenser be added because that is certainly a rather substantial change, and there are other changes that are suggested in the list. The block valves, we haven't really suggested that those be implemented because we are reasonably certain that they would reduce challenges, but they probably wouldn't be reasonable in terms of changes to the existing plant, since it is already built.

Q Well, would you consider cost as an item, for example?

A (WITNESS BRIDENBAUGH) I think certainly you would consider cost. And I guess that cost is basically the reason that I mentioned the two that I just did. The emergency condensers and block valves would be very costly in terms of schedule and hardware changes.

Q Would you consider the contribution or decrease to overall risk, not just improved performance of that valve but the overall contribution to risk?

A (WITNESS MINOR) In the PRA terms that we have come to know in this hearing, do you mean?

Q Well, I was trying to avoid the quantification. But the concept is there.

A (WITNESS MINOR) Well, I think that is definitely one that you would consider, and I think that a PRA comparison apples to apples would be a good way to get at it.

(Pause.)

Q My background is a little deficient. I'm not too clear what is involved in items 10 and 11 of 0737, the main steam isolation valve testing and the pressure setpoint tradeoff. Could you explain what's involved?

(Panel of witnesses conferring.)

A (WITNESS BRIDENBAUGH) Let me talk about 11, since I seem to be the one that has been mentioned with reference to that one in the past remarks. This particular item -- and of course, I really don't know. Not having written this particular requirement, I'm not sure what was in the writer's mind.

But as I understand it, it is being proposed here that you would reduce the testing frequency of the MSIV's. This would tend to minimize the potential for a transient on the system, because if you test the MSIV under load, why, you put a pressure transient on and then you come closer to the setpoint of the SRV's, plus you also have the potential for causing a scram of the reactor if you happen to get too big of a transient, and then you go through the SRV cycle.

I suppose there is perhaps a halfway point that you can go to, and that is you can say that you always reduce load before you test MSIV's, and that is a way of doing it without reducing the frequency. I'm not sure if that is responsive to your question or not, Judge Morris.

Q If you reduce the load, would you feel that you had run a valid test?

A (WITNESS BRIDENBAUGH) I think there is nothing like 100 percent, I suppose. But I think in terms of the way that particular valve works, I don't think it would have a large effect on the functionability of the valve. The temperature and pressure obviously are the same.

Q In fact, very small, wouldn't it; do you agree?

A (WITNESS BRIDENBAUGH) Yes. There is -- I guess the difference might be that if you had full load and were testing one of the valves closed, depending upon what the pressure drop were through the other three sets of valves, you might have a somewhat lower low seat pressure of the valve and it might function a little differently. But I wouldn't expect it to be a very significant difference.

BY JUDGE BRENNER: (Resuming)

Q Mr. Bridenbaugh, I was surprised to hear you say that you weren't too sure what was involved here, certainly on items 10 and 11, because I thought Mr. Minor cited one or both of these items as one of the things that should be looked at, that he agreed should be looked at. And maybe I misunderstood that.

It doesn't sound like you are terribly excited as to those two possibilities as being real important to reducing SRV failures.

A (WITNESS BRIDENBAUGH) I think they should be looked at, Judge Brenner. What I meant when I said I wasn't sure what was involved, I was really saying I wasn't sure exactly what Mr. Hodwges had specifically in mind when he wrote that, those particular points, if he is the one who wrote them.

Q It sounds at least as if you agree there are tradeoffs for which an analysis has to be performed, which would be consistent with LILCO's testimony as distinguished from just some simplistic judgment as to whether to implement it or not.

A (WITNESS BRIDENBAUGH) I am certainly in agreement that an analysis needs to be performed before you go ahead and do any of these.

MS. LETSCHE: Excuse me. I'm not sure, Judge Morris; did you also ask the panel about item number 10, or had you only asked about 11?

JUDGE MORRIS: I had mentioned both. If the panel wants to add something on 10, I would be happy to hear it.

WITNESS MINOR: Judge Morris, I don't think we have anything to add really beyond what is in attachment 4 to LILCO's testimony. I might comment that it is generic amongst all of our exhibits, and we don't have page 17 of LILCO's testimony, which is their discussion -- excuse me -- of their attachment 4 to their testimony, which is their discussion of the previous item you were talking about, other than the conclusion at the top of page 18.

JUDGE BRENNER: Well, I am not going to solve your paper problem now. It should have been solved long ago. But you are talking about page 17 of LILCO's challenge testimony?

WITNESS MINOR: Page 17 of attachment 4 to their testimony. I was only commenting that may be part of the reason why the question was prompted.

BY JUDGE CARPENTER:

Q Mr. Bridenbaugh, first of all, my apologies. The hour grows late, but I would like to have a little bit of help, if I may. Do you have a copy of Suffolk County Exhibit 35 with you? That is the SIL number 196 supplement 11.

A (WITNESS BRIDENBAUGH) Yes, I do, some place in my stack here.

Q I wanted to direct your attention to page 2 which in the original copy was not Xeroxed adequately, so there is a separate page. Do you have that?

A (WITNESS BRIDENBAUGH) Yes I do.

Q Looking at the top of the page where it reads tail pipe temperature monitoring, looking at the second sentence, it reads "Leakage on three-stage SRVs often resulted in a spurious plant blowdown due to stuck open SRV."

Can you confirm that that has been a major cause of the stuck-open SRV was leakage in the third stage?

A (WITNESS BRIDENBAUGH) I am checking my memory. That is my recollection of the case several years ago, yes.

Q Would that same statement be true for the two-stage?

A (WITNESS BRIDENBAUGH) I don't know for sure, Judge Carpenter. I haven't seen any operating experience that verifies that one way or the other. However, it is a claim or a statement that is made in the BWR Owners Group report. I think it is found on page 23 or thereabouts, as I recall, that the two-stage valve -- no, I am sorry, it is not on page 23. It is on page 22.

It says, "With the use of the two-stage Target Rock Crosby or Dikkers valve, the leakage is not a concern because leakage does not significantly affect the spurious blowdown probability." And I think they are talking about the same thing there, but I am not positive of that. But I don't have any personal experience in that.

Q Well, I come back to our earlier review of the difference between the three-stage and the two-stage only to see if you could confirm from the design point of view that that feature had been eliminated in the two-stage.

A (WITNESS BRIDENBAUGH) Could I take a couple of minutes and just look at the drawings and see if I can refresh my memory as to why that may be the case?

Q Yes.

(Pause.)

(The panel of witnesses conferred.)

JUDGE BRENNER: Mr. Irwin, while the witnesses are doing that, oage 17 from attachment 4 is missing from the record also.

MR. IRWIN: We have discovered that it is apparently missing from everybody's copy this afternoon. And I will get copies for everybody this evening.

JUDGE BRENNER: All right. I want to bind it in first thing tomorrow also.

MR. IRWIN: Will do.

JUDGE BRENNER: If there is hot stuff on that page that other parties have not seen, we will have to give them an opportunity.

MR. IRWIN: There is no question we could all be back.

JUDGE BRENNER: Well, let us get it to everybody tonight and decide what to do with it first thing in the morning. The subject has been discussed so much I almost feel as if I know what is on the page without seeing it, but we will have to read it to make sure.

(Pause.)

JUDGE BRENNER: Also, while the witnesses are conferring, I will take advantage of that. We are going to get the ATWS testimony of LILCO and the Staff bound in today, but without the witnesses, in order to do it in a hurry. We will just bind them in by stipulation. But I want to do it carefully enough to make sure that the right portions have been marked as having been struck on the copies we bind in and that any corrections have been made on the copies that are going to be bound in. And I would like somebody to give us a reference to the rulings on the motion at the time we do it. But we will not bother putting the witnesses up. But I do want the testimony bound in today to save time.

MR. IRWIN: Mr. Reveley is here, and I am sure he is appropriately prepared.

(Pause.)

JUDGE BRENNER: We are ready if you are.

WITNESS BRIDENBAUGH: I am afraid this is going to be somewhat anticlimactic because after that time I am really not certain whether I can identify the reason for that statement other than in rather general terms. I think that, well, the statement contained in the BWR Owners Group report talks only about leakage of the valve, and that would imply to me that they are talking about leakage of the main disk as well as leakage through the pilot valves.

I don't really see any reason to believe that if the main disc is leaking it would affect spurious blowdowns significantly. But I certainly would agree that if you begin to get leakage in the three-stage valve through that second-stage disc, that that could very easily cause a spurious opening and it could keep the valve open, because if the leakage through that disc is as great as or greater than the main piston orifice, it will stay open. And I suspect that that is what the case was on the three-stage valves that stuck open for that reason.

I think on the two-stage it appears to me that the pilot valve itself on the two-stage is -- or I believe that it is an improved design and it is less sensitive to leakage and has better -- it has a better opportunity. It also has another control path for the steam so that the leakage will not affect the valve as much as far as just arbitrarily opening for no reason.

There is a set of lands on the pilot valve stage that I think would tend to limit the leakage and perhaps not cause it to stick open.

BY JUDGE CARPENTER:

Q You see, it is confusing me that in the supplement 11 they are referring back to this experience with the three-stage. If it does not apply to this two-stage, that is what I was trying to see whether you felt that that was inappropriate that they dragged that along.

A (WITNESS BRIDENBAUGH) I can only respond that I don't have any detailed information on exactly why that is the case. But I know the reasons for or the changes that -- I know that the three-stage valve had a lot of trouble in this area in this second-stage pilot and that I believe that it is more resistant to spurious opening.

Q What I was really asking, from a design point of view, you can see that apparently, if I could paraphrase what you just said to be sure I understand it, you are saying from a design point of view, comparing the three-stage to the two-stage, the three-stage design was such that leakage could lead to damage in some way which then resulted in a stuck-open condition being probable, whereas the two-stage design has apparently if not eliminated it, substantially eliminated that concern.

A (WITNESS BRIDENBAUGH) I think that is right, Judge Carpenter. I believe it to be less sensitive, but I don't think it has been totally eliminated.

Q The next sentence does refer to the two-stage and reads, "Recent anomalies identified in the two-stage SRVs indicated that prolonged leakage may result in pilot valve disc and seat surface erosion. This effect may cause an upward drift in the set-point of the valve that may be beyond acceptable limits for a plant as determined from plant transient analysis."

And I am trying to find out whether you think that is the principal concern with the leakage, that it is going to cause the set-point to drift upward vis-a-vis also contribute to the stuck-open problem.

(The panel of witnesses conferred.)

A (WITNESS BRIDENBAUGH) I can understand functionally why the set-point would tend to drift upward under those conditions, because what is happening is the pressure under the pilot valve, which is going to cause it to move upward and thus open the valve, is going to be somewhat reduced from the pressure that actually exists in the line because you are losing steam out of that area and the amount of steam that can come into that chamber is restricted by the orifice in the main disc or in the piston.

It would seem to me that you couldn't preclude the possibility of that leakage getting high enough that you would have a stuck-open valve. But I don't totally understand why they believe that to be the case or why they claim that to be the case.

(The panel of witnesses conferred.)

A (WITNESS BRIDENBAUGH) I am afraid I don't know the answer to your question.

Q One final question. If you were designing a test program from the point of view of trying to understand safety relief valves reliability, the next sentence says, "The lack of available data needed to adequately correlate leakage, time, and extent of pilot valve seat surface erosion versus its specific effect on the valve set-point," how would you evaluate -- and I am asking really for your judgment opinion now -- evaluate the probable importance of a test program which took a number of valves and made them leak for extended periods of time and measured the rate at which their servicability decreased vis-a-vis doing a physical stressing for 5 seconds?

