NUCLEAR REGULATORY COMMISSION

ORIGINAL

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	:	
	:	
LONG ISLAND LIGHTING COMPANY	:	DOCKET NO. 50-322-OL
	:	
(Shoreham Nuclear Power Station)	:	

DATE: September 21, 1982 PAGES: 10,617 - 10,791

AT: Hauppauge, New York

TR01

ALDERSON REPORTING

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

Telephone: (202) 554-2345

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

- x

In the Matter of: :

: Docket No. 50-322-OL

LONG ISLAND LIGHTING COMPANY :

(Shoreham Nuclear Power Station) :

- x

Third Floor, B Building
Court of Claims
State of New York
Veterans Memorial Highway
Hauppauge, New York 11787

Tuesday, September 21, 1982

The hearing in the above-entitled matter convened, pursuant to recess, at 10:30 a.m.

BEFORE:

LAWRENCE BRENNER, Chairman
Administrative Judge

JAMES CARPENTER, Member
Administrative Judge

PETER A. MORRIS, Member
Administrative Judge

APPEARANCES:

On behalf of the Applicant, LILCO:

W. TAYLOR REVELEY, Esq.
ANTHONY F. EARLEY, Esq.
T.S. ELLIS, III, Esq.
Hunton & Williams
707 East Main Street
Richmond, Virginia 23212

On behalf of the NRC Regulatory Staff:

RICHARD BLACK, Esq.
Nuclear Regulatory Commission
Washington, D.C.

On behalf of Suffolk County:

LAWRENCE COE LANPHER, Esq.
Kirkpatrick, Lockhart, Hill,
Christopher and Phillips
1900 M Street, N.W.
Washington, D.C. 20036

* * *

C O N T E N T S

WITNESSES:	DIRECT	CROSS	REDIRECT	RECROSS	BOARD
T. Tracy Arrington, Frederick B. Baldwin, Robert G. Burns, William M. Eifert, T. Frank Gerecke, Joseph M. Kelly, Donald G. Long and William J. Museler (Resumed) By Mr. Lanpher	10,629				
(Afternoon Session.. page 10,694)					
T. Tracy Arrington, Frederick B. Baldwin, Robert G. Burns, William M. Eifert, T. Frank Gerecke, Joseph M. Kelly, Donald G. Long and William J. Museler (Resumed) By Mr. Lanpher	10,694				

E X H I B I T S

NUMBER	IDENTIFIED	RECEIVED	BOUND IN TRANSCRIPT
Suffolk County 52	10,705		10,726
Suffolk County 53	10,711		10,726

RECESSES:

Noon - 10,693

Afternoon - 10,725

P R O C E E D I N G S

(10:30 a.m.)

JUDGE BRENNER: Good morning.

I guess, consistent with our policy of last week, I have another happy announcement. Our other intrepid court reporter and his wife, Mr. and Mrs. Ray Heer, are now the proud parents of one Michael Chambers Heer, who was born at 2:53 a.m. on Friday, September 17th and weighed in at 6 pounds, 13 ounces.

MR. ELLIS: This is a fertile hearing.

JUDGE BRENNER: Due to the long lead times involved, we disclaim any credit pro or con with respect to births so far.

Actually, they delayed the announcement because there had been some dispute over the name, and we offered to adjudicate it for the parents. But like most other issues in this hearing, as soon as we threatened to apply our judgment the parties settled the matter.

Turning to less important things, today was the day we were going to receive the report from the parties on emergency planning. I don't know whether the parties plan on doing that orally or in writing.

MR. REVELEY: We will have something for you in writing, Judge, later in the day. It is my

understanding that the County's lawyers and our lawyers are negotiating the language at this very moment, and they will send it up later today.

JUDGE BRENNER: Okay, very good.

(Panel of witnesses conferring.)

JUDGE BRENNER: The Board's decision on the emergency planning discovery documents we will issue either at the very end of the day today or early tomorrow morning, and we have made arrangements to have copies up here, hopefully tomorrow, for everyone. If counsel wish to receive rapid copies in the Washington area, they can contact my secretary tomorrow morning and get them.

That's all we had with respect to matters unrelated to quality assurance. If there are no other unrelated matters, we can turn to that subject.

Judge Morris has a question before we resume the cross-examination. Are there any other matters we need to discuss?

MR. ELLIS: Yes, Judge Brenner, just a couple of minor matters, administrative matters. Mr. Muller would like to be absent today to return triumphantly home, and Mr. Youngling is, I think after discussion briefly with the Board -- I think Mr. Earley had discussion with the Board on Friday and with Mr.

Lanpher. There are some fairly vital operations going on in the preoperational area today, but he will be back, I think, tomorrow.

WITNESS MUSELER: He will be back whenever we need him. If that needs to be tomorrow, that's fine. He is available on an hour's notice at the most.

MR. ELLIS: Thank you, Judge.

JUDGE BRENNER: That's fine for us. We'll leave it up to the parties to keep talking with each other as to when he should be here. And also, consistent with what we discussed last week, Mr. Alexander is not a part of the panel, and when we need him we'll give you notice also. I don't expect it will be this week, the way we're going.

Well, nobody has brought it up. I guess I should ask if there has been any progress as a result of our discussion at the end of the day on Friday towards a differently organized, more summary approach, without losing the substance of any of the important information.

MR. LANPHER: Judge Brenner, I was going to address the Board on that. I was sort of waiting my turn. I have considered, we have considered, very carefully your remarks the other day and I think they were useful, and thank you.

The way I intend to proceed with respect to the pattern matters, without in my opinion cutting down the important stuff, I have limited the areas substantially and am deleting from that summary list that I provided to the Board the other day -- I'm not intending to cover as separate matters procedures, special processes, inspection or corrective action.

I am intending to complete calculations, proceed to E&DCR's, storage matters, handling and storage, FSAR, matters related to whether the design conforms to FSAR, though that will -- and I have advised Mr. Earley of this -- I believe focus mostly on the configuration reports which were item one of the subpoena, as opposed to focusing at length on review of audit reports; then also cover the subject matter of document control.

I may also have rather brief examination along these pattern lines in the areas of drawings, substantive problems with drawings. With respect to those areas that I am intending to cover, I think this is one of your requests and I think it's probably a good idea. I'm going to try to cover, for instance, within E&DCR matters which seem to relate directly to each other.

I don't know just how well it's going to

work. It's going to result in some jumping around. But all the signature E&DCR's, we'll cover those, all the places where people failed to sign them, we'll handle in one place and that kind of thing. And hopefully that will not result in too much jumping around between the reports, but it will, I think, help to focus the attention on the same discrete problems.

In doing that, I want it to be clear that it's not -- I don't mean to testify on this, but it's not necessarily the County's intention that each -- it's not our position that each of these discrete areas I'm going to address necessarily are unrelated to other areas. But just as a convenience in questioning the witnesses, hopefully it will make things go faster.

JUDGE BRENNER: We appreciate that. We realize no matter how you organize it there is no perfect way, and you may even see fit to vary what you said somewhat depending on how a subject is going, and we recognize that. We just think it's worth a shot, as they say, and we appreciate your adjusting.

We're also going to be alert during the testimony and in the findings to problems with respect to matters you said you weren't going to address individually in terms of directly going to pattern evidence, such as inspections, corrective actions and

procedures.

You didn't say it, but what we inferred or in any event what we independently will be looking at through the course of what comes out in testimony before us would be problems in those areas as they relate to the other areas. The interrelationship is obvious.

MR. LANPHER: Judge Brenner, my further proposal would be that early during the break -- and I am very hopeful that I can finish. I'm trying to look at, how long does all this take. I am very hopeful that all this so-called pattern examination will be completed this week, or the vast majority of it.

And I would then be returning to my cross plan, which I think will be probably significantly shorter in view of some of the things that we will have covered here. I would be proposing during the break and early in the break to prepare a summary outline, or not really a summary outline, a detailed outline of the areas within the audit reports that were covered and addressed and that we think support the pattern arguments that we are making.

That way LILCO will be on notice of things that we think are pertinent. And then on redirect or whatever, if they need to address it or whatever, they won't be surprised if we later want to cite something in

findings.

JUDGE BRENNER: All right, that sounds like a good way to begin and we'll see how it goes. I think it has potential for efficiency, as you indicated.

Mr. Ellis?

MR. ELLIS: Yes, sir, we do too.

Last week, when the Board suggested getting to the nitty-gritty, which led to the one-day recess, we thought that was helpful. We felt the Board's comment last Friday was helpful to add more focus. And we think that what Mr. Lanpher told us yesterday in terms of how he was limiting -- it was also helpful, but I don't think we quite reached the point yet that we need to.

I think wherever possible -- and I can understand that it may not be possible in many instances, and it may not be in his judgment desirable, but whenever possible we would like to be advised of the specific findings, that is the numbers, that he's interested in, because then we are able to present, I think, a more complete picture to the Board, as we did, for example, on the one involving the suppression pool, suppression chamber, that sort of thing.