A (WITNESS BRIDENBAUGH) I think that certainly the question that we were just considering before this one -- that is, what kind of leakage rate can you take through the pilot valve before the valve may spuriously open or stick open -- is one that could be tested through the method that you suggested. That is, you could put bigger leakage paths through the seat area. I think that it would be quite difficult to correlate before it ceases to function. I think that is about all you could do in a test program.

Q You are thinking of some time constraint on the test program, the duration of the test program?

A (WITNESS BRIDENBAUGH) Well, as I read this particular sentence, I was interpreting it to say that there is -- if you have a pilot valve seat leakage, they do not have adequate data to be able to predict how rapidly the erosion is going to progress as a result of that leakage through the wire drawing effect, I would assume.

Q Do you see any impediment to establishing that in an experimental setup where the duration -- I believe the maintenance schedule for these valves is every 36 months?

A (WITNESS BRIDENBAUGH) That is correct.

Q So it would seem like a time period of 36 months of leaking would be the bounding value, if you will, for various leak rates, and then you would begin to get some data rather than wait for the plant experience to provide guidance, which we might not get adequate data for 20 or 30 years.

A (WITNESS BRIDENBAUGH) Well, I think certainly you could set up a test and measure how rapidly the seats would deteriorate. Is that what you are suggesting? That certainly could be done.

Q Well, coming to the point of the plant specific understanding of what the thermocouple readings mean in terms of leak rate, one still has to know what that leak rate is doing to the valve seat.

A (WITNESS BRIDENBAUGH) That is true.

Q So it would seem to me the test program, first of all there is the erodability of the valve seat depending upon what the leak rate is, and then there is the plant-specific situation of what thermocouple reading means in terms of leak rate.

Thank you for your help.

A (WITNESS BRIDENBAUGH) I am sorry I could not answer it more explicitly.

(Board conferring.)

JUDGE BRENNER: We have no further questions of this panel. Are there any other questions of this panel?

MR. IRWIN: No.

MS. LETSCHE: Judge Brenner, the only thing I might suggest since I seem to think you are trying to dismiss the panel, they have just received a copy of page 17 which was supplied by Mr. Irwin. I do not know if they have had an opportunity to read it, or if they have, if they have anything that they might want to add to their prior statement in light of having received it.

JUDGE BRENNER: Well, I do not want to hear it right now. Let them look at it, and you can come back with it tomorrow morning if that is the case, because we have not read it either.

Does that present a problem?

MS. LETSCHE: No, I guess not.

JUDGE BRENNER: We do have some things we want to say about this issue, but I want to get other matters bound in because of the mechanics of getting the materials on the plane so we can get the transcript on time tomorrow.

But the panel is dismissed, and we thank you very much for your time. And if you do want to bring them back for something on this page, you may do that.

(The witnesses were excused.)

JUDGE BRENNER: I would like to bind this page in, being, as I recall -- and I will probably get this wrong -- page 17 to Attachment IV of the LILCO testimony on the challenge contention, which is 28(a)(vi).

Did I get that right?

MR. IRWIN: Yes.

(The information referred to follows:)

Lay-in #3

3.1.4.2 Improved Recirculation Flow Control System

Definition - Failures in the recirculation flow electronic control systems can result in reactor isolation. If an augmented recirculation flow control system with signal deviation alarms and signal rate alarms to detect failures in the control electronics were provided, the significance of flow changes could be reduced. The failure detection scheme in the augmented system would cause the logic signal to change from automatic flow control to a steady recirculation flow to prevent a core flow excursion and eventual scram.

Discussion - It is estimated that approximately 2% to 6% of the S/RV challenges could be eliminated with this equipment. However, the cost and increased complexity of the control system must be evaluated further before this candidate modification can be considered feasible.

3.1.4.3 Reduce Isolations Caused by Surveillance Testing

Definition - This candidate calls for developing an improved method of carrying out surveillance tests without causing inadvertent isolations. This may involve hardware and design changes. In addition, reduction of surveillance testing frequency could reduce the inadvertent closures.

Discussion - A maximum of 4 to 5% reduction in S/RV challenges could be achieved through the implementation of this candidate modification.

3.1.4.4 Reduce MSIV Testing Frequency

Definition - This candidate modification is suggested in NUREG-0737. A number of isolation events occur while the MSIV closure tests are being conducted. A reduction in the MSIV test frequency would result in a reduction in number of isolation events.

JUDGE BRENNER: The reason it states Revision 22-July 1981, I take it that is because this is the copy from the FSAR, and that document was also an attachment in the FSAR, is that correct?

MR. IRWIN: That is correct.

JUDGE BRENNER: So it will be bound in now for convenience. It is also in evidence through the FSAR in addition.

All right. I am going to identify the ATWS testimony and then ask counsel if they have any corrections to it. We will ask the witnesses to verify whether they have no other corrections and that it is true and correct tomorrow.

I have a copy of the testimony of Leonard J. Calone, Harry R. Carter, Eugene C. Eckert, Henry C. Pfefferlen, John A. Rigert, and William P. Sullivan for Long Island Lighting Company on Suffolk County Contention 16, ATWS.

It consists of 37 pages, and in addition, there is one attachment denoted Attachment 1. It is the procedure entitled "Transient With Failure to Scram, Emergency Procedure No. SP-29.024.01."

Previously in ruling on the motions to strike we struck question and answer 21, and that should be indicated on the copy starting at the bottom of page 19 through page 20 and through part of page 21.

Mr. Reveley, do you have a transcript cite for that by any chance?

MR. REVELEY: Yes. You struck it at page 8524, Judge.

JUDGE BRENNER: Thank you.

Are there any further corrections to this testimony?

MR. REVELEY: Yes. I want to mention five.

First, the first correction on the first page of the statement of purpose, change Mr. Carter's middle initial to T as in Tom. Make the same change on pages 1, 2, and 27 of the testimony.

The second correction, on page 12, second to last line in the first paragraph, the answer to question 16 insert these words after the words "hydraulic control units." The words to be inserted are "standby liquid control system, transient analysis."

The third correction, on page 13 of the testimony, the second line, insert the word "board" between the words "control" and "layout."

The fourth correction, on page 22, line 8, delete the phrase "capable of being."

The fifth correction, on page 5 of the testimony note that the next question and answer will be question and answer number 10, even though the prior question and answer was number 7. There are no questions and answers 8 and 9 to be found. They have vaporized.

JUDGE BRENNER: I was going to say at least not any more.

MR. REVELEY: That is right, Judge. Not any more.

Those are all of the corrections I have. They have been marked on the copy of the testimony that we will give to the Reporter.

JUDGE BRENNER: I guess if the County's first question is what were question and answer 8 and 9?

MR. REVELEY: They can ask, but we do not remember.

(Laughter.)

JUDGE BRENNER: In kidding around, which I should not have been doing, I did not hear your last phrase, something about 2[illegible]. Did you have something else?

MR. REVELEY: No. Those were the five corrections that we had, and we have marked the Board's order and the pertinent transcript page at question and answer 21.

JUDGE BRENNER: Okay. Thank you very much.

As identified, in the absence of objection we will bind the testimony -- we will admit the testimony into evidence and bind it into the record as if read.

(The information refers to follows:)

Lay-in #4

LILCO, June 29, 1982

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
LONG ISLAND LIGHTING COMPANY	)	Docket No. 50-322 (OL)
	)	
(Shoreham Nuclear Power Station, Unit 1)	)	

TESTIMONY OF LEONARD J. CALONE, HARRY T. CARTER,
EUGENE C. ECKERT, HENRY C. PFEFFERLEN,
JOHN A. RIGERT AND WILLIAM P. SULLIVAN
FOR LONG ISLAND LIGHTING COMPANY
ON SUFFOLK COUNTY CONTENTION 16 -- ATWS

Purpose

This testimony demonstrates that LILCO has gone beyond the steps relied upon by the Commission when it found that the risk from ATWS is acceptable pending the implementation of the outcome of the ATWS rulemaking. The Commission's finding was based upon, among other things, the installation of a recirculation pump trip (RPT) in each BWR, as well as the development of emergency operating procedures and operator training for ATWS events. LILCO has taken each of these steps.

Furthermore, LILCO will install prior to fuel load alternate rod injection (ARI) and improvements to the scram discharge volume (SDV). These measures further reduce the already low probability of an ATWS.

Thus, Shoreham is well protected against an ATWS in the interim period between the time the plant starts operation and the implementation of whatever requirements result from the ATWS rulemaking.

ATTACHMENTS

1. SP 29.024.01, Transient with Failure to Scram

LILCO, June 29, 1982

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
LONG ISLAND LIGHTING COMPANY	)	Docket No. 50-322 (OL)
	)	
(Shoreham Nuclear Power Station, Unit 1)	)	

TESTIMONY OF LEONARD J. CALONE, HARRY R. CARTER,
EUGENE C. ECKERT, HENRY C. PFEFFERLEN,
JOHN A. RIGERT AND WILLIAM P. SULLIVAN
FOR LONG ISLAND LIGHTING COMPANY
ON SUFFOLK COUNTY CONTENTION 16 -- ATWS

1. Q. Please state your names and business addresses.1/

A. My name is Leonard J. Calone; my business address is the Long Island Lighting Company, Shoreham Nuclear Power Station, Wading River, New York.

1/ Wherever possible, this testimony indicates the witnesses who are sponsoring particular answers. If no witness is indicated, it is sponsored by the panel. In any case, all of these witnesses are knowledgeable in matters dealing with ATWS and have reviewed the testimony as a whole.

My name is Harry ~~R~~T. Carter; my business address is Long Island Lighting Company, Shoreham Nuclear Power Station, Wading River, New York.

My name is Eugene C. Eckert; my business address is General Electric Company, 175 Curtner Avenue, San Jose, California.

My name is Henry C. Pfefferlen; my business address is General Electric Company, 175 Curtner Avenue, San Jose, California.

My name is John A. Rigert; my business address is Long Island Lighting Company, 175 East Old Country Road, Hicksville, New York.

My name is William P. Sullivan; my business address is General Electric Company, 175 Curtner Avenue, San Jose, California.

2. Q. What are your respective positions with LILCO or the General Electric Company?

A. (Calone) I am the Chief Technical Engineer for the Shoreham Nuclear Power Station.

(Carter) I am the Plant Engineer for Operations at the Shoreham Nuclear Power Station.

(Eckert) I am Manager, Plant Transient Performance Engineering for the General Electric Company.

(Pfefferlen) I am Manager of BWR Licensing Programs in the Nuclear Power Systems Division of the General Electric Company

(Rigert) I am employed by LILCO as Head of the Systems Engineering Section of the Nuclear Engineering Department and serve as the Lead Nuclear Systems Engineer for the Shoreham Project.

(Sullivan) I am Technical Leader in the Nuclear Energy Engineering Division of the General Electric Company.

3. Q. Please state your professional qualifications.

A. The resumes on pages 24-37 summarize our professional qualifications.

4. Q. Are you familiar with Suffolk County Contention 16?

A. Yes.

5. Q. What issue is presented in that contention?

A. Suffolk County contends that, although the issue of anticipated transients without scram is generically before the Commission in a rulemaking proceeding, LILCO and the NRC Staff have not adequately demonstrated that Shoreham meets the requirements of GDC 20 "regarding correction of the ATWS problem in the interim period of several years pending completion and implementation of the result of the rulemaking for Shoreham."

6. Q. What does General Design Criterion 20 require?

A. (Pfefferlen) GDC 20 requires that the protection system shall be designed to automatically initiate the operation of systems to assure that specific acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences and to sense accident conditions and to initiate systems needed to mitigate the accident.

7. Q. How does Shoreham now comply with GDC 20?

A. (Pfefferlen/Rigert/Calone) A General Electric boiling water reactor, such as Shoreham, is equipped with a reactor protection system designed to provide timely protection against conditions that threaten the integrity of the fuel. Fuel damage is prevented by automatic actions, including a rapid shutdown (scram), if monitored nuclear system variables exceed pre-established limits. The scram function provides assurance that the plant will be shut down without exceeding acceptable fuel design limits during abnormal operational transients. In addition to this protection system function which provides for automatic reactor shutdown, functions are also provided to sense accident conditions and initiate other systems such as the emergency core cooling systems and the emergency diesel generator system. These protection systems are installed in the Shoreham plant; the plant has been evaluated for its response to anticipated operational occurrences and accident conditions, and the appropriate operating limits have been established to avoid fuel damage and to protect the reactor system.

NEXT QUESTION IS #10

10. Q. Please describe Shoreham's scram system in more detail.

A. (Pfefferlen/Rigert/Calone/Carter) The Shoreham scram system is a highly redundant safety related system. It consists of 137 individual control rods, each of which is driven by two separate hydraulic pressure sources, a pressure accumulator, or pressure from the reactor vessel itself. Because each control rod drive is scrammed as an individual unit, the protection function is highly tolerant of component failures. The scram system is designed to shut the plant down and maintain it in that condition at any temperature with no xenon2/ in the core, even with failure of the highest worth control rod to insert.

The plant can be shut down from power operation with a significant fraction of the control rods withdrawn from the core because xenon will be present in the core. Hot shutdown is accomplished if at least 50% of the control rods are inserted in a checkerboard pattern, or approximately 70% of the rods are

2/ Xenon is a neutron absorbing fission product that is present during power operation but decays following shutdown.

inserted in a random pattern. The plant can be maintained in this hot shutdown condition indefinitely utilizing various coolant injection systems for makeup water and shutdown cooling for decay heat removal, provided sufficient control rods are inserted or liquid boron injected to offset xenon decay. The addition of rods or boron due to xenon decay would not be needed until many hours after shutdown.

The reactor protection system, working in conjunction with the scram function, automatically assures that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences. Fuel damage is prevented by initiating a scram if monitored reactor variables such as pressure, power level and water level exceed specified limits. The reactor protection system utilizes multiple units of different types of sensors to monitor the plant. These include (1) pressure sensors, (2) position switches, (3) level sensors, (4) reactor power monitors, and (5) radiation detectors. The redundancy and diversity provided by these sensors assures that unacceptable conditions will be detected and timely corrective actions initiated with a high degree of reliability.

In addition to this scram system capability, control of the reactor coolant recirculation system flow provides a diverse means of reactivity control to accommodate normal power change requirements. The system utilizes the negative reactivity feedback from an increase in voids as a means of controlling reactor power.

The standby liquid control system is an independent back-up reactivity control system. This system has the capability to shut the reactor down from full power and maintain it in a subcritical condition at any time during the core life.

11. Q. Has the Commission said that there is a reasonable assurance of safety pending the outcome of its ATWS rulemaking?

A. (Pfefferlen). Yes. The notice of proposed rulemaking indicated that the risk from ATWS in the two to four years it will take to fully implement an

ATWS rule is acceptably small. The NRC's conclusion was based upon several factors, including (1) favorable experience with operating reactors, (2) the addition of a recirculation pump trip feature in BWR's, and (3) steps taken to develop procedures and train operators to respond to ATWS events.

12. Q. In other words, the Commission said that the interim risk from ATWS is acceptable for BWR's so long as some interim measures are taken?

A. (Pfefferlen) Yes. As noted above, the notice of proposed rulemaking specifically mentions the interim measures the NRC considered in making this judgment: installation of a recirculation pump trip, the development of ATWS operating procedures, and ATWS operator training.

13. Q. Has LILCO taken these interim measures?

A. (Rigert/Calone/Carter) Yes and more. Let's begin with the measures listed by the Commission. Shoreham has installed a recirculation pump trip (RPT) feature. LILCO has also adopted an emergency operating procedure that addresses ATWS events and has conducted operator training on this procedure.

14. Q. Please explain how RPT helps mitigate ATWS events.

A. (Eckert/Pfefferlen/Rigert) Under ATWS conditions the automatic recirculation pump trip feature alone provides prompt reduction in power to less than 40% reactor power. This occurs because, when the recirculation pumps are tripped, the core flow quickly drops to natural circulation levels. The reduced flow results in an increased void fraction which, in turn, leads to the significant reduction in power. This process is well understood in the BWR and, as mentioned previously, is utilized as a control mechanism for normal power changes. The ATWS recirculation pump trip is initiated on a reactor high pressure or low water level signal. These signals are selected because they would be encountered under ATWS conditions. The Shoreham system utilizes a redundant two-out-of-two logic to interrupt breakers in the power supply to the recirculation pumps. Each recirculation pump has two supply breakers, one for each division of the RPT logic, either of which can trip the pump. There are four pressure sensors and four water level sensors.

Each of the two separate electrical divisions utilizes a logic based on two-out-of-two high pressure or two-out-of-two low level signals to initiate a trip signal. A signal out of this logic from either electrical division will trip both of the recirculation pumps. This system is a single-failure-proof design of high reliability.

In other words, RPT provides a prompt, significant reduction in reactor power and assures that reactor pressure is maintained well below acceptable limits.

15. Q. Please describe operating procedures that address ATWS.

A. (Calone/Carter) There is one emergency procedure which addresses the anticipated transient without scram scenario. That procedure is SP 29.024.01 "Transient with Failure to Scram" (Attachment 1).

This procedure has been developed in accordance with guidance provided by General Electric. It has been reviewed and accepted by the NRC as adequately incorporating the appropriate emergency guidelines. In addition, the procedure was demonstrated for the

NRC at the Limerick simulator in October, 1981, and again was deemed acceptable. A revised Emergency Procedure Guideline for ATWS developed by the BWR Owners' Group and General Electric is currently under review. Upon its acceptance by the BWR Owners' Group and the NRC, Shoreham's ATWS emergency procedure will be revised accordingly.

16. Q. What training do the Shoreham operators receive with respect to ATWS?

A. (Calone/Carter) Training for ATWS is part of the licensed operator training program. This program begins with classroom lectures and examinations on various topics and systems, which include subjects directly related to ATWS. These ATWS-related subjects include reactor protection system, vessel physical layout, physics, recirculation system, reactor instrumentation, electrical distribution, control rod drive system, hydraulic control units, standby liquid control system, transient analysis and the reactor manual control system.

Along with classroom lectures, the operator attends Shoreham plant walk throughs on these systems, including physical field inspections, control room instrumentation and control board layout reviews, procedural reviews and technical specification reviews.

Examinations ensure that the operator has learned these subjects and systems and can demonstrate his understanding of them.

In addition, the licensed operator is thoroughly trained in the causes for scrams, scram set points, which signals are involved, and how reactor power, control rod drive, and other reactor parameters should respond to a scram condition.

An operator also learns what instrumentation is available; how it should respond in normal and abnormal situations; what alarms can occur; how to respond to these alarms; and most importantly, how the system should respond to anticipated transients. After the operator has successfully completed his formal classroom and site training, and demonstrated his mastery of this knowledge, he is then required to practice these responses at a simulator. His simulator performance is evaluated by independent instructors to assure LILCO that the training has been successful.

In the case of ATWS, the licensed operators have demonstrated their knowledge of the required topics and systems, and have also demonstrated their ability to handle ATWS events at simulator facilities. An important part of this training is emphasis on the need to verify the initiation of automatic functions, including scrams, and on the need, if the automatic functions fail, to initiate them manually.

During simulator training, we have directly observed that an operator recognizes an ATWS event within seconds of its occurrence, with a response being initiated by the operator almost immediately thereafter.

17. Q. In addition to the interim measures mentioned in the notice of proposed rulemaking on ATWS, what other measures are being taken at Shoreham to deal with ATWS?

A. (Rigert) By fuel load, LILCO is planning to install two additional measures to further reduce the probability of an ATWS. The first is a feature called alternate rod insertion (ARI). The second is a set of measures taken to improve further the reliability of the scram discharge volume (SDV) system.

18. Q. Please explain the alternate rod insertion system.

A. (Pfefferlen/Rigert) This system provides redundant and independent sensors and logic which initiate control rod insertion through actuation of dedicated backup scram valves. A control rod insertion initiated by this system is similar to a normal scram with the exception of a small delay in the time of initiation. ARI is effective in further minimizing the possibility of an anticipated transient without scram event. In other words, with ARI, Shoreham's already highly reliable reactor protection system will be backed up by another redundant and diverse system that can initiate a rapid control rod insertion.

19. Q. What improvements are being made to the scram discharge volume?

A. (Rigert/Pfefferlen/Sullivan) As already described, each of the plant's 137 control rods is driven by its own hydraulic control unit. The control rod hydraulic mechanisms exhaust into the scram discharge volume system. Instrumentation is provided to assure that sufficient free volume is available when control rods are withdrawn. The presence of water in the scram discharge volume is indicated in the control room and a high water level signal will automatically initiate a scram.

Shoreham's SDV system was substantially better than the Browns Ferry design even before the latter's partial failure to scram occurred. Shoreham has two scram discharge instrument volumes that are integral to the scram discharge volume. Browns Ferry had a single instrument volume connected to the scram discharge volume by a long run of relatively small pipe. Subsequent to the Browns Ferry event, LILCO reviewed Shoreham's SDV design and decided to make the following modifications:

(a) Six new level instruments are being added to the instrument volume to make a total of 12, thereby providing full redundancy and diversity of level monitoring and scram initiation.

(b) All level instruments are being relocated and repiped directly to the instrument volume rather than being connected to vent and drain lines.

(c) A second air operated vent valve and drain valve are being added to the SDV to provide redundancy of SDV isolation during a scram.

(d) Additional surveillance test procedures are being provided to assure operability of the level instruments, the vent and drain valves and the overall system.

Furthermore, the SDV piping design and installation were reviewed closely to assure that adequate volume, proper venting and draining and protection against thermal expansion and dynamic pressure effects are all provided.

20. Q. Are operating procedures and operator training

effective in mitigating a postulated anticipated transient without scram?

A. (Calone/Carter/Eckert) Yes. If an ATWS should occur in spite of the redundancy and diversity built into the system, training has demonstrated that the operator will act quickly to manually insert the rods, reduce power and, if necessary, use the standby liquid control system (SLCS) to inject the liquid boron solution to achieve a safe shutdown of the plant.

The operator's ability to mitigate the consequences of an ATWS is significantly enhanced by the incorporation of the recirculation pump trip feature. This feature automatically limits reactor vessel pressure and reactor power. Following the recirculation pump trip, the operator can further reduce reactor power and thus minimize the heat load on the suppression pool. It should be noted that in many of the postulated ATWS events, the main condenser is available as a heat sink. In these cases suppression pool heating is not a problem and manual initiation of the SLCS will bring the plant to a cold shutdown state.