And I think that's important. The finding by itself standing alone is not terribly informative.

JUDGE BRENNER: The document by itself

standing alone?

MR. ELLIS: Yes, sir.

JUDGE BRENNER: Yes. Well, I think that is reasonable, where you can do that, Mr. Lanpher, the day before, even late on the day before. I recognize there are some areas where you might not want to give them that kind of notice, and we'll leave that up to your judgment.

But I would think that that would be the minority, because it takes a while for the witness to reread the document and get the full flavor and so on. However, we're only requiring the document indications, and as to the more specific indications in advance we are urging you to do it where you can, but we're not requiring it, so that you can have some reasonable judgment as you pursue cross-examination.

In addition, if you do identify specific findings, we are not going to estop you from discovering another part of the finding in the document as you get closer to your cross-examination.

All right. If there's nothing else, we'll go to Judge Morris' question and then resume the cross-examination from there.

Whereupon,

T. TRACY ARRINGTON,

FREDERICK B. BALDWIN,
ROBERT G. BURNS,
WILLIAM M. EIFERT,
T. FRANK GERECKE,
JOSEPH M. KELLY,
DONALD G. LONG, and
WILLIAM J. MUSELER,

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

JUDGE MORRIS: Mr. Eifert, Friday morning just before lunch I directed a question to you about whether there was a definition of positive traceability or criteria that would in effect tell the auditor what he should be looking for and how he would judge an observation.

Were you able to find anything on that subject?

WITNESS EIFERT: Yes, sir, I was. We don't define the term "positive traceability," but in our engineering assurance procedure 5.3 for calculations, in the instructions with respect to preparing the calculation we give specific details on how a preparer is to identify input sources.

This would be the requirement that auditors

would use in developing their checklists and in conducting audits, and if I can read briefly from that -- and I won't read all the words, I will read the pertinent words -- it indicates that "input values and identification of the sources -- let me start again:

"Input values, including units and identification of sources, see sample source reference below," and then the same is technical document, document number and/or title, issue date, revision number, and section, page or table numbers if applicable. The second item as an example is incoming letters from outside organizations, letter identification number, date, name of originator, name of addressee, file location, and an originator's source when available.

So we have been very specific in establishing the strict requirements in the procedures themselves, and this is therefore the criteria that the auditors use in conducting the audits.

JUDGE MORRIS: Thank you.

CONTINUED CROSS EXAMINATION

ON BEHALF OF SUFFOLK COUNTY

BY MR. LANPHER:

Q Gentlemen, I'm going to direct some questions relating to engineering assurance audits on

calculations, and first try to follow the new format. I'm going to cover a number of audits generally under the rubric of traceability or positive traceability, as we were talking about last week. And I would like to direct your attention first to engineering assurance audit 34 and audit observation 119, page 2 of that at the bottom of the page, item 2 at the bottom under the heading "One-Line Diagrams."

It starts out, "Calculation for service loading fails to meet the requirements of EAP 5.3. The calculation provides data without identifying the source of information." And it continues.

Did you find that, Mr. Eifert?

(Pause.)

Q Mr. Eifert, is this an example of an instance where positive traceability requirements of EAP 5.3 were not met?

A (WITNESS EIFERT) Mr. Lanpher, this is an example of where the specific identification of the source document for the input data was not identified. In this particular situation, the data that was in question was amperage ratings of equipment, which is found in the vendor data which comes with the equipment.

It was identified that this was an isolated

case. The situation here in the electrical discipline at this point in time was that they had had low calculation preparation activity and the preparer of this calculation had used an old calculation as a model in preparing this calculation, that had been prepared prior to Stone & Webster's strict requirements for specific traceability.

The information is traceable to the vendor documentation. The situation is that there wasn't ready traceability with specific identification of that vendor document.

Q This observation goes on to state that the calculation fails to incorporate the latest input data available at the time that it was prepared. Is it a requirement under your EAP that the latest input data be incorporated?

(Pause.)

A (WITNESS EIFERT) When people prepare calculations, the practice is to use the latest input data. The situation in this case is a very unusual circumstance, where the motor and load lift was in the process of being revised when the preparer prepared this calculation. The motor and load lift was revised and dated between the time the preparer prepared the calculation and the time it was reviewed.

I was unable to establish specifically in going back and talking to the auditors whether or not that motor and load lift had indeed been distributed at the time of the review. The situation I believe is very unusual that the motor and load lift was being revised at that point in time; not a significant problem.

The electrical discipline periodically goes back and has to update these calculations as the data used as input to this analysis changes. They do not necessarily update the analysis each time an individual input item changes, but they go back and periodically update these analyses. So that would have happened even had we not identified the specific concern as a finding in the audit.

Q Is the identification of updated or new input data that should be included in the calculation one of the responsibilities of the reviewer or checker of the calculation? In other words, is that person supposed to look to make sure the most current input is used?

A (WITNESS EIFERT) Yes, it is. But as I indicated, the situation in this case may be that the revised motor and load lift had not been distributed. There is a date indicated on engineering documents, the issue date. There is normally some small amount of time that it takes to reproduce those documents and get the

distribution date to the individuals that use that information.

As I indicated, the situation here may have been that it had not been distributed, and the individual who prepared the calc then, prepared and reviewed it, would not have been aware that a change was coming at that point in time. The fact that the information is distributed, I am confident, provides me confidence that the calculation would have been again revised as appropriate to make adjustments for the changes in the data on the motor and load lift.

Q Gentlemen, I'd like to now turn your attention in the same audit to observation 120, page 1, item 2. That item, the first two sentences or three sentences read: "The calculations used information obtained from vendor catalogues which were not identified. The sources of various formulae used were not identified. Therefore, traceability is not maintained."

Gentlemen, is this an example --

A (WITNESS EIFERT) I'm sorry, Mr. Lanpher, I missed your reference.

Q It's page 1 of 2 of observation 120. It is item 2.

(Pause.)

Q Mr. Eifert, is this an example of failure to

comply with the traceability requirements of EAP 5.3?

(Panel of witnesses conferring.)

A (WITNESS EIFERT) Again, Mr. Lanpher, I believe it's fair to say that ready traceability was not provided in this case, and this is in some respects again a different problem from the problem we have seen in other audit observations. In going back over the weekend and spending a lot of time talking to the auditors, we have been able to put together some additional information with respect to these situations.

This particular situation, the practice in documenting these calculations was to maintain a standard listing of the input sources for the documents, which is included in the front of the book of calculations for a series of pipe supports. In this particular case, for this book of calculations that page had been lost.

With respect to the two specific areas identified, the vendor data as well as the reference to the various formulas that were used, as we have discussed earlier the vendor data is one of the many input sources that we use in many calculations. The standard practice that Stone & Webster employs utilizes systems that identify on vendor data, index vendor data

by specification, so that the engineers can use that data file. Engineers preparing and reviewing calculations know that they have to go to those files.

The second situation, with respect to the formulas, again this is a situation where these were standard formulas that were very familiar to the people doing the work, standard welding formulas, as I recall in our discussions. In this particular case, the auditor was not specifically familiar with this set of formulas and therefore identified the observation and worded the observation as she did.

But again, the situation is that proper formulas were being used. As I would expect, the reviewer places his emphasis on assuring that the methods and the conclusions in the calculations are appropriate. The concerns that we have been discussing are the administrative concerns, which our engineers appropriately consider of secondary importance.

Traceability did exist. There wasn't a concern with the analytical method. It was ready traceability that did not exist.

Q Mr. Eifert, could you please turn to Engineering Assurance Audit 38, the first page of it? And if you could keep open to the audit that you were just referring to, Audit 34, and Observation 120, and specifically in Audit 38, if you could review the second paragraph that starts, "The review of the corrective action proposed for engineering assurance audit observation 120," and I think this is a followup on the earlier audit observation.

(Pause.)

Q Mr. Eifert, was a review of pipe stress design calculations undertaken as a result of Audit Observation 120?

(Whereupon, the witnesses conferred.0

A (WITNESS EIFERT) Specifically, no. You said pipe stress design. This is pipe support design calculations that are addressed in Audit Observation 120. It affects the pipe support design calculations. We did undertake a review, but not specifically because of the item you have indicated. We have discussed here Item 2 with respect to the traceability of input sources.

Q The paragraph I was referring to you in Engineering Assurance Audit 38, which does reference pipe stress design calculations, you are correct in

that. What portion of Audit Observation 120 does that relate to?

(Whereupon, the witnesses conferred.)

Q Mr. Eifert?

A (WITNESS EIFERT) With respect to the report on Audit 38 and the reference there to pipe stress design, that is, I believe, a typographical error. That is referring specifically back to Audit Observation 120, which is pipe support design. This concern relates to pipe support.