In those cases in which the loss of the main condenser occurs, steam is discharged to the suppression pool. The suppression pool is provided as a heat sink for certain transient and accident events. Under ATWS conditions this large quantity of water can be heated significantly. The operator, however, will take the actions outlined in procedure SP 29.024.01 to reduce power to minimize the heat discharged to the suppression pool and to initiate pool cooling to maintain containment conditions within acceptable limits. These actions include manually inserting the control rods or, if necessary, controlling reactor coolant inventory and injecting the liquid boron solution into the reactor. Thus, under a wide range of ATWS conditions, the operator can take appropriate action to place the plant in a safe condition. Even under the most severe ATWS conditions involving isolation of the reactor vessel, the operator can take steps to mitigate the consequences of the event.

21. ~~Q. How likely is it that an operator will confront severe ATWS conditions in the "interim" period?~~

STRUCK By Board Order of July 30, 1982, Tr. at 8524

~~A. (Pfefferlen/Sullivan/Eckert) Exceptionally~~ unlikely. It is important to remember that ATWS is an exceedingly low probability event. The scram system design features discussed previously have resulted in a system which is highly redundant, testable and not susceptible to failures which could incapacitate the entire system.

A multiple failure, such as a low probability common mode failure or a number of independent failures, must occur in order to cause an ATWS. Because of this, the probability of a scram failure involving a significant fraction of the control rods is very low. General Electric has performed a comprehensive reliability assessment of the BWR scram system. This study involved more than eight man years of engineering effort and analyzed all appropriate systems and components. The probability of each of hundreds of different potential failure modes was evaluated. This included the identification and evaluation of common-mode failures. Experience from operating reactors was an important consideration in ~~this assessment. The conclusions from this study~~

were (1) the probability of a failure of the control rods to shut the reactor down when called upon is less than once in a million demands; (2) if a complete scram failure were to occur, it would most likely be caused by a failure in the electrical circuit logic; and (3) the addition of a diverse electrical scram logic could significantly improve the already highly-reliable scram function. General Electric's review of operating experience and reliability methodology developed subsequent to the study discussed above shows that those conclusions remain valid.

22. Q. Is there anything unique about the Shoreham design, the standby liquid control system in particular, that would make it necessary to automate the SLCS even though the Commission has yet to decide whether this step is needed?

A. (Pfefferlen/Rigert) No. In Shoreham as in other BWR's, the standby liquid control system is a diverse, backup reactivity control system capable of shutting down the reactor from rated power operation to the cold shutdown condition in the extremely unlikely event that not enough control rods could be inserted. This system is initiated by the operator from the control room using a safety grade keylock switch.

The SLCS provides redundant loops of safety grade active equipment necessary for boron injection. The redundant loops are powered by separate power sources ~~capable of being~~ connected to the standby AC power for operation during a station power failure. This system has been designed to high standards consistent with its intended function as a backup reactivity control system and also with its use to mitigate ATWS.

Manual initiation of the standby liquid control system from the control room is consistent with the operator's ability to detect and react to an antici, ted transient without scram in the Shoreham plant. Recall that the recirculation pump trip automatically takes actions to limit pressure and power. The SLCS can be called upon to completely shut the plant down and thereby limit suppression pool heat up in cases where the main condenser is lost.

There are no unique features of the Shoreham SLCS that would make the Commission's findings concerning the acceptability of ATWS risk pending the outcome of the rulemaking inapplicable to Shoreham.

23. Q. In summary, how would you describe the ability of Shoreham to accommodate anticipated transients without scram?

A. Since the issue of ATWS was first raised a number of years ago, a significant number of plant improvements have been made at Shoreham to reduce the probability and consequences of ATWS. These include recirculation pump trip, alternate rod insertion, improvements to the scram discharge volume, and operator procedures and training specificially focused on ATWS events. These measures go beyond those that the Commission has already found to be acceptable interim measures for ATWS. These features and actions have resulted in a substantial reduction in the probability of unacceptable consequences from ATWS. Shoreham does meet the requirements of GDC 20 so far as ATWS is concerned.

PROFESSIONAL QUALIFICATIONS

Leonard J. Calone
Chief Technical Engineer
LONG ISLAND LIGHTING COMPANY

I am the Chief Technical Engineer of the Shoreham Nuclear Power Station, a position I have held since July 1979. As such, I am responsible for managing, administering, evaluating, supervising, and coordinating all functions in the plant's technical sections, which include Instruments and Controls, Health Physics, Radiochemistry and Reactor Engineering. I am also responsible for development and review of the technical section portions of the Station Operating Manual, Emergency Plan, the corresponding areas of the FSAR and Technical Specifications, and the Environmental Technical Specifications. The Chief Technical Engineer's primary function is to provide technical support to the Plant Manager in the above-mentioned areas, and to insure optimization of overall plant performance.

I graduated from Stevens Institute of Technology in 1967 with a degree in Mechanical Engineering and received a Masters of Science degree in Physics in 1974 from C.W. Post College. I completed the General Electric Boiling Water Reactor Simulator

Program in June 1976 and obtained a Senior Reactor Operator certification.

I have also completed a number of additional nuclear-related training and qualification programs including:

(a) General Physics course: Practical Nuclear Power Plant Technology;

(b) General Electric BWR Technology course;

(c) Brookhaven Laboratory's Basic Applied Health Physics course;

(d) Ten training criticals at the Brookhaven National Laboratory's Medical Research Reactor;

(e) General Electric Station Nuclear Engineering course;

(f) A thirty (30) week field assignment to TVA's Browns Ferry Nuclear Plant;

(g) SAI Probabilistic Risk Analysis Course; and

(h) Participation in Browns Ferry Refueling Outage.

Prior to assuming my present position I was the Reactor Engineer at Shoreham from 1976 through 1979. The responsibilities of the Reactor Engineer include the nuclear and thermal performance of the core; the maintenance of overall unit performance, fuel inventory, refueling schedules, and refueling patterns; supplying current nuclear and thermal information to the operating staff, and participating in the preparation of physics-related programs.

In 1975, I was the Station Performance and Compliance Engineer at Shoreham, responsible for writing LILCO's portion of operating system descriptions for Shoreham. I was also responsible for the development of the first draft operating procedures and surveillance test procedures.

In 1973-74, I held the position of Operating-Control Engineer at the E. F. Barrett Power Station, responsible for the daily operations and reliability of the plant, for supervision of the Watch Engineers, for overall direction of the operating personnel, and for adherence to operating procedures and parameters.

During 1972-73, I was an Industrial Relations Representative on a one-year management training program. Prior to that time I held positions as Associate and Plant Engineer at the E. F. Barrett Power Station from 1970-1972.

I was initially hired by LILCO in June 1967. From 1967-1970 I was an Assistant Engineer at Glenwood Power Station, and held several plant supervisory positions in the Company.

I am a member of the American Nuclear Society and a member of the Executive Committee of the ANS Long Island Section. I am also a member of New England Reactor Engineers Association.

PROFESSIONAL QUALIFICATIONS

Harry T. Carter

Plant Engineer - Operations

LONG ISLAND LIGHTING COMPANY

I am the Plant Engineer for Operations at the Shoreham Nuclear Power Station, a position I have held since February 1979. My duties include the development and implementation of the station's operational activities. In particular, these include the startup, operation and shutdown of all station equipment and the development, review and implementation of the operating section's station operating manual. During this period I have participated in the following projects: the Control Room Audit of Shoreham Nuclear Power Station by the General Physics Corporation, the NRC Control Room Audit, the writing of the Shoreham Nuclear Power Station Emergency Procedures based on the Emergency Procedure Guidelines and the testing of these procedures on the Limerick Simulator. I am presently a member of the BWR Owners' Group Subcommittee on Emergency Procedures, which has been developing Emergency Procedure Guidelines for BWR Plants.

I graduated from New York State Maritime College in 1964 with a Bachelor of Marine Engineering Degree and a 3rd Assistant Steam, 3rd Assistant Diesel License, U.S. Coast Guard. I have also completed the following industry seminars and training programs:

(1) General Electric Company BWR Technology course;

(2) BWR Simulator Training;

(3) Assistant to the Operations Section of the E.I. Hatch Nuclear Power Station;

(4) BWR Simulator Refresher Training;

(5) Fire Fighting Training -- Suffolk County Fire Department;

(6) American Management Association Supervisory Management Course.

Prior to my employment by LILCO, I worked for the Knolls Atomic Power Laboratory Division of the General Electric Company, Schenectady, New York, from 1971 to 1979. During this period, I was assigned to the D1G, MARF and S1C Naval Nuclear Prototypes.

At S1C, I was a Qualified Engineering Officer of the Watch and Shift Supervisor. As Shift Supervisor, I had the authority to order the reactor shut down. While on shift, I assumed the authority for any site casualties in the absence of the Site Manager or his designated representative, authorized all tests, plant operations and maintenance, and authorized all casualty control drills. I was also responsible for all training performed on the shift including training Navy personnel on various watch stations.

I was Qualified Engineer Officer of the Watch on the D1G Naval Nuclear Prototype and a Shift Test Engineer at the MARF Nuclear Power Plant.

From 1967 to 1971, I was employed by Grumman Aerospace Corporation, Bethpage, New York, as a Test Engineer on the Lunar Module Program and tested the main propulsion systems of both the ascent and descent stages of the lunar modules which landed on the moon.

From 1964 to 1967, I was employed by Grace Lines, Inc., North River, New York. I held a Second Assistant Engineers License Steam, Third Assistant Engineers License Diesel, U.S. Coast Guard. My duties included on-watch operation of marine propulsion plants and underway repairs to marine machinery.

PROFESSIONAL QUALIFICATIONS

Eugene C. Eckert

Manager, Plant Transient Performance Engineering

GENERAL ELECTRIC COMPANY

My name is Eugene C. Eckert; my business address is General Electric Company, 175 Curtner Avenue, San Jose, California. My current position is Manager, Plant Transient Performance Engineering. I am responsible for establishing the simulation requirements of the computer models needed to perform transient analyses, development of design procedures evaluation of BWR stability, and evaluation and specification of the functional protection systems required for reactor abnormal transient protection. Included is the analysis and mitigation of transients with postulated failure of reactor scram (ATWS).

Immediately upon joining General Electric Company in September 1959, I participated in a company-wide engineering training program. My work assignments in this program included large jet engine control design, aircraft nuclear propulsion control analysis, nuclear submarine kinetics and control analysis, and industrial control simulation analysis at GE's Research and Development Center. After completing this program in 1962, I joined General Electric's Nuclear Energy Division to work on Boiling Water Reactor simulation and dynamic analysis. I have been responsible for design and licensing documentation of the dynamic analysis for several GE BWRs and have participated in initial startup testing of many of the units. I led the dynamic design efforts which established the BWR/4 product line, culminated in 1974 by the startups of the Browns Ferry (TVA), Peach Bottom (PECO) and Fukushima-2 (Japan) units. Since then, my design and analysis work has been applied in all BWR product lines. I have been lead total plant design engineer and, since 1971, manager of transient analysis for BWRs.

I received a Bachelor of Science Degree in Electrical Engineering from Valparaiso University in Indiana in 1958. During the next year, I attended Stanford University under an Oak Ridge Fellowship and received the Master of Science Degree in Engineering Science in August 1959.

PROFESSIONAL QUALIFICATIONS

Henry C. Pfefferlen

Manager, BWR Licensing Programs

GENERAL ELECTRIC COMPANY

My name is Henry C. Pfefferlen. My business address is General Electric Company, 175 Curtner Avenue, San Jose, California. I am manager of BWR Licensing Programs in the Nuclear Power Systems Division of the General Electric Company in San Jose, California.

I have responsibility for all licensing aspects of the ATWS issue within General Electric. My duties include establishing requirements for engineering, reviewing design and analysis results, and interacting with the NRC to assure compliance with regulatory requirements. I was assigned this responsibility in 1978.

For five years prior to my current position, I served as responsible manager for licensing activities associated with General Electric participation in the LMFBR program. Specific responsibilities were similar to those of my current position and also included preparation of Clinch River Breeder Reactor PSAR material.

My early career included seven years in project related functions associated with General Electric's participation in safety development programs associated with LMFBR fuels. Prior to this, I was responsible for the design and testing of safety related irradiation experiments for LMFBR fuel. My initial assignment at General Electric was to a training program which included work as a health physicist and reactor operator. It was during this time that I obtained a license to operate the Vallecitos Boiling Water Reactor.

I am a licensed Professional Mechanical Engineer in the state of California. I received a Bachelor of Science degree in Mechanical Engineering from California State University, San Jose, in 1960.

PROFESSIONAL QUALIFICATIONS

John A. Rigert

Section Head, Nuclear Systems Engineering Section

LONG ISLAND LIGHTING COMPANY

My name is John A. Rigert. My business address is Long Island Lighting Company, 175 East Old Country Road, Hicksville, New York. I am the Section Head of the Systems Engineering Section of the Nuclear Engineering Department. I have held this position since October 1978. My responsibilities include the review and approval of the technical aspects of nuclear and radwaste systems engineering and the performance of special studies relating to nuclear and radwaste system design and performance. In addition, I will provide technical support for modifications and improvements during nuclear plant operations.

I received my Bachelor of Mechanical Engineering degree from Pratt Institute in 1970 and my Master of Science degree in Nuclear Engineering from Polytechnic Institute of Brooklyn in June 1976. I have completed courses in GE BWR systems and simulator training, Westinghouse PWR systems training and other subjects related to nuclear power.

I am a member of the American Society of Mechanical Engineers and am a registered Professional Engineer in the State of New York.

I have been employed by LILCO since June 1970. In the period from June 1970 to February 1972, I held the position of assistant engineer in the Gas Production and Operations Department. Then, from February 1972 to August 1976, I held the positions of associate engineer and engineer in the Power Engineering Department. I was responsible for various assignments related to Shoreham, Jamesport, Northport 3 & 4 and other projects with emphasis on mechanical and electronic instrumentation and controls, demineralizers and water treatment.

In the period from August 1976 to October 1978, I held the position of Nuclear Systems Test Engineer in the Shoreham Startup organization. I was responsible for procedure preparation, flushing, testing and other activities on the following systems: control rod drive, reactor core isolation cooling, standby liquid control, refueling and reactor vessel servicing, fuel pool cooling and cleanup and other miscellaneous systems.

PROFESSIONAL QUALIFICATIONS

William P. Sullivan
Technical Leader, Availability Engineering
GENERAL ELECTRIC COMPANY

My name is William P. Sullivan. My business address is General Electric Company, 175 Curtner Avenue, San Jose, California. I am employed by General Electric Company as a Technical Leader in the Availability Engineering Subsection of GE's Nuclear Energy Business. In this capacity, I am responsible for providing technical guidance, work assignments and output review for a group of four senior level engineers. My primary task is assessment of boiling water reactor system designs for safety and plant reliability improvements. Most recently, I was responsible for the reliability analyses in the probabilistic risk assessment for the General Electric BWR/6 Standard Plant. I have also participated as a reviewer in several BWR PRA's. During 1976, I was responsible for the preparation of the BWR Scram System Reliability Analysis and have participated in subsequent reliability studies of the scram and standby liquid control systems.

I have 22 years of reliability engineering experience in advanced technology programs. My program responsibility included ballistic missiles, manned spacecraft, large gas turbine power generating units and nuclear power reactors. My primary tasks have involved the application of reliability and quality assurance techniques in the design, development and manufacture of large systems. I have performed safety and reliability probabilistic analyses to support engineering designs. These analyses have provided input to defense organizations, NASA, the Nuclear Regulatory Commission and utility organizations. My recent experience has been in the application of probabilistic techniques in the identification of major contributors to the safety and availability of operating BWR plants.

I am a registered Professional Engineer in Quality Engineering in the State of California.

PUBLICATIONS OF WILLIAM P. SULLIVAN

W.P. Sullivan, T.Y. Fukushima, L.H. Youngborg, "BWR Scram System Reliability," NEDE-21514 (1976) (GE proprietary).

Lay-in #5

LILCO TESTIMONY ON SC CONTENTION 16

Attachment 1

SP 29.024.01 Transient with Failure to Scram

M.C - 1

Submitted: ______________________ (Section Head)

Approved: ______________________ (Plant Manager)

SP Number 29.Ø24.Ø1

Revision Ø

Date Eff. 4/22/82

TRANSIENT WITH FAILURE TO SCRAM

EMERGENCY PROCEDURE

1.0 SYMPTOMS

1.1 A valid scram signal or condition due to a reactor transient is alarmed or indicated and all control rods do not fully insert as indicated on the full core display, rod position printout on the computer, or four rod display.

1.2 Reactor pressure and/or neutron flux indication increases abruptly and may go off-scale on recorders and meters.

1.3 Safety relief valves may lift.

2.0 AUTOMATIC ACTIONS

2.1 1115 psig reactor vessel pressure and above actuates various safety relief valves. ______

2.2 1120 reactor vessel pressure TRIPS the reactor recirculation pumps. ______

3.0 IMMEDIATE OPERATOR ACTIONS

3.1 Manually scram reactor per SP 29.Ø1Ø.Ø1 (Emergency Shutdown) ______

3.1.1 Arm and depress manual scram pushbutton. ______

3.1.2 Place the Mode switch in shutdown. ______

3.3.3 Verify all rods are inserted. ______

3.2 IF the reactor scrams AND all rods insert, AND power is decaying, THEN continue in SP29.Ø1Ø.Ø1. ______

3.3 Trip the recirculation pumps. ______

3.4 Commence suppression pool cooling per SP 23.121.01 (Residual Heat Removal (RHR) System). ______

3.5 The following attempts to scram the reactor are to be performed concurrently if manpower is available.

1982

3.5.1 Insert those rods not fully inserted with the reactor manual control system as the Rod Sequence Control System (RSCS) permits. ________

3.5.2 Bypass the scram discharge volume high level scram switches, reset the RPS trip and verify the vent and drain valves open. ________

3.5.2.1 Alternately RESET the Reactor Protective System and SCRAM the reactor until all rods are fully inserted. ________

3.5.3 Confirm all scram valves are open by observation of scram valve position lights. IF not, THEN perform the following: ________

3.5.3.1 DE-ENERGIZE RP's subchannel logic by opening the following breakers on 1C71*PNL-ØØ1 in the relay room:

a) CB2A ________

b) CB2B ________

c) CB7A ________

d) CB7B ________

3.5.3.2 Vent air from the scram air system by closing valve C11-Ø2V-Ø7Ø4 and opening vent valve downstream of C11-Ø1V-71Ø4. ________

3.5.3.3 Restore the breakers and air valves to normal when all scram valves are open. ________

3.5.4 Bypass the scram discharge volume (SDV) high level scram switches, reset the RPS trip and verify the vent and drain valves open. ________

3.5.4.1 INDIVIDUALLY SCRAM Control Rods at Local Hydraulic Control Units (HCU's) by placing both NORM-TEST-S.R.I. switches to the TEST position. ________

3.6 IF reactor power is above 6% OR RPV level cannot be maintained OR suppression pool temperature reaches 110°F, THEN perform the following. ________

3.6.1 Start either A or B standby liquid control pump and inject the entire contents of the tank. ________

3.6.1.1 IF RWCU automatic isolation did not occur, THEN manually isolate RWCU.

3.6.1.2 Terminate all injection into the RPV with the exception of CRD and RCIC or HPCI to maintain RPV water level above the top of active fuel (TAF).

4.0 SUBSEQUENT OPERATOR ACTION

4.1 Verify immediate operator actions.

4.2 IF reactor pressure is causing the safety relief valves (SRV's to cycle, THEN perform the following.

4.2.1 Manually open enough SRV's to reduce reactor pressure to between 800 and 960 psig.

4.2.2 For subsequent SRV operation, the valves should be cycled in order to minimize local heat loading of the suppression pool.

4.2.3 If the HPCI system is not in service, it may be placed in full flow test to minimize SRV cycling.

4.3 SAMPLE reactor coolant frequently to verify boron concentration above the level determined to maintain the plant shutdown.

4.4 After the reactor is shutdown, PROCEED to stabilize Plant Condition in Hot Shutdown by performing either steps 4.4.1, 4.4.2, or 4.4.3.

CAUTION

Do not shutdown SLC Injection once it has been started until the SLC Solution Tank is verified to be empty.

4.4.1 Maintain Reactor pressure between 800 and 960 psig by use of Main Turbine Bypass Valves.

CAUTION

Consult with the Nuclear Engineer to confirm that boron concentration in the reactor will be sufficient to maintain the reactor shutdown after accounting for a normal startup of the Steam Condensing Mode of RHR.

4.4.2 Maintain reactor pressure between 800 and 960 psig by use of the RHR steam condensing in accordance with SP 23.121.01 (Residual Heat Removal (RHR) System). ________

4.4.3 Maintain reactor pressure between 800 and 960 psig by opening safety relief valves and utilizing Suppression Pool Cooling to limit Suppression Pool temperature. ________

4.5 Place the reactor in COLD SHUTDOWN, by performing the following:

4.5.1 Confirm by sample results and consultations with the Nuclear Engineer that sufficient negative reactivity has been inserted into the reactor to account for the positive reactivity effects of temperature decrease and dilution. ________

4.5.2 Start the reactor recirc pumps at minimum speed. ________

4.5.3 Shutdown and Cooldown in accordance with SP 22.ØØ5.Ø1 (Shutdown to Cold Shutdown). ________

4.6 Override the RHR pump minimum flow valve to the closed position to prevent the loss of borated water when shutdown cooling is placed in service. ________

4.7 When reactor pressure has decreased to 135 psig, Startup RHR Shutdown Cooling in accordance with SP 23.121.01 (Residual Heat Removal (RHR) System). ________

4.8 If flooding the reactor vessel up to the steam dome is necessary, use the SLC system. ________

4.9 Maintain boron concentration in the vessel between 750 and 1000 PPM. ________

5.0 FINAL PLANT CONDITIONS

5.1 The plant is in cold shutdown conditions. ________

5.2 Reactor level being maintained in the normal operating range (between 34" and 42") ________

Watch Engineer Review________________
(Watch Engineer)

6.0 DISCUSSION

An ATWS is extremely unlikely but will require prompt operator action to mitigate the consequences. Operator concerns are as follows:

6.1 Verify Recirc. pumps trip.

6.2 Shutdown the reactor.

6.3 Limit reactor pressure.

6.4 Maintain the core covered.

6.5 Limit Suppression Pool temperature.

6.6 Place plant in Cold Shutdown.

The operator must attempt to scram the reactor with the most readily available means. If the reactor cannot be maintained subcritical with Control Rods and reactor level falls below +12.5" or Suppression Pool temperature can't be maintained below 110°F, SBLC must be initiated to minimize containment heat-up. Suppression Pool Cooling should be initiated as soon as possible to ensure suppression pool temperature limits are not exceeded.