Q So this in Audit 38, this is incorrect. It should have said pipe support design calculations?

A (WITNESS EIFERT) Yes. With respect to the corrective action that was undertaken as a result of Audit Observation 120, the concern, if you refer back to Audit Observation 120, and the cause for management's decision to perform an extensive corrective action, was reported in Item 4 of that audit observation. Item 4 identifies that the auditors in looking for design consistency between the calculations and the design drawings identified some discrepancies between the STRUDL model used in the analysis, the finite element analysis, and the actual configuration of the pipe supports, because in that concern management undertook an extensive program of going back to determine if any

of the discrepancies were of significance to the adequacy of the plant. That program has been ongoing for some time, and my understanding in talking to the people on the project is that they have not identified any discrepancies because of that, the inconsistencies that would have resulted in an unsafe plant.

Q They did identify, however, discrepancies or errors in the calculations that needed to be addressed in a re-evaluation program?

A (WITNESS MUSELER) I think it is important to address that particular question and to focus on this particular audit observation a little bit because this is one that we considered a significant concern when this came up.

Q Mr. Museler, you are back on 120?

A (WITNESS MUSELER) I am back on Audit 120, the one that kicked off the re-evaluation of the pipe supports in accordance with this concern, because as you can see, if you read Observation Number 4, the auditors identified that there was something amiss in the calculations they looked at. They found that the analyzed condition was off in this one particular case by a few inches, but there was a discrepancy between the analysis that was done and the actual design drawing of the plant.

That is the kind of thing that is significant, as opposed to the kinds of concerns that we have been discussing all along here. It was significant. It was brought not only to the attention of Stone and Webster's management. It was brought to the attention of our company, and our project engineer was involved in it, and in effect any questionable calculations that might have had this particular problem were the subject of review, which, as I recall, was almost all of them that had been done prior to a certain point in time.

They were all reviewed. The number of pipe supports that comes to mind is in the neighborhood of 1,800 pipe supports, and of those, we did identify a few, approximately on the order of 1 percent, that did require some minor modifications as a result of this problem, but minor or not, that is a significant concern to us, because it did affect the plant, whereas none of the other observations we have been discussing have had an effect on the plant.

Those modifications were minor, and I also asked when I looked into this whether or not they constituted a safety hazard to the plant. The design engineers who worked on that indicated that while we did have to modify a small number of pipe supports in order to have them meet their design margins, that in fact

they would not have failed even if we had not made these changes, but nevertheless, this is one that we considered significant, that we took, and I believe this program is largely done, but there may still be some small amount of cleanup work left where we went back and reviewed anything that could possibly have had an effect on the plant.

And I think that is indicative of how the engineering assurance program works relative to things that are really substantive from the standpoint of the safety of the plant. This was one where we did have concern, and as it turned out, we did have to make some minor modifications which would not have constituted a safety hazard, but nevertheless we did have to make some minor modifications to some pipe supports.

Q Mr. Museler, were you able to determine what the cause of the problem was? Was there a generic cause? Or what?

(Whereupon, the witnesses conferred.)

A (WITNESS EIFERT) The primary cause of the discrepancies as we have been able to establish were situations where in installing the pipe supports it was necessary to make some adjustments to the pipe support for installation. These adjustments are normally documented, required to be documented on engineering and

design coordination reports which were reviewed by the pipe support people and approved on the basis that they were acceptable within the bounds of the analysis.

This was a judgment process that is ongoing, and it is an acceptable process. The audit observation in this particular case reflected a concern of the auditors that the changes were beyond what could be accepted specifically by engineering judgment. The STRUDL analysis is a finite element. It is a very precise, if I can call it that -- I am not a STRUDL expert by any means -- process, and the auditor's judgment was that in some cases possibly re-analysis was warranted.

The company had extensive, or had extensive concern, and we went to a lot of effort to determine if the auditor's concern was valid, and then undertook the corrective action program as Bill described.

Q Mr. Museler, you indicated, I believe, that those supports or areas that needed actual modification were areas where the original design bases were not met. Is that correct?

(Whereupon, the witnesses conferred.)

A (WITNESS MUSELER) I believe what I indicated, Mr. Lanpher, is that the margin available, and I am sure you are familiar with the fact that all of the

engineering design has a built-in margin. It is not just designed to perform its function, but it is designed with various safety factors, depending on the components, and the ones that required modification did not have the required design margin. Therefore, they were redesigned and reworked so that they did have the appropriate design margin, but in no case did that margin decrease to anything close to having no margin available over and above what would be required from the safety standpoint, but it did require an upgrading of a small number of supports to achieve the required design margin.

I would like to point out again that of the 1,800 supports that we reviewed, even though more than that small number may have had a numerical discrepancy, of that 1,800, only a very small number, approximately 20, did require any upgrading, which is indicative of the margin and really the extra margin that is put into the design. So, even if a few inches were required to be either added or taken out of a support because of an installation geometry situation, that the inherent conservatism in the design had more than enough to accommodate that.

Q Mr. Museler, you indicated that about 20 out of the 1,800 supports needed rework, but you also

indicated that more than that number of calculations had problems. The implication was that in some cases you found a calculation error, but it didn't lead to a requirement for rework. Is that a fair summary?

(Whereupon, the witnesses conferred.)

A (WITNESS MUSELER) I believe what I am indicating is that there were cases where the engineer did make a judgment, and that judgment was borne out by the redoing of the calculation.

Let me back up a little and explain the process. As Mr. Eifert indicated, the reason for an actual as built condition being different from the as analyzed condition many times is due to the geometry or the interference with other components in the plant when we install a pipe support. So if we were to go to install a pipe support and find that in order to make it fit, we would have to change the dimension of one piece by so many inches, the engineer would look at that and decide whether or not in his judgment the particular change would fall within the design margin that was available.

In other words, he knows when he is making a change, he knows what the calculation of record was based on. He knows he is making a change to that calculation of record. He knows that that change will

either increase or decrease the margin available, and in his judgment, if it were to decrease the margin, his judgment, which was applied in these cases, was that it would not decrease the margin to something that was less than the required margin.

So, that happens in almost every case where we need to modify a pipe support to put it in the field. So I think the answer to your question properly -- I don't know how many fall into that category. We modify a large number of pipe supports to put them in, just because of again the geometry of the plant and the amount of equipment that is put in there, and these changes are all looked at by the engineers, so every time we modify a pipe support from its calculated design, an engineer has to either redo the calculations or make a judgment that the change is minor and will not affect the margins available.

So, that happens quite frequently, and I can't give you the number of pipe support modifications we have made, but it's large.

Q Where you modify the design in order to be able to implement the pipe support, is there a requirement that the engineer's judgment, if it be documented by a calculation or not?

(Whereupon, the witnesses conferred.)

A (WITNESS MUSELER) Excuse me. Could you repeat the question, Mr. Lanpher?

Q Let me rephrase it for you. When a modification needs to be made to a pipe support, is an engineer permitted to approve that modification based only upon his or her judgment or does that judgment have to be supported by a calculation or a revision to the earlier calculation?

A (WITNESS MUSELER) In the first case, the engineer's judgment is reviewed by his supervisor, and then either by the project engineer or by the project engineer's representative, so it is not a case of one man making that decision, but the basic answer to your question is, yes, engineering judgment is permitted to be used in certain instances and with the appropriate reviews involved.

What the particular audit observation that we are talking about here in Audit 120 indicates is that the engineering assurance division and later on the agreed to by the engineering division identified a situation where judgment should be backed up by calculation more than it had been in the past.

A (WITNESS EIFERT) Mr. Lanpher, I would like to also point out that we spent a considerable amount of time this weekend going over all the observations that

we discussed as well as other observations, and this is the only example of the situation where the auditors identified a difference between the analysis and designs in all of our calculation audits that we performed on Shoreham over the years.

This is a very important audit observation. We have gotten a flavor for the amount of effort that management has put into correcting it and evaluating the concern to assure that we do have a safe plant. This is the kind of situation that if there was a trend, I would be very concerned, and we haven't had a trend with respect to this type of design consistency.

It demonstrates, I think, to me, and I was responsible for the engineering assurance audit program for sure, it demonstrates to me that our audit program is effective in finding both the administrative control problems that we have spent many hours now on, discussing wtih respect to the ready traceability of inputs, but we also have a thorough audit program, as we discussed earlier, that looks at the correctness of the inputs used in calculations and the use of the calculation results.

It is on this basis, this kind of evidence, this confidence, that my people have thoroughly audited and that the technical adequacy of the work is what it

should be, that it is of high quality. That is consistent with what I have indicated before, the way the engineers do their job. They appropriately put their primary attention and emphasis on ensuring the technical adequacy of the work product, and secondary importance on the administrative.