A Cooldown must not be initiated until control rods are inserted or Boron concentration is satisfactory to prevent a restart of the reactor.

Once Boron injection is started, it must be run to completion.

JUDGE BRENNER: I will ask counsel very briefly when we get the witnesses up to indicate whether it is true and correct as corrected.

Incidentally, it might be that we should come up with a procedure close to this for the future -- that is where counsel does all the mechanics -- and we will just ask the witness to verify it, unless there are any objections to that procedure for the future.

All right. I would like to get the staff's testimony, and also I have before me NRC staff testimony of Marvin W. Hodges on anticipated transients without scram (ATWS)(SC Contention 16), consisting of, in addition to the one-page outline, which is there for convenience and not as testimony, five pages of testimony followed by Mr. Hodges' professional qualifications consisting of two pages.

Are there any corrections to this testimony?

MR. BLACK: Just one, Judge Brenner, for what it is worth. On the first page of Mr. Hodges' professional qualifications in the third paragraph, I should note that he supervises the work of seven graduate engineers as opposed to six.

JUDGE BRENNER: I should have been able to make that one on my own by now.

(Laughter.)

JUDGE BRENNER: Listen, if you ever fire one of these guys, Mr. Hodges, we are going to have to go back and change it again.

(Laughter.)

MR. BLACK: Also, I believe it has been customary in this proceeding to bind into the record at the testimony to the applicable SER sections that the staff witness would rely on, and at this time we would like to bind into the record Section 13.5.2.C, the second supplement to the SER, and also Section 15.3 of the second supplement to the SER. And we will give copies to the Board and the parties immediately after the hearing date today.

JUDGE BRENNER: Were you finished, Mr. Black?

MR. BLACK: Yes, I was.

JUDGE BRENNER: In the absence of objection I will admit the staff's testimony in evidence and bind it into the record along with the excerpts identified from the SER as if read at this point.

(The information referred to follows:)

Lay-in # 6

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
LONG ISLAND LIGHTING COMPANY	)	Docket No. 50-322
	)	(OL)
(Shoreham Nuclear Power Station Unit 1)	)	
	)	

NRC STAFF TESTIMONY OF MARVIN W. HODGES ON ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS)

(SC Contention 16)

8

OUTLINE OF TESTIMONY

This testimony addresses Suffolk County (SC) Contention 16, which concerns the issue of anticipated transients without scram (ATWS). The generic ATWS issue is currently being addressed by the NRC in a rule-making proceeding. However, the contention, and this testimony, are focused on the interim period for Shoreham prior to the implementation of the generic resolution.

The testimony describes the interim measures that will be taken at Shoreham to reduce the risk from ATWS events. These include:

1) a recirculation pump trip (RPT) system;

2) ATWS procedures; and

3) operator training.

The testimony further indicates that the NRC Staff has concluded that it is acceptable to operate Shoreham pending final resolution of the ATWS issue for several reasons. These include:

1) the low probability of a severe ATWS event;

2) the fact that the interim measures are adequate to mitigate most ATWS events; and

3) the fact that the interim period prior to issuance of an ATWS rule should be short.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of LONG ISLAND LIGHTING COMPANY (Shoreham Nuclear Power Station Unit 1)	))))))	Docket No. 50-322 (OL)

NRC STAFF TESTIMONY OF MARVIN W.
HODGES ON SC CONTENTION 16: ATWS

Q. Please state your name for the record.

A. My name is Marvin W. (Wayne) Hodges.

Q. What is your position with the NRC?

A. I am employed as a Section Leader in the Division of Systems Integration. A copy of my professional qualifications is attached. (Attachment 1).

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to respond to SC Contention 16 which states:

> Although the anticipated transients without scram issue is generically before the Commission in a rulemaking proceeding, Suffolk County contends that LILCO and the NRC Staff have not adequately demonstrated that Shoreham meets the requirements of 10 C.F.R. Part 50, Appendix A, GDC 20, regarding correction of the ATWS problem in the interim period of several years pending completion and implementation of the result of the rulemaking for Shoreham. This is because the interim measures to be taken at Shoreham, including operational procedures and operator training, will not

> compensate for the lack of an automatically initiated and totally redundant standby liquid control system (SLCS) which meets the single failure criterion.

Q. What is the status of the unresolved safety issue, "Anticipated Transient Without Scram (ATWS)"?

A. In November, 1981, the Commission issued for comment two proposed rules on ATWS. These are known as the "Staff rule" and the "Hendrie rule." The comment period for an earlier proposed ATWS rule which I call the "utility group rule" was also reopened. The comment period is over and a task force has been formed within the NRC Staff to prepare a Commission paper proposing a final ATWS resolution.

Q. Will the rulemaking address the need for "an automatically initiated and totally redundant standby liquid control system which meets the single failure criterion?"

A. It would not be fruitful for me to speculate on the requirements of the rule. However, I expect that a final decision on ATWS will be based upon a consideration of the expected frequency of ATWS events, the severity of various ATWS events and the desired equipment reliability. This leaves open the possibility that the ATWS mitigation systems may not be required to be totally redundant or single failure proof. For Shoreham, and other BWRs, multiple failures must occur for an ATWS to occur; therefore, it can be argued that an ATWS mitigation system need not be single failure proof.

Q. What is the purpose of the interim measures referenced in the contention?

A. The decision to permit Shoreham and other plants to operate prior to final resolution of the ATWS issue is based on the Staff's conviction that the present likelihood of severe consequences arising from an ATWS event is acceptably small, and that presently there is no undue risk to the public from ATWS. This conclusion is based on engineering judgment in view of: a) the estimated arrival rate of anticipated transients with potentially severe consequences in the event of scram failure; b) the favorable operating experience with current scram systems; and c) the limited number of operating reactors. However, as a prudent course, in order to further reduce the risk from ATWS events during the interim period before completing the plant modifications determined by the Commission to be necessary, the Staff felt that the interim measures would further reduce the risk due to ATWS.

Q. Describe the interim measures which are being implemented at Shoreham for ATWS mitigation.

A. LILCO has installed a recirculation pump trip (RPT) system at Shoreham. This system will trip the recirculation pumps and thus reduce reactor power on receipt of a high vessel pressure signal. LILCO has developed ATWS procedures based on emergency procedure guidelines developed by the BWR Owners' Group. These ATWS procedures have been reviewed and accepted by the NRC. LILCO has also committed to train the operators to perform the proper actions for ATWS events.

Q. Contention SC 16 claims that the interim measures to be taken at Shoreham for ATWS mitigation, including operational procedures and operator training, will not compensate for the lack of an automatically initiated and totally redundant standby liquid control system (SLCS) which meets the single failure criterion. Does the Staff agree or disagree?

A. The Staff evaluations in NUREG-0460, volumes I through IV support the need for improved or new ATWS mitigation systems. The "Staff" version of the proposed rule and the "Hendrie" version of the proposed rule both provide for new or improved ATWS mitigation systems. We make no claim that the interim measures taken for ATWS mitigation (i.e., recirculation pump trip, ATWS procedures and operator training) are adequate to prevent core damage for all ATWS events.

The NRC Staff, in NUREG-0460, estimated the probability of an ATWS event to be approximately 2×10^{-4}/reactor year. The probability of an ATWS event which will result in core damage is somewhat smaller for several reasons. These include:

1) Not all plant transients result in closure of the main steam isolation valves (MSIVs). With the MSIVs open, the main condenser is normally available to absorb up to 25% of full power heat load.

2) Not all ATWS events will occur at full power. For example, the partial scram failure which occurred at the Browns Ferry plant was from a low power condition.

3) For some ATWS events, manual insertion of some control rods will rapidly terminate the event.

The major concern for an ATWS event in a BWR is the heat load to the suppression pool. Analyses in NEDO-24222 have shown that for even the most severe ATWS events, the vessel pressure remains within acceptable limits. However, overheating of the suppression pool could lead to a loss of heat sink and eventual core damage. Therefore, if the heat can be rejected to the main condenser, if the event starts from reduced power or if manual rod insertion terminates the event, then the ATWS poses no serious threat.

The comment period for the proposed ATWS rules has ended and the Staff is in the process of evaluating the comments. The current Staff schedule calls for submission of a Commission paper in early fall of 1982. The resolution this appears to be proceeding on a reasonable schedule. Because the probability of a severe ATWS is small, because the interim ATWS mitigation measures are adequate for most ATWS events, and because the delay until issuance of an ATWS rule appears to be short, we feel that the incremental risk of severe ATWS in the interim is acceptable.

Marvin W. (Wayne) Hodges

Professional Qualifications

Reactor Systems Branch

Division of Systems Integration

U. S. Nuclear Regulatory Commission

I am employed as a Section Leader in Section B of the Reactor Systems Branch, DSI.

I graduated from Auburn University with a Mechanical Engineering Degree in 1965. I received a Master of Science degree in Mechanical Engineering from Auburn University in 1967.

In my present work assignment at the NRC, I supervise the work of 7 graduate engineers; my section is responsible for the review of primary and safety systems for BWRs. I have served as principal reviewer in the area of boiling water reactor systems. I have also participated in the review of analytical models use in the licensing evaluations of boiling water reactors and I have the technical review responsibility for many of the modifications and analyses being implemented on boiling water reactors post the Three Mile Island, Unit-2 accident.

As a member of the Bulletin and Orders Task Force which was formed after the TMI-2 accident, I was responsible for the review of the capability of BWR systems to cope with loss of feedwater transient and small break loss-of-coolant accidents.

I have also served at the NRC as a reviewer in the Analysis Branch of the NRC in the area of thermal-hydrulic performance of the reactor core. I served as a consultant to the RES representative to the program management group for the BWR Blowdown/Emergency Core Cooling Program.

Prior to joining the NRC staff in March, 1974, I was employed by E. I. DuPont at the Savannah River Laboratory as a research engineer. At SRL, I conducted hydraulic and heat transfer testing to support operation of the reactors at the Savannah River Plant. I also performed safety limit calculations and participated in the development of analytical models for use in transient analyses at Savannah River. My tenure at SRL was from June 1967 to March 1974.

From September 1965 to June 1967, while in graduate school, I taught courses in thermodynamics, statics, mechanical engineering measurements, computer programming and assisted in a course in the history of engineering. During the summer of 1966, I worked at the Savannah River Laboratory doing hydraulic testing.

ENCLOSURE 7

Lay-in #7

Surveillance
Emergency Plan
Health Physics
Chemistry
Reactor Engineering
Plant Security
Radioactive Waste Management

Our review disclosed that the applicant's program for use of operating and maintenance procedures meets the relevant requirements of 10 CFR 50.34, and is consistent with the guidance provided in Regulatory Guide 1.33 and ANSI N18.7-1976/ANS 3.2. Therefore, we concluded that the applicant's program is acceptable.

13.5.2.C. Reanalysis of Transients and Accidents; Development of Emergency Operating Procedures

In letters of September 13 and 27, October 10 and 30, and November 9, 1979, the Office of Nuclear Reactor Regulation required Licensees of operating plants, applicants for operating licenses and licensees of plants under construction to perform analyses of transients and accidents, prepare emergency procedure guidelines, upgrade emergency procedures, and to conduct operator retraining (see also item I.A.2.1). Emergency operating procedures are required to be consistent with the actions necessary to cope with the transients and accidents analyzed. Analyses of transients and accidents were to be completed in early 1980 and implementation of procedures and retraining were to be completed three months after emergency procedure guidelines were established; however, some difficulty in completing these requirements has been experienced. Clarification of the scope of the task and appropriate schedule revisions were included in NUREG-0737, Item I.C.1.

Pending staff approval of the revised analysis and guidelines, the staff will continue the pilot monitoring of emergency operating procedures described in Task Action Plan Item I.C.8 (NUREG-0660). The adequacy of the BWR Owners' Group Guidelines will be identified for each near term operating license (NTOL) during the emergency operating procedure review.

In a submittal dated June 30, 1980, the BWR Owners' Group provided a draft of the generic guidelines for Boiling Water Reactors. The guidelines were developed to comply with Task Action Plan Item I.C.1(3) as clarified by NUREG-0737 and incorporated the requirements of short term reanalysis of small break loss-of-coolant accidents and inadequate core cooling (Task Action Plan Items I.C.1(1) and I.C.1(2)). In a letter dated October 21, 1980, from D. G. Eisenhut to S. T. Rogers, the staff indicated that the generic guidelines prepared by General Electric and the BWR Owners' Group were acceptable for trial implementation at the Shoreham Nuclear Power Station. Additional information was requested by the staff and was submitted by the Owners' Group on January 31, 1981. This additional information is still under review prior to the staff making a final conclusion on the acceptability of the guidelines for implementation on all Boiling Water Reactors. The guidelines are still considered acceptable for trial implementation at the Shoreham Nuclear Power Station.

Based on our review of the emergency operating procedures developed from the BWR Owners' Group Guidelines and our observation of the procedures being implemented on a simulator and in a walk-through in the control room, we have concluded that the guidelines have been adequately incorporated into the procedures. This fulfills the requirements of Item I.C.1 of NUREG-0737.

In accordance with NUREG-0737, Item I.C.7, NSSS vendor review of the low power testing, power ascension testing, and emergency operating procedures is necessary to further verify adequacy of the procedures.

This requirement must be met before issuance of a full power license.

The NSSS vendor, General Electric Corporation, will review the startup tests and emergency operating procedures prior to these procedures being implemented. The startup tests encompass the low power testing and the power ascension testing phases. The applicant has committed to ensuring these reviews are complete prior to fuel load. The staff must review the applicant's resolution of vendor comments to confirm vendor review and implementation of vendor comments into the procedures. The staff will confirm that this review is completed prior to issuance of a full power license.

In accordance with NUREG-0737, Item I.C.8, correct emergency procedures as necessary based on the NRC audit of selected plant emergency operating procedures (e.g., small-break LOCA, loss-of-feedwater, restart of engineered safety features following a loss of ac power and steam-line break). This action will be completed prior to issuance of a full power license.

The staff and personnel from Battelle Pacific Northwest Laboratories reviewed the procedures forwarded by the applicant to the NRC to ensure that the procedures were consistent with the plant's design, the BWR Owner's Group guidelines, and incorporated applicable human factors considerations. The review resulted in two pages of general comments and numerous specific detailed comments on the procedures. The general comments included human factors consideration on the use of standard logic format, procedure identification, interaction with non-emergency procedures, inconsistency between emergency procedures and control room displays and the inadequacy of the graphs that were included in the procedures. The specific comments include clarification and the locations of caution statements, the inclusion of action steps in cautions, the need for the addition of specific information to reduce operator judgments such as the preferred sequence for starting various systems, the need to add decision points to aid operator actions, and numerous references to changing words and using standard logic format to clarify action steps. A meeting was held with the applicant on September 16, 1981, to discuss the results of the review. During the meeting many of the comments were resolved by incorporating the recommended changes.

On October 16, 1981, a simulator exercise was held at the Limerick Training Center. Operators used the revised emergency operating procedures to respond to simulated transients and accidents. Scenarios were designed to require the concurrent use of procedures and transition among procedures. The scenarios varied from minor transients to accidents involving multiple system failures. The simulated transients and acidents included:

1) Loss of feedwater from leaks or breaks in feed lines, faulty valve operation, and pump failure.

2) Various initiating events followed by failure of various injection systems (e.g., RCIC, HPCI, LPCI) when needed for level control, level restoration and containment control.

3) Turbine trip followed by a reactor trip.

4) Failure of off-site power with subsequent failure of a diesel generator.

5) Stuck open relief valves resulting in loss of Reactor Pressure Vessel Water inventory and emergency conditions in containment.

All of the emergency operating procedures were tested in responding to the simulations. The review team observed the exercises and discussed them in detail with the operators. Special emphasis was placed on the need to use written emergency procedures and evaluating the clarity and usability of the procedures. Several changes were made to the procedures as a result of the exercises and subsequent discussions. The changes involved sequencing of steps, labeling to help locate specific steps, and clarifying priorities of actions.

On October 17, 1981, the team of reviewers that had participated in the simulator exercises conducted a walk-through of the emergency operating procedures in the control room. The operators were presented with the initiating event (an intermediate-size break), with the desired sequence of steps. The operators then walked through the scenario, while the team of reviewers evaluated the operators' use of the procedures, the interaction of the operators with the control panels, and the interaction between the operators. The entire sequence was discussed in detail with the control room operators and the plant operations staff at the conclusion of the simulated event. The effective manner in which the operators used the emergency operating procedures indicates that they are clear, properly sequenced, and compatible with the control room and its equipment.

During the review, it was noted that: 1) some plant specific data were not available and noted by a "(Later)", 2) the graphs referenced in the procedures need revision to improve their usability, and 3) there are a few additional changes required in the procedures as noted during the simulator exercises. The applicant has committed to incorporate the plant specific data when they are available and to make the agreed to changes to the procedures and graphs. The staff will verify that the missing data and changes have been included in the procedures before issuance of an operating license.

15 ACCIDENT ANALYSIS

15.3 Anticipated Transients Without Scram

We stated in the Safety Evaluation Report that the applicant agreed to develop an emergency procedure for an ATWS event. The Shoreham ATWS procedure was reviewed by members of the NRC staff and contractor personnel from Battelle . Pacific Northwest Laboratories and comments were discussed with the operations personnel. Based on our evaluation, we conclude that the Shoreham ATWS procedure provides an acceptable basis for licensing and interim operation of Shoreham pending the outcome of the proposed rulemaking on ATWS in accordance with General Design Criteria 10, 15, 26, 27, and 29 of 10 CFR Part 50 Appendix A. The staff has recommended to the Commission that rulemaking be used to determine any future modifications necessary to resolve ATWS concerns and the required schedule for implementation of such modifications.

JUDGE BRENNER: I do not know if there is anything pertinent in the responses to the Board inquiries. I do not recall anything. But if there is, perhaps the staff or LILCO, if it pertains to their responses, could let us know tomorrow.

That is all we have on the ATWS testimony.

MR. REVELEY: Judge, I have one matter. I suppose it falls in the category of a coming attraction.

Mr. Christman has informed me that requests for four subpoenas are on their way here. They have not yet arrived partly because our telecopy machine is under the weather. I imagine they will come tomorrow. Needless to say, these are subpoenas for emergency planning witnesses and depositions that are now pending.

JUDGE BRENNER: All right. There is nothing else on ATWS for right now? I will know when I see the subpoenas, but if they are for non-party witnesses then we need addresses, or I will probably use the parties to handle the mechanics so that they can be informed of their rights if we in fact issue the subpoena.

We are going to come back to safety relief valves in a moment, so I do not want to get into miscellaneous matters, just matters related to ATWS.

MR. BLACK: Do you intend to bind the County's testimony into the record?

JUDGE BRENNER: Not at this point. Just prior to their testifying we will. We thought we would wait for some other contention before putting everybody up there together; but we might find the right one before the end of the proceeding.

MR. REVELEY: Seriously, it might be quicker if the experts were all sitting up there together and could disagree with one another.

JUDGE BRENNER: We have talked about it a lot, and we might do it on some testimony. In fact, frankly, since we brought it up -- and I do want to get back to SRV -- we might do it on Suffolk County 27 if that is not settled; and we invite the parties to suggest contentions in which they would like us to do that, but we will not do it on this one at the last minute. But we think it might be a good idea in many circumstances, not necessarily all.

All right. With respect to SRV we have got two things that we would like to ask counsel for LILCO primarily to do, and the other counsel are welcome to participate; but if possible we would like to hear about it orally this week, and that is not a requirement. We know time is tight; just if possible.

We would like an identification by counsel of in counsel's view what in LILCO's testimony or where in

LILCO's testimony there is a discussion or some sort of focusing on how the differences in the two-stage valve as contrasted to the three-stage target rock valve will make the two-stage valve more reliable from the point of view of being resistant to stuck-open relief valve events or spurious opening.

Now, we know there is discussion that it is better. Those assertions are in the testimony. And we recall some reference to the experience, although we would not mind being refreshed with that reference, but beyond the experience, what is there about the difference in design from LILCO's and anybody else's point of view already in the testimony, whether it be the direct, the attachments, or the cross examination, but because of the shortness of time we will accept an interim report as to the direct testimony in the first instance, because frankly we do not recall a lot on that point, and we want to decide whether we want more on it or not, but first we want to get a handle on what is there.

In the same vein, although I asked County witnesses to make certain assumptions, we are not sure as of this moment that those assumptions are reflected in the record, and we would like to be pointed to the portions, if they exist, of the record, whether it be again the direct testimony or the oral testimony, as to whether the loads that would be experienced during hypothetical operator error of cycling the valve closed while there was still water in the line have been bounded by the test results and/or where the consequences of the valve failing in that situation, failing open in that situation under those loads are bounded by other analyses such as the design basis accident.

So the answer might be that you have some place in the testimony where it is stated that those loads are bounded by the test results, in addition, or in the alternative that even without the loads being bounded, assuming the failure, that there is testimony that the consequence is bounded by some other analysis.

Now, we recall the general testimony, primarily of Dr. Crawford, that there are other events that he did not consider because their probability was lower and their consequences were lower; but we do not know if there is anything in the testimony that ties it to this event during this reactor condition. That is, you are going into the alternate shutdown mode or in the alternate shutdown mode, and the valve is cycled so rapidly that there is still water in the tailpipe column, if you will; I think the column below the valve. I hope I said that right.

MR. IRWIN: I think I understood it.

JUDGE BRENNER: All right. Those two were for counsel, at least in the first instance. I guess we are asking you for instant preliminary findings, if you want to phrase it that way, and to some extent it reflects our lack of strong confidence in our recollection of the record, and for that we apologize. It is for that reason that we are seeking the comments of all of the parties.

In addition, we would like a witness or witnesses on behalf of LILCO to tell us how LILCO's maintenance, in-service testing, and surveillance requirements, and I underline requirements, as distinguished from reading advice and SIL's, will minimize the problems with respect to crud or other foreign matter which occurred in the past with respect to safety relief valves.

Now, we are not requiring that this week, obviously. We are not requiring that it be in writing, although that would be helpful, and we are prepared to ask questions, but we would like some going forward in the nature of direct. It would be better, of course, to have the points at least outlined in writing. It doesn't have to be as polished in the question and answer form, and should include any existing procedures or testing requirements.

MR. IRWIN: We will be happy to provide it in writing.

JUDGE BRENNER: We will schedule it in consultation with all parties after it is served and the parties have notice. The quicker we can proceed on it, I should add that our request for that shouldn't necessarily be taken as any lack of the testimony provided. This has become of interest to the Board in the course of our considering the testimony and looking at the experience and the questions we have asked.