I would like to point out one example to maybe counteract the situation in this audit where the auditors have identified that the STRUDL model didn't precisely agree with the support design. In Audit 23, we have an audit observation that indicated that -- you want to refer back to the specific audit observation. It is Audit Observation 030 in Audit 23.

(Pause.)

A (WITNESS EIFERT) In this audit observation, we indicate that interoffice correspondence had been referenced as a source of input data in some calculations without noting the issued engineering document from which the information was obtained, and spending time going back over the weekend we were able to go back and look specifically at some of these calculations to illustrate the difference between traceability and ready traceability. The situation on one of the calculations was that the calculation indicated that a pressure loss figure was from a vendor

document, that he had gotten information from another engineer, and the precise wording is, pressure loss from vendor via engineer. That is the words on the calculation.

The traceability is there. The engineer preparing it knew that it was from the vendor document, and others can trace back and identify the specific vendor document, and have traceability to the information. These are the types of administrative problems that we have discussed as I indicated for some hours during these proceedings, as contrasted with the technical problem that we identified by Audit 120, which we do consider very important, and have taken all the necessary action to ensure that that situation is corrected and we have a safe power plant.

I might also point out at this time that I went back and reviewed the procedures that were in effect. I know, Judge Morris, I described to you the criteria from today's procedure. If you go back to the procedures in effect in 1972 and 1973, the wording in the procedures does not require the precise identification such as document numbers and page numbering and that sort of requirement as I related from the current procedures.

The wording indicated that we wanted

traceability, that indicated that the engineer was responsible for providing reference to documents and so forth as necessary to provide traceability. I think that we see in a lot of the early audits and probably as a cause in the later audits after all procedures became more stringent, is that the engineers make judgments on when something is unique enough or unusual enough that they need to have a specific reference to it, and for those I expect they would and provide the traceability.

But for the documents that were actively in use on the project, vendor documents, when you need a pressure drop for an operating characteristic of a filter, for example, that is the place you go get that information. It is the only place to get it, and the engineers, any engineer in the power industry knows that that is the way to get the information.

In the early calculations, we see that they were making those judgments and the audits were reflecting, in some cases, at least, a difference of opinion between the auditors and the people preparing the calculation on what was sufficient, and not that there wasn't traceability, but that the detail wasn't there. It wasn't until the late seventies that we changed our procedures to provide the more specific criteria that I described in response to Judge Morris's

question.

I am not sure exactly what conclusions we can draw, but if we look at the number of audit observations on input identification problems, approximately two-thirds of them, as I recall, the numbers occur before Stone and Webster had the detailed criteria, and one-third after that.

The conclusion that I can draw from that is that once there was a standard practice in the company with respect to precisely what the company was requiring, there was less discussion or confusion, if you will, between the auditors and the engineers, and we are achieving the specificity that the company now requires in the EAP's. I continue to want to emphasize that I am confident in all the discussions I have had with the auditors this weekend and looking at calcs and looking at other correspondence between engineering assurance and the project that we haven't had a situation where we didn't or weren't able to establish that traceability.

Traceability may not have been ready traceability, but it was traceability.

JUDGE MORRIS: Gentlemen, I would like to understand your concept of margin a little better. I'm not an engineer, so let me try to express my understanding and you correct me where I start to go astray.

But if you design a pipe support that is designed to withstand certain loads or combinations of loads, these are expressed numerically?

WITNESS MUSELER: Yes, sir.

JUDGE MORRIS: And is the margin also expressed numerically?

WITNESS MUSELER: It's expressed or expressable numerically, but not in relationship to the required load. The required load is the input data and the margin would come in when one gets to, for instance, in any given member, the allowable stresses that will be incurred in that member from the load, from the design load.

So to accommodate -- a given member may have an allowable stress of one type of another by code of, let's say, 25,000 pounds per square inch. That may be its allowable load. Its ultimate capability, in other words where it might fail or yield, would be considerably higher than that.

For instance, if the allowable were 25,000

perhaps the yield would be 40,000. So the concept of margin is the concept of the numerical difference between the allowable load, which is what the code says, the allowable stress, which is what the code says you design the object to, against when the particular component would really have a problem, would really go into some mode other than a normal mode, either a yield mode or, even further than that, into a failure mode.

So the margin is there. It can be back-calculated into how much of a margin that would mean with respect to the design load. The design loads also are generally conservative, but the margin I was speaking of is relative to the allowable stresses.

JUDGE MORRIS: You used the expression, I believe, "required margin." Is that different? Is there a difference between allowable and design required margin?

WITNESS MUSELER: Yes, sir. In general that's what I was referring to. The code requires, depending on which structural code, or the piping code, requires you to use an allowable number which is some factor higher than the actual required number to support the particular load that we're talking about.

So the answer to your question is yes, the required margin is the difference between the allowable

design condition and the condition at which one might expect to have some type of a problem.

JUDGE MORRIS: And the problem you apparently ran into with some 20-odd supports was, because of field modifications of the design that margin was decreased; is that correct?

(Panel of witnesses conferring.)

WITNESS MUSELER: That's correct, sir.

JUDGE MORRIS: And so design modifications were made to achieve the required margin for those cases?

WITNESS MUSELER: Yes, sir, design modifications and field modifications were made to achieve those margins.

JUDGE MORRIS: But for the balance, which would be nearly 1800, you mentioned that there were some where the margin was decreased, but not to the point where in the engineer's judgment modification needed to be made; is that correct?

WITNESS MUSELER: That's true. That's what the engineer's judgment said, that the modifications didn't need to be made. And that was confirmed by the calculational program that was done as a result of this audit observation.

In other words, the engineer had made that

judgment that there was sufficient margin available to accommodate the dimensional change we made in the field, and the program embarked upon as a result of this audit observation confirmed that by redoing the calculations in those cases.

JUDGE MORRIS: Recalculating the stress for the actual configuration?

WITNESS MUSELER: Yes, sir.

JUDGE MORRIS: What was the criterion on which you decided that it was okay?

WITNESS MUSELER: I believe the calculations were redone on all of them and the acceptance criteria was that it had to meet the allowable stresses. The pipe supports, because the components of pipe supports, for one reason only, are discrete sizes and many of our pipe supports are designed utilizing -- if you have a specific size strut, piece of steel beam, you only have discrete sizes to choose from, and when you design it you always choose the more conservative size.

Therefore, some of the supports, a large number of them in fact, have an inherent margin over and above the margin that we just discussed, caused simply by the fact that the components are always chosen conservatively. And we may have had, if the allowable were again, say, 25,000 pounds per square inch, we may

have had and did have many instances where the support, when one analyzed it, which they had done, the first time had a stress of only 5,000 or 10,000 pounds per square inch.

So even before you start to get into what we have discussed as the required design margin, there's a margin over and above that in almost all of them, just because of the nature of the design process and the fact that the components and the sizes and the configurations were chosen conservatively in the first place.

It should never be inferred that all of the pipe supports are in fact, or most any component in the plant, is designed right on the allowable requirements. It's designed either on the allowable or better, because of the nature of the process and the nature of the way the engineers do their work.

JUDGE MORRIS: Did I understand that your program of recalculation is not wholly complete at this time?

(Panel of witnesses conferring.)

WITNESS MUSELER: That's correct, sir. We believe that there is still some small amount of work remaining. We can get you the exact status.

JUDGE MORRIS: I'm not interested in precision.

WITNESS MUSELER: It is essentially complete, but there may be a few that have just not gone through the process yet.

JUDGE MORRIS: Then is it your conclusion for those supports that have been recalculated that they all meet the concept of required margin and that they can take the allowable loads?

WITNESS MUSELER: There's no question about that, sir, after the program that we have gone through, that all of those supports do meet the required margins. They meet their allowable stresses, and in fact, as I discussed, a large number of them are substantially more conservative than that.

JUDGE MORRIS: So that in effect the design margin is there or better; is that correct?

WITNESS MUSELER: That's exactly correct, sir.

JUDGE MORRIS: Thank you.

JUDGE CARPENTER: I'd like to ask a couple of questions to try to understand a little better. What is -- going back to 120, what is the STRUDL model? Can you give me just a brief word picture of what it is we're talking about here for the last hour?

(Panel of witnesses conferring.)

WITNESS MUSELER: Judge Carpenter, it's been

over ten years since I performed any finite element analysis, but to the best of my knowledge the STRUDL model is what is termed a finite element analysis. What they do is, they conceptualize the support configuration with member sizing. So if it's going to be an angle, a piece of angle steel as one of the members, for example, they model that so that it can be used as input to a calculation.

So they use that one piece of steel as an element of the model, and that then, the configuration of that one member in relation to the other members that make up a support is mathematically modeled for configuration. That information, plus the material properties of the various members, are input to the computer program and the computer then, using finite element techniques which I can't explain in detail, analyzes that support configuration, with the computer output being the stresses in the pipe support, in the various members of that support.

JUDGE CARPENTER: The thing I was curious about was, when was the STRUDL model or the STRUDL pipe calculations first applied to the Shoreham design? Looking at 120, paragraph 4, you see the drawings existed while the STRUDL model calculations were being made, and I'm trying to understand that, whether the

design had been developed using something else and then STRUDL was laid on top of that, and now we are trying to look at the agreement between the two or not.

JUDGE MORRIS: If I might interject, what is a BZ drawing?

WITNESS MUSELER: I think we need a moment. But the question, what is a BZ drawing, a BZ drawing is strictly -- it's nothing more than a detailed design drawing of the pipe support itself. It shows the members, the base plate, the structural members, and shows where the pipe goes relative to the pipe support.

I think we need a moment to confer.

JUDGE BRENNER: I'm sorry, I still don't understand everything. I thought you were going to tell me about BZ in the context of the question. Is it the original configuration or still pre-built drawing?

WITNESS MUSELER: I'm afraid I'm not going to help you much, because it can be both. It's the original design drawing. It becomes an as-built at the end of the job. And in fact, the stress reconciliation program that we have spoken about several times already does utilize the fi l as-built BZ either as a total new drawing or as the last revision with any applicable E&DCR's.

So the term is used to denote a pipe support

drawing. Its particular vintage, either before installation or as-built after installation, depends on when you are looking at it.

JUDGE BRENNER: I inferred from this audit observation 4A in audit 120 that the problem here is that this was an as-built condition, so that this BZ drawing was as-built. But maybe that's wrong.

WITNESS MUSELER: That is generally a correct assumption, sir. It does reflect the as-built condition. There is a program to reverify that again as part of the stress reconciliation program, and that had not been done at this particular point in time. But I believe for purposes of the discussion we're having here it does present an as-built condition.

(Panel of witnesses conferring.)

WITNESS EIFERT: Judge Carpenter, the impression that I believe you received from our discussions, that the practice possibly is to draw up a support and build it and then do the analysis to support that at a later date, is incorrect. The practice is to design a pipe support that includes the effort of developing what the configuration would be and doing an analysis.

In this case we are discussing the STRUDL analysis as a mechanism of ensuring that it is an

adequate configuration and adequate materials in that configuration. The normal practice would be that there would probably be more than one STRUDL analysis performed as a basis of adjusting that configuration to ensure that we wouldn't have any stresses in any members beyond the allowables.

That process is ongoing and the BZ is developed as a part of or as a result of that process, and those drawings are then approved, together with the analysis that is also approved as the normal practice prior to any release for construction of the pipe supports. What we are seeing here primarily, as I was able to establish in discussing with a lot of people, that this situation relates to changes that occurred after that process was completed and the judgments being made with respect to the need to update or revise the analysis for these changes to the support configurations.

JUDGE CARPENTER: I guess what was giving me that feeling, you see, item 4 starts out, "The STRUDL model." And do I understand you correctly, you just testified that actually the STRUDL type calculations may be made several times for any particular support? If something was designed originally in, say, 1972, would it have had the STRUDL-type calculation made at that

time?

(Panel of witnesses conferring.)

WITNESS EIFERT: I believe the answer to that is yes, but I'm not really sure when the computer program STRUDL was first used and I would rather check that to give you a specific answer. I'm not sure if I understand your concern, and maybe I can restate the answer I gave you.

An analysis is performed and the support design drawing, the BZ, is prepared based on that analysis prior to the construction. The reference here to the STRUDL models would have been reference to the model of record in the analysis.

I may have confused you with some reference to the fact that in performing the pipe support analysis, the pipe support designers and the engineers may perform more than one finite element analysis using STRUDL, making adjustments in the configuration to get a configuration that is an acceptable design within allowable stresses.

WITNESS MUSELER: Judge Carpenter, I believe, if I can interpret your question, that you are concerned as to whether or not we issue the design drawings to the field prior to the completion of whatever analysis or calculations are required to verify that design. And if

that is the question, the answer to it is that the general procedure, with few exceptions, is that we do do the analysis and the calculations prior to the issue of that design to the field.

Where we change the design, either because of field condition or some other reason, as we go along, the proposed change to the design may exist prior to the confirmatory calculations, but the confirmatory calculations, except in the case of engineering judgment, as we have been discussing, is in fact done to confirm that change.

So the general thrust of your question I thought was, do we do the calculations prior to the issue of the designs to the field, and the answer to that question is that generally that is the way we do business.

JUDGE CARPENTER: Well, what I was really trying to get a feel for is why in October-November of 1980, as you all testified to, this matter which you felt was the basis for serious review of all the calculations suddenly appeared. I was trying to get a feel for whether STRUDL was a new technique or something.

I think, if I understand you correctly, that's not so at all. So I was trying to find what was

happening in this time period to the design process that led to this audit finding. I still don't quite see what happened.

(Board conferring.)

WITNESS MUSELER: The audit observation is not directly related to whether the analysis was a STRUDL analysis or another kind of -- or a hand calculation. It was the analysis that was used for these pipe supports when they were originally done. The answer to the question, why did it occur at this point in time, goes back to the discussion we had relative to the installation of the pipe supports requiring changes to the original design as a result of geometry or interferences or whatever, and those judgments, that the E&DCR's are generated to document those changes.

Let me say also that someone may have gotten the impression all of the changes to the pipe supports are made on the basis of engineering judgment, and what we have done is found at a certain point where we have said we had to back that up with calculations. Many of the changes to the pipe supports require calculations right at that point in time, and they are done, the calculations are done, before any change to the pipe support is authorized.

These are the ones where the changes to the

pipe supports were relatively minor, small dimensional changes generally or what I will characterize as minor changes in configuration. And it is those changes that resulted in this particular situation where the engineer made the judgment that those changes would not result in any degradation of the design margins, and the audit and subsequently the engineering department observed that that judgment may need to be backed up by further calculations.

And when we did that we found, in the few cases we have spoken about, that in fact we did have to make some minor changes to get to the design margins.

But your question goes to why did it occur at this point in time. This point in time was a time when we were installing the bulk of the pipe supports in the plant. We had the largest number of changes to the pipe supports because we were putting in the largest number of pipe supports at that point in time.

There's nothing inherent in the STRUDL model that has anything to do with this, to my knowledge.

JUDGE CARPENTER: Well, looking again at Item 4 of Report Number 120, 4-B, it references two different lengths, one in the BZ drawing and one in the STRUDL model. I was trying to get a feel. There are no dates given for either one of those, you see, so I can't get any feeling for the chronology of how the discrepancy developed.

WITNESS MUSELER: The chronology would have been that the STRUDL model, the calculation was done for the original design. That was done first. The original design was issued to the field. When we went to install it, or for whatever reason, we needed to make some modification to that design, in this case a change in length of, it looks like a little over 24 or 26, a little over six inches in one of the numbers.

Now, that occurred at a later point in time than the original calculation, and that is what the auditor observed. He said, the actual condition that you are building it to is six inches different than what the calculation was done to. So, the change, the required change came after the original STRUDL model, and the question is, does that six inches make a significant difference, and again, that is what triggered the re-evaluation of all of them. Did six inches make a difference here, did nine inches make a

difference here, did two inches make a difference somewhere else.

The net result of all of that was that in a small number of cases it did make a difference to achieve the required design margins. It would not make a difference with regard to the ability of the pipe supports to perform their function, but still, the program requires that the design margin be maintained, and that is what was done as a result of this program.

Does that help your question, sir?

JUDGE CARPENTER: Yes. It clarifies my understanding that this is more a comparison with -- if it wasn't an as built drawing, it certainly was the drawing which was applicable at that time for all practical purposes. The as built drawing did not conform to the STRUDL model calculation for that particular number shown on that drawing.

What further surprises me is that in 14 months after this audit report, the next audit, Audit Number 38 that we have been talking about, the auditors report some progress, and it would have been nice if they had used a number there, 10 percent or 50 percent or something. Usually when someone says some progress, the progress is not major, for sure.

I am surprised that in 14 months of people

busily installing supports there wasn't a feel for a need. I understand your testimony about there probably being margins. You are confident that this wasn't going to be a major modification. But I am still surprised at the slowness.

WITNESS EIFERT: I think I can explain some of the situations and activities that were in progress during that time period. As a result of this audit observation, the project engineering group, together with some staff pipe support specialists from our engineering mechanics division spent a considerable amount of effort looking at the pipe support design activities being conducted for the Shoreham project for the primary purpose of determining the extent of the conditions identified in the observations and their significance, in order to give management a full basis for making a decision with respect to the corrective action.

In addition, during the same time period, the project was developing the final plans for the as built piping program, and there was a need to coordinate those two activities and coordinate the activities primarily to assure that we didn't duplicate activities. Specifically, if a new stress run for a given piping system indicates that loads have changed, there would be

a need for the engineers to go back, possibly a need to redo the STRUDL analysis for the supports for that system. Knowing that that was an activity that was being planned in the near future from the time of the audit observation 120, there was effort being made to coordinate those activities.