So, we are not implying any defaults on any points in the past. We have newly focused on it as part of the litigation of these contentions. There is no doubt about that. It does fall within our general comments earlier as to our view of the importance of procedures and in-service testing and surveillance requirements, and now we have a concrete application of where the Board believes that could be very important.

JUDGE CARPENTER: Since the very end of the day, I would like to ask whether the applicant has any notion when there might be a response to my "castor oil" question. I am just trying to get a feel whether we might look for it in the very near future or whether it would be some time before we get a response.

MR. IRWIN: I know that Mr. Boseman has been talking with people in San Jose about it this week. I don't know whether he will have a final answer this week. I will certainly have a fairly good progress report for you tomorrow or the next day as to what kind of answer there might be.

JUDGE BRENNER: You might want to schedule it along with this further presentation now. I will leave that up to LILCO, and you may want to talk with the other parties also.

MS. LETSCHE: Judge Brenner, with respect to the Board's request, I would just like to make a couple of comments with respect to the first two things that you have asked of counsel, to identify places in the record with respect to particular items that you have indicated an interest in. I assume that -- I mean, this sounds an awful lot to me like sort of advanced proposed findings technique going on here.

JUDGE BRENNER: Yes. I think I characterized it that way.

MS. LETSCHE: With respect to whatever LILCO submits, the County will have an opportunity to review that and respond to it, given whatever they submit?

JUDGE BRENNER: Let me explain the context. And, yes, we are going to give you an opportunity to comment, but we are looking for some instant feedback this week. We are not going to make any definitive rulings based on it. We are going to decide whether we want to pursue anything further on the record based on it.

MS. LETSCHE: My concern, Judge Brenner, is the obvious one, which is, this is an opportunity for counsel for one party to cull the record and pull out information that they feel is pertinent or is responsive to the Board's request, and I think that it is appropriate in light of that for the party on the other side to be able to review that and to respond in whatever way it sees fit. That is the concern that I am raising here.

I think that it is certainly not the norm that that is done at this stage of the proceeding, in the middle, a couple of days after the litigation is completed, and it is my belief that in light of the unusual circumstances here, that the County is entitled to have some time to respond in whatever way is appropriate.

JUDGE BRENNER: This isn't the first time, although the contexts have varied, that the parties have accused us of not being normal, and we always choose to take it as a compliment, even when it is not intended that way.

(General laughter.)

JUDGE BRENNER: There is not going to be a lot of time to respond, because we are going to decide whether we want to pursue something further or not this week. That is a very tentative type decision, and it is no prejudice to our ultimate decisions on these questions at the time of the findings. What you should do now is respond in the same rapid time frame if you wish to do so, in terms of what in the record you think addresses the point. I don't care if it is positive from the utility's point of view or positive from the County's point of view. We just want to know what is on it.

MS. LETSCHE: Well, Judge Brenner, I can't respond to whatever LILCO determines they want to bring to the Board's attention as somehow supporting whatever their position may be until I know what it is they have identified that way, and frankly, if I am going to be sitting here litigating ATWS in the next two days, I am not going to have time to be going through the SRV record at the same time.

JUDGE BRENNER: Well, let's see what it is when they provide it. Then we will deal with it. We are not envisioning a lot of argument. In fact, no argument. We just want to know. We want record references, period. And then we are going to look at them. So you give us whatever record references you want us to look at on those points. I can tell you this. It would be very detrimental to a party to temporarily mislead us, even if unintentionally, in their zealous advocacy, to think that the record is covered on a point, and then when we get back to the findings at the end of the case decide that it is not.

MS. LETSCHE: Judge Brenner, I have noted the County's objection to the procedure, and we will do whatever we feel is appropriate, given the Board's suggestions, and whatever LILCO files with respect to your --

JUDGE BRENNER: They are not going to file anything. They are going to tell us right on the record. If they want to prepare a written outline, that is fine. We are not requiring it.

MS. LETSCHE: With respect to the Board's second request that an additional witness or witnesses for LILCO be provided to discuss maintenance, testing, and surveillance requirements, we have stated a number of times the County's objection to the request for additional testimony, and I think the Board is aware of our position on that, so I won't restate that.

However, I do want to restate the County does reserve its right to submit additional rebuttal testimony if that is necessary in light of whatever is filed by LILCO if it is in writing, and if it is in writing also the right to recall either an additional witness or to recall the past witnesses for additional cross examination in light of whatever additional testimony is filed on behalf of LILCO.

JUDGE BRENNER: We will certainly consider any requests along those lines after we see what it is, so there are no promises, but you certainly have the right to request it, and I think you know we have been sensitive to that before. If we get additional testimony and we are going to start asking questions on it, you are certainly entitled to ask questions on it. Once you are entitled to ask questions, that leads to all of the other possible avenues of approach, such as possible rebuttal or recalling of other witnesses, and so on.

Although we think this is a rather discreet category as compared to all of the avenues of the subject covered by the large panel we had, we are not going to preclude anything in the abstract, and we will be happy to hear you again when we see what it is that we are dealing with.

MS. LETSCHE: I think the point, Judge Brenner, is exactly that, that it is additional testimony, and in light of that, coming in at the end, after we finished and litigated what we thought we were litigating, it is quite possible that it will raise new issues that the County will feel it is necessary to address, and I just want to alert the Board to that and to our objection, frankly, to this continuous additional evidence and witnesses and issues coming into what we thought was pre-agreed upon contentions and prefiled testimony.

JUDGE BRENNER: Well, we will deal with steps taken to preserve your rights, as I stated. I guess I never did understand the County's continuing objection to our search to where the facts lie, and I will repeat that again. If you want to object on the basis that we are going beyond the contention impermissibly, then the result of your being granted that would be to have us barred from any inquiry.

That would end the matter for all purposes for findings in support of your position or against your position or whatever. It doesn't sound to me like that would be in the County's interest. The other effect would be for us to believe that there may be some other information that we want, just keep quiet about it for four or five months, put it in our findings, and then saying, this gap, we have identified a gap in the record.

Now, that is a different finding from saying, we have examined the whole record and find against the party. The result of a finding that we have identified a gap in the record may lead to the legitimate request for relief from the party against whom we found that gap, to say, well, here are a few witnesses to supplement that gap, and we ask you to hear them. What is the point of waiting six months if we can hear those witneses now? It is a whole different type of finding than believing we have a full record and finding in favor of one party or another, and I think you recognize that distinction.

MS. LETSCHE: Yes, Judge Brenner. Let me just say that the County has never taken the position, nor do we now, that the point of this inquiry should be anything other than to find out the facts and make this plant safe. The County's objection is to the procedures that have been followed and that we feel are not in line with the ones that should be followed with respect to prefiled testimony and giving parties an opportunity to respond to that within the necessary time frame in the testimony that they have initially filed, and I think we have stated that several times, and I don't need to belabor it.

JUDGE BRENNER: The hour is late, and I don't want to belabor it, but you tell me how I should do this one better. I am open to suggestions. What should I do differently on this one?

MS. LETSCHE: Well, Judge Brenner, I don't know specifically what you are --

JUDGE BRENNER: We think there may be a gap in the record on a subject that could be important to the reliability of the safety relief valves. We want to follow it up to see what this utility is doing on this nuclear power plant in terms of either telling us that they don't have to do certain things or they are doing certain things, and we want to look at whether things they are doing are okay. That is our goal. So, you tell us whether we shouldn't pursue that goal or how I should pursue it differently from this point in time. How should we go forward that procedurally would be better for the county?

MS. LETSCHE: My point, Judge Brenner, is that procedurally, to protect the County's interest, the County should have a right to file additional rebuttal testimony following whatever additionally is submitted by LILCO in response to the Board's request, and if necessary, have the right to recall additional witnesses or to recall to the stand whatever witnesses provide direct testimony.

I certainly did not suggest that you shouldn't pursue a concern that you have. My concern is in protecting the rights of the County to litigate whatever is presented by LILCO.

JUDGE BRENNER: Well, as to those rights I don't think we have any debate. I told you I would hear you in the particular context of what we admit. Now, it's not quite an open right to file rebuttal no matter what. But I assure you, you identify some portion that is new which you want to file testimony on that was material to the consideration, and you have a very, very high probability of being granted that leave.

But I'm just not going to say in the abstract you can file any rebuttal. But your showing isn't going to be very difficult in these circumstances.

I thought the debate was about whether we should pursue it at all by requesting additional testimony. I'm tired and so I don't want to say too much, but it is just surprising that it is the County that is objecting. If anything, the utility would have the largest possible objection here. And if they had objected, I am sure I would hear the County saying, oh, the utility is trying to stop the Board from proceeding with matters pertinent to the inquiry. So I am just surprised by the County's posture in this particular context.

But you've said it and I have said it. Obviously, if LILCO upon consideration believes that this isn't pertinent to considerations of minimizing stuck-open relief valve events, you have got a right to object also and we will hear you. Your silence now isn't a waiver for all time of any objection.

MR. IRWIN: As I understand the Board's request, it deals with a circumscribed issue which we will attempt to address in supplemental testimony. My only observation is that LILCO no more intends to reopen the general issue of SORV's that we have explored for the past week plus than the County hopes we do. And I wouldn't, if I were the County, presuppose that there would be a call to recall witnesses outside this defined area of the Board to ask for pretrial testimony. And we think the Board has acted within its proper functions.

JUDGE BRENNER: Remember, we also instructed the Staff that as to items they were working on that they would be filed as promptly as possible in the case, and that includes a follow-up to the Board notification of the particular event, and I forget which reactor at this point, either Hatch or Cooper -- I think it was Hatch. And it included Browns Ferry, but Browns Ferry was the counterbalance. It was the Hatch event that was of concern, and also the follow-up items that the Staff is looking at, as discussed last week, the consideration of the stress analysis that's going to be submitted.

And there was at least one other item, and perhaps more. That is not -- as we said yesterday, we're not holding the litigation open for those matters, but we want them filed promptly in the case, so that the parties and the Board can decide whether any further requests would be appropriate.

(Pause.)

JUDGE BRENNER: One brief thing, just so you can start thinking about it. Some time this week, which is between now and Thursday, and the sooner the better, perhaps the end of the day tomorrow, clue us in as to what we're going to be litigating right after the break, bearing in mind that there may still be contentions that you want to keep aside if discussions are still proceeding.

Tomorrow morning we will talk to you briefly about the security plan and we might be ready to briefly say something about the County's filing on reconsideration of emergency planning.

MS. LETSCHE: Judge Brenner, in that connection, will it be necessary to have somebody who is very familiar with either one of those pleadings here?

JUDGE BRENNER: I don't believe so.

All right. We thank you for your patience on what has been a long day, especially when you consider the start of travel for some of us today. And we will come back at 9:00 o'clock tomorrow morning.

(Whereupon, at 5:55 p.m., the hearing in the above-entitled matter was recessed, to reconvene at 9:00 a.m. on Wednesday, August 4, 1982.)

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NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

ATOMIC SAFETY AND LICENSING BOARD

in the matter of: LONG ISLAND LIGHTING COMPANY (Shoreham Nuclear Power Station)

Date of Proceeding: August 3, 1982

Docket Number: 50-322-OL

Place of Proceeding: Riverhead, New York

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

ALFRED H. WARD

Official Reporter (Typed)

Alfred H. Ward

Official Reporter (Signature)