During that time period, the engineering mechanics division took considerable action with respect to the preventive action, established some additional training. As I indicated earlier, training not only with respect to the STRUDL, but all aspects of calc preparation to assure that people understand the requirement as well as -- and the basis of the requirement as well as the requirement itself.

There was a lot of activity going on. This was a significant problem when it was initially identified. This was of great concern to Stone and Webster management and LILCO management, to ensure that we went slow enough in effect to ensure that we did and took all the appropriate action to ensure that we had a safe plant.

I think that's what the timing demonstrates to some degree.

JUDGE CARPENTER: Well, wouldn't you agree that slow enough needs to be viewed in the perspective

of level of effort going on? Failure to meet the Phase 1 due date of July 31, 1981, as shown in Audit Number 38, Phase 1, was almost six months overdue. And the auditor comments, some progress. Certainly it would be reasonable to talk about being properly deliberate, but I don't read this that that's the way the auditor felt at all. He is saying there has only been some progress, and these due dates, the Phase 1 has gone by and the entire corrective action is supposed to be finished in another six months.

(Whereupon, the witnesses conferred.)

WITNESS EIFERT: I wasn't trying to characterize the audit observation 142, which we did issue late in 1981. I was giving some background with respect to the process that was ongoing that is the cause for the delay. The audit observation was issued, Audit Observation 142 was issued because the auditors, in this case, my people, thought that there was undue delay from the time that the joint project and division staff group had reviewed a considerably enlarged number of analyses and support designs. Then there was a delay from the time they had completed that activity, which I believe was at the end of the summer of 1981, until the time where a firm corrective action plan had been established, and significant progress being made.

And that is why we issued Audit Observation 142, to bring management's attention to that. It is an unusual situation to have an audit observation like 142 because management at Stone and Webster was fully aware of the problem and had authorized the project and extended the amount of time to complete this action. When Audit Observation 142 was issued, the project still had additional time to complete the combined effort of Phase 1 and 2, but had not yet completed the Phase 1 effort, and the audit observation reflects that concern of the auditor that the Phase 1 effort hadn't been clearly completed with the detailed action plan for the Phase 2 effort established.

WITNESS MUSELER: I might add, Judge Carpenter, that in something of substance such as this type of a problem, the first thing that the engineering department would do would be to look at the entire problem and try to establish very quickly whether or not it represented a significant problem or whether or not it represented a problem that, while it existed, was something that was minor in nature and under control.

I think in this particular case, at this point in time, which was the end of last year, we had already established quite confidently that the problem, while there were cases where we recognized we had to make some

modifications, that the problem was bounded, was properly characterized as a minor problem with respect to the plant itself, and that the problem was also under control as a result of the program from the audit findings, and the type of instruction given to some of the designers that Mr. Eifert referred to.

So, it's true that it was not accomplished on the schedule originally set. However, there was a judgment made with regard to the resources applied to closing out that problem, but at the time that judgment was made, it had already been established that the problem did not represent anything that we had concern of with respect to the plant. We recognized that we probably were going to modify a few pipe supports, but we had also done enough work to know that the number would be very few, and that the impact of even those would be negligible.

JUDGE CARPENTER: One final question. Was the NRC advised of this at the time that the need for remedial action was identified?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: No, sir. This particular matter was not reported to the NRC.

JUDGE CARPENTER: I ask that only from the point of view of whether I can get another opinion about

this as the hearing proceeds. You are telling me that there really isn't anybody at NRC who has been on top of this.

WITNESS MUSELER: No, sir. We didn't notify the NRC because it was our judgment that the condition did not represent something that affected the safety of the plant.

JUDGE CARPENTER: Thank you.

JUDGE BRENNER: I may have some thoughts on this matter, too, in the form of questions, Mr. Lanpher, but I am not going to jump in now. One reason is, I don't think you were finished necessarily with this matter, and I am not sure how far you are going to take it in relation to other matters. So my silence now shouldn't be taken to say that I may not come back to this one myself.

MR. LANPHER: In my organization, I was going to come back to this originally. I think I am going to try to finish this up now myself.

BY MR. LANPHER: (Resuming)

Q To follow up first, gentlemen, on Judge Carpenter's last line of questions, regarding the timing of the corrective action, now, this was originally identified in 1980, and we have been -- in the fall of 1980, I guess, and we have been focusing on Audit

Observation 142 in Audit 38, and that audit report was issued in December of 1981.

I would now like to turn your attention to Audit 39, Engineering Assurance Audit 39, Page 2 of it. And the longest paragraph on that page, I believe, concerns this same matter. It states that "The responses to audit observations have not been kindly. Of particular concern is the corrective and preventive action on Audit Observation 120 for pipe support design calculations."

If you could review that and also review Attachment 2, which about halfway down the page states that the stop work order was being prepared.

(Pause.)

Q Mr. Eifert, have you had a chance to review those portions?

A (WITNESS EIFERT) Yes, I have.

Q This indicates, does it not, the continued judgment of the auditor approximately two months after the previous audit was issued that still adequate corrective and preventive action had not been taken, correct? Or timely corrective and preventive action had not been taken?

A (WITNESS EIFERT) The information in Audit 39 related to Audit Observation 142, and is tied directly

to Stone and Webster's strict policy for the timeliness of response and completion of corrective action on all engineering assurance audit obervations. Our practice and rule is that all audit -- all action necessary to correct and prevent concerns identified in audit findings must be taken within 60 days of the date of the audit report unless the organization responsible has otherwise obtained engineering management's approval for an extended period of time.

The audit report which issued Audit Observation 142 is dated December 22nd, 1981. The audit report for Audit 39 is issued just about 60 days after that, on February 24th, 1982. This was a report on status, and is an automatic processing and reporting and doing the engineering assurance followup for all audits.

Q Well, Mr. Eifert, an extension had in fact been granted beyond February, 1982, correct? I will refer you --

A (WITNESS EIFERT) Not for Audit Observation 142. Yes, it had been extended until May, the end of May, 19 -- let me confirm that for a second.

Q I am not trying to trick you, sir. You might want to --

A (WITNESS EIFERT) Audit Observation 120 had

been extended. They didn't have to have that completed until May of '82, I believe. We are talking here of Audit Observation 142.

Q Aren't they inextricably intertwined, sir?

A (WITNESS EIFERT) It is confusing in the fact that we chose to issue Audit Observation 142 to provide for the additional detail of the Phase 2 effort. Audit Observation 142 was primarily to assure that we got a definition of the Phase 2 effort, and it was issued for that purpose, and Audit Observation 142 today is closed because they established the plan for the Phase 2 effort and are carrying it out. 142 is today closed. It is 120 that they have the extension approval to complete the total corrective action, and that is the observation which is tracking this concern.

Q Was a stop work order in fact issued?

A (WITNESS EIFERT) Yes, it was.

Q How was that finally resolved, or is it still in effect?

A (WITNESS EIFERT) The stop work order was issued and the project immediately submitted the final plan for the Phase 2 effort to engineering management. It was accepted, and the stop work order was lifted, or withdrawn.

Q Mr. Eifert, you have talked about Phase 1 and Phase 2. I am not sure we have really defined what was contained in each of those phases. Could you briefly do that?

A (WITNESS EIFERT) Phase 1 involved the efforts that the project and the engineering mechanics division staff personnel undertook to fully explore and understand the extent of the conditions reported in Audit Observation 124.

Q 120?

A (WITNESS EIFERT) 120. Excuse me. And the importance of those observations to obtain the information management would need to determine and decide on a corrective action program. I agree that the auditors, and it was my responsibility, I agree that in my judgment the progress was not being made at a pace that I felt it should be. On the other hand, recognizing the situation that the project was in, project engineering, in evaluating this, this was a significant amount of effort that would be undertaken if a decision was made to go back and review the number of calculations that we are talking about.

It's a decision that you want to assure is the right decision. In some things that we do, all of us in our daily lives, there are certain things that you know

you should go slow on to make sure you do the right decision, make the right decision. We can have disagreement between engineering assurance division and the project engineering people on that kind of progress, but in no case was there really any doubt that eventually a decision would be made and corrective action would be carried out.

This was unusual, as I indicated. This was, to the best of my ability to go through all the audit observations, this is the only one where we found an inconsistency in a calculation and the design. This is a very important situation, and appropriately was given careful consideration and evaluation with the ultimate decision to review these pipe supports to assure that we had a safe plant.

So, I think what you are seeing here is that we took time to make that decision. It was captured in the program. It wasn't a lost decision that nobody realized had to be made. We are seeing here in the documentation the difference of opinion between my people and myself and the project people with respect to how fast the decision was being made, but it was made, and the corrective action program has been implemented.

Q Mr. Eifert, you forgot the second half of my question. What is Phase 2?

A (WITNESS EIFERT) Phase 2 was implementing the corrective action plan that was decided upon and agreed to by the project engineering mechanics division staff and engineering management as a result of the product of Phase 1.

Q Defining that corrective action plan was the subject of Audit Observation 142, correct?

A (WITNESS EIFERT) Yes, sir.

Q So that plan was finally defined only after the stop work order was issued earlier this year. Is that correct? I mean, you have been working on it, but in terms of adopting a corrective action plan.

(Whereupon, the witnesses conferred.)

A (WITNESS EIFERT) Mr. Lanpher, the Audit Observation 142 and the associated stop work order did not in itself create or force, if you will, the establishment of the corrective action plan. Prior to the issuance of the stop work order, I was personally involved in some of the management discussions with respect to the observation and the need for the Phase 2 plan.

I have personal knowledge that engineering management was aware of the need to develop this plan. I know that there were meetings between engineering management and the engineering mechanics division and

project personnel discussing this situation, so that is an ongoing process. The decision was going to be made without question from my involvement in that process.

The stop work order, the way we define it in our program, is a mandatory step that is based on an arbitrary schedule of 60 days for the projects to complete action in respect to findings of an audit observation. It is there quite arbitrarily with the primary purpose being to assure that management gets involved with the corrective action plans for items which are going to take more than 60 days to respond.

Q Mr. Eifert, I just want to be clear on the record, however, that the time that the Phase 2 corrective action plan was adopted and implemented was some time after issuance of Audit 39, earlier this year. Is that correct?

A (WITNESS EIFERT) That is correct.

JUDGE BRENNER: Why don't you break up your question? You said adopted and implemented. Why don't you stay with just adopted?

BY MR. LANPHER: (Resuming)

Q With that modification, it was adopted some time after Engineering Assurance Audit Number 39 was issued, which would mean after February 24, 1982.

A (WITNESS EIFERT) Yes. A Phase 2 plan was

developed and approved by engineering management after February 24th, 1982.

Q Do you know when after that date?

(Whereupon, the witnesses conferred.)

Q Mr. Eifert, I am not looking for an exact date. Was it March? Was it July? Along those lines?

A (WITNESS EIFERT) I believe it was in April, but I don't recall specifically.

A (WITNESS MUSELER) Mr. Lanpher, my recollection on that matter is that it was prior to April 15th, and it may have been at the end of March. It is that time frame. I am certain of the time frame. I am not certain of the exact date.

Q Is that corrective action plan addressed in your testimony, gentlemen, in your prefiled testimony?

(Whereupon, the witnesses conferred.)

A (WITNESS EIFERT) We did describe in our testimony the stop work activity with respect to Engineering Assurance Audits.

Q I am talking about are the details or a description of that corrective action plan, is that addressed?

A (WITNESS EIFERT) No, we do not describe that in our prefiled testimony.

Q Is there any document that describes this

corrective action plan? Is it a formal issuance?

A (WITNESS EIFERT) The corrective action plan was described on an interoffice memorandum from the project to engineering management, describing the plan and requesting their approval of that plan and milestones in schedule.

Q That interoffice memorandum was adopted by the engineering department?

A (WITNESS EIFERT) Yes, it was.

A (WITNESS MUSELER) The engineering department prepared that plan, Mr. Lanpher, and it was approved by engineering management within Stone and Webster and accepted by the engineering assurance program, so it was developed by the engineering department, which was satisfactory with their management as well as to the engineering assurance department.

I should note that that plan and the one Mr. Eifert has been referring to as Phase 2 was the final confirmatory process to clear this matter up. The evaluations that we have been speaking of earlier, and that plan, by the way, Phase 2, is what I referenced earlier when I mentioned that we are essentially complete with that, and that is the basis for the numbers that we used before, but the early part of that, the evaluation, was ongoing from the time that there was

Audit Observation 120.

So, the evaluation of the problem to assure that it was a controlled situation and that the problem was bounded had been begun long before the final adoption of the Phase 2 corrective action plan.

MR. LANPHER: For the benefit of the board, I am going to return to the corrective action plan, but there were some followup questions I had on earlier aspects that I think will relate to the corrective action plan, so I will go back to that, unless the board has a particular question they want to ask at this time.

JUDGE BRENNER: You are still on this item? I want to break for lunch, but I want to let you finish this item.

MR. LANPHER: Yes, I am still on this item.

JUDGE BRENNER: Do you think you will finish shortly, or should we break now?

MR. LANPHER: I had no idea I was going to be on this item this long.

JUDGE BRENNER: You weren't by yourself.

MR. LANPHER: I hesitate to make a prediction, Judge Brenner, as to how long.

JUDGE BRENNER: All right. Why don't you go for about ten more minutes, and we will break.

BY MR. LANPHER: (Resuming)

Q Mr. Museler, I think probably half an hour or so ago, you mentioned, I guess it was in connection with what we call the Phase 1 efforts, that you or Stone and Webster, someone initially made a determination of which were the questionable calculations. I think questionable was the word you used. And I understand that that was about 1,800 calculations. Is that correct?

A (WITNESS MUSELER) No, sir. We are looking at two phases of the situation. The 1,800 number that I referred to was in connection with the final closeout of the entire item. That was the number that needed to be looked at as a result of this item. I will characterize it as the final Phase 2 evaluation. What I had referred to earlier is that the engineering mechanics division and the pipe support design people at Stone and Webster in Boston surveyed the population of the calculations. That is not to say that they evaluated each one specifically. That was the final confirmatory process. They were able to determine with some ease those that are more significant than others.

For instance, if in a particular type of support the judgment may have been made on the basis of a 12-inch change, another one may have been made on the

basis of a one-inch change, and if both those situations are similar geometrically, you obviously look at the one where you change something 12 inches, and the one where you changed it one inch you would not look at. And if the one that turned out to be a 12-inch change turned out to be okay, you would make the assumption that anything between one and 12, since it has the same effect, would not cause a problem.

So, it is in that context that I mentioned the engineers involved conducted a review of the situation.

Q Is it fair to state, then, that there were approximately 1,800 calculations where changes had been made presumably in the field and had been made on the basis of judgment, and your later survey determined that those judgmental decisions should be supported by revised calculations?

(Whereupon, the witnesses conferred.)

A (WITNESS MUSELER) The 1,800 number is the number that I was given as requiring evaluation, as requiring the calculations to be redone to ensure that they did in fact meet the required design margin. I have been using one example, which is a very common example of what would cause that. I don't mean to imply that there may not have been some other situations that required the same calculation to be redone, so I can

characterize them all as due to field changes. A large number of them were, but I wouldn't want to give you the impression that they were all due to the same exact situation.

Q I understand that, and I shouldn't have focused on field changes so much as changes at whatever stage which were made, but -- and which were made on the basis of engineering judgment at the time, and your subsequent review, or Stone and Webster's subsequent review determined that an analysis or a calculation should be performed to document that the exercise of that engineering judgment was correct.

(Whereupon, the witnesses conferred.)

A (WITNESS MUSELER) That is basically correct.

Q Now, these were all in the pipe support area or the pipe support calculation area? Is that correct?

A (WITNESS EIFERT) Yes, that's correct.

Q Did you perform a survey of calculation changes made in other areas to determine whether this problem existed there?

(Whereupon, the witnesses conferred.)

JUDGE BRENNER: Mr. Lanpher, I guess I don't know what you mean by other areas.

MR. LANPHER: For instance, structural calculations or changes made to other calculation

areas. We have been talking about different disciplines and activities in the calculation area, and apparently these 1,800 or approximately 1,800 all related to pipe support calculations. I am wondering whether their review tried to determine whether there were problems with judgment in other areas, or unsupported judgment.

(Whereupon, the witnesses conferred.)

WITNESS EIFERT: As I indicated earlier, Mr. Lanpher, our audits in disciplines look for consistency between the results of the analysis and the design. We audit that as a regular practice. The normal practice in all of our audits. This is the only discipline to my knowledge that we have identified this discrepancy via the engineering assurance audits. The corrective action is appropriately taken with respect to this area of work from the engineering assurance program's viewpoint, because it is limited and isolated in this discipline.

Audits in other disciplines have not found discrepancies, inconsistencies, if you will, between the results and conclusions of analyses and the design as originally released or as changed, and it is our practice to look for that in engineering assurance audits.

BY MR. LANPHER: (Resuming)

Q So, because your engineering assurance audits

had not identified this same kind of problem with respect to calculations in other disciplines, you have not made any specific analysis in connection with this problem of different disciplines?

MR. ELLIS: I still have a problem, Judge, with the same kind of problem. It is not clear to me that it translates all over the place one to another, from one discipline to another. And the question implies that without there being any testimony to that effect.

JUDGE BRENNER: I think the same kind of problem, I will state with some trepidation, fairly clearly, and Mr. Lanpher can tell me if I am wrong, after saying fairly clearly, relates to the situation where the dimensions of items in the plant, either as installed or as a result of changes in design in advance of being installed, are not different than the assumed dimensions in the calculations presently in effect as far as the engineering organization is concerned. Is that it, Mr. Lanpher?

MR. LANPHER: I wouldn't have limited it just to dimensions or calculations -- dimensions in the plant. So maybe I should ask --

JUDGE BRENNER: In that case, Mr. Ellis's point is a good one.

MR. LANPHER: Let me ask some further questions on this then.

BY MR. LANPHER: (Resuming)

Q Mr. Eifert, the pipe support area is not the only area where field changes to design might have to be effected, correct?

A (WITNESS EIFERT) No, it is not the only area.

Q Could you tell us some of the other areas where E&DCR's, for instance, might have to be issued because there is an obstruction or a need to change the design when you get to installation?

(Whereupon, the witnesses conferred.)

A (WITNESS MUSELER) Mr. Lanpher, another example of that might be the electrical cable installation in the plant, where for various reasons, either a cable size or even in some cases the length of the cable because of routing might be different than the original design called for for various reasons, but that's an example of where the conditions in the plant in the final as built configuration might be different than what was originally called for. And it is also an example of where the normal process of how the engineers do business requires that that information be fed back and any significant or any calculations that use those

parameters, the size of the cable certainly, the length of the cable, would be fed back in, and if in the analysis that is appropriate to that particular installation, for instance, if it were a certain size cable hooked to a motor, the voltage drop in the current carrying characteristics, if they were affected by the physical parameters in the plant, the size and length of the cable, that analysis would also have to be re-evaluated in that light.

So, it is a somewhat analogous situation to the pipe supports we have been discussing.

Q In that example that you gave in the electrical area, are there certain instances where the need for a change in the field might be identified and the engineer in the field would make a judgment that the calculation -- that the change didn't affect the original calculation? Is that one of the possible occurrences that might take place?

A (WITNESS MUSELER) That might take place, that the engineer would make the judgment, have that judgment reviewed, and it might be issued and the field modification made. In that case, again, the types of parameters we are speaking of, if it were the characteristics of the motor, would have to be re-evaluated unless the change were extreme, you know,

again, a matter of engineering judgment.

We have not seen in the case of the electrical area where we have found a condition analogous to the particular pipe support condition we have been discussing where those judgments did require a look back at large numbers of calculations.

Q You said that you have not seen, and I am not going to try to paraphrase you exactly, but you basically say you have not seen instances of the same kind of problem in the electrical area. I assume you mean since identification of this problem in the pipe support calculation area.

(Whereupon, the witnesses conferred.)

A (WITNESS EIFERT) Mr. Lanpher, I have indicated earlier that our audit program includes audit checks in our audits of calculations to ensure that the analysis is consistent with the design. That is an attribute that we have been auditing to for some time, not just since the fall of 1980, when we reported the concerns with the pipe supports. It is in that light that we are indicating that we have not found problems of the nature of what we have identified with respect to pipe supports in the other disciplines.

I am confident that if those problems existed, that we would have identified those in the other

disciplines, reported those, and ensured corrective action, but we have not identified problems of this nature in other disciplines, and I am confident that this is a situation that is limited to the particular complexities, if you will, of the pipe support design and installation process.

A (WITNESS MUSELER) Mr. Lanpher, in the particular area of the electrical installation which we were discussing, the major electrical tests which verify those calculations and in fact confirm whatever judgments were made were completed over the last six months, and those particular preoperational tests do verify by measurement the particular voltage drops and the various other electrical characteristics that are the output of the design process, and those tests have indicated that the design and the judgments were correct, so the entire program, if you will, I can say is being verified once again through a test program, and in the electrical area where both the AC and DC systems have gone through their major tests, all of those judgments that affect the kinds of things we have been discussing here have in fact been verified once again through actual tests.

Q Gentlemen, attachment 27 to your prefiled testimony is site engineering organization audit number 12. I understand it is the entire audit package. I think that's the way you described the attachment. On pages numbered 702 in the top right-hand corner -- it's probably the last 15 or 18 pages of that attachment -- is the audit plan for Shoreham site engineering office structural design calculations.

A (WITNESS MUSELER) Mr. Lanpher, can you give us that citation again?

Q This is attachment 27 to your prefiled testimony. My understanding is that this includes not just the audit report, but all the checklists and the responses. I want to go to the checklists for structural design calculations, and I think those are all on pages with the number 702 in the upper right-hand corner. It's toward the end of that attachment.

MR. ELLIS: Judge Brenner, if this is going to be a long examination, this might be an appropriate time to break. We didn't bring in our attachment 27. We brought in some other material.

JUDGE BRENNER: Okay. We have run past when we normally break for lunch. If it won't disrupt you too much, Mr. Lanpher, to break now, let's break for an hour and we'll come back at --

MR. LANPHER: Could I ask that we maybe take just a little longer than an hour? By the time you get food and also call the office and try to, being the one doing the cross-examining, to gather thoughts -- a little more time would be very much appreciated.

JUDGE BRENNER: Do you want an hour and 15?

MR. LANPHER: That would be great.

JUDGE BRENNER: Well, let's round it off and make it 2:00 o'clock.

MR. LANPHER: Thank you very much.

(Whereupon, at 12:40 p.m., the hearing in the above-entitled matter was recessed, to resume at 2:00 p.m. the same day.)

AFTERNOON SESSION

(2:00 p.m.)

JUDGE BRENNER: Mr. Lanpher, we're going to have you continue your cross-examination. You tell us when you are finished with matters related to what started as audit report 34, and then we are going to jump in with some things.

MR. LANPHER: Okay.

Whereupon,

T. TRACY ARRINGTON,
FREDERICK B. BALDWIN,
ROBERT G. BURNS,
WILLIAM M. EIFERT,
T. FRANK GERECKE,
JOSEPH M. KELLY,
DONALD G. LONG, and
WILLIAM J. MUSELER,

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

CONTINUED CROSS EXAMINATION
ON BEHALF OF SUFFOLK COUNTY

BY MR. LANPHER:

Q Mr. Eifert, after we went off the record I indicated that I wanted to come back to attachment 27 to

the prefiled LILCO testimony, particularly the checklist for Shoreham site engineering office structural design calculations. I don't have your exact words, but I believe you stated prior to the lunch break that the audit checks have to make sure that calculations are consistent with design.

Do you recall a statement to that effect?

A (WITNESS EIFERT) Yes, sir, I do.

Q Is this Shoreham SEO structural design calculation checklist generally representative of the kind of calculation checklist which is used on the Shoreham project, sir?

A (WITNESS EIFERT) Yes, it is.

Q Can you show me the kinds of checks which would ensure that the calculations are consistent with design?

(Panel of witnesses conferring.)

A (WITNESS EIFERT) Mr. Lanpher, if you will refer to page 1 of section C of the audit plan, which is the eighth page into the attachment.

Q Is that entitled "backup calculations," that page?

A (WITNESS EIFERT) Yes, sir, that is the correct page. And this page, what you are seeing is the instructions to the auditor while performing an audit of

calculations to additionally select some design documents and the parameters from specific parameters contained in those design documents and to determine whether required backup documents had been prepared for those.

The audit plan then goes on in section 2 at the bottom half of that page describing the process that the auditor goes through in looking at those calculations. So in addition to auditing a selection of calculations, the auditor also selects some specific parameters contained in design documents and audits back to see that they are appropriately supported by calculations or other documentation.

Now, I'd like to point out some other audit plans in addition to the audit plan for engineerings. I could do that now or --

Q You piqued my interest. Go ahead.

A (WITNESS EIFERT) If you go back to attachment 24 of our testimony, the first audit plan in attachment 24 is the audit plan for E&DCR's. Page 3 of that audit plan, attribute number 7 in the middle of page 3. This attribute is used by the auditors when auditing E&DCR's to document an evaluation based on their judgment of the technical adequacy of the response given on an E&DCR.

The way that attribute is applied by the

auditors includes determining if calculations are appropriate to support the decisions documented on the E&DCR.

Q Mr. Eifert, before lunch there had been some passing reference to E&DCR's in connection with the audit observation that we were discussing, the one that you termed as the serious one that you found in your review of all these audits.

Were there numerous E&DCR's which were issued to support the changes that were made to pipe supports? And it's not just field changes, but there were field changes as I understand it. We have 1800 calculations, approximately, that you eventually decided to redo. Are there a comparable number of E&DCR's that were issued for these?

(Panel of witnesses conferring.)

A (WITNESS EIFERT) I'm not familiar with the specific number of E&DCR's relating specifically to pipe supports. There are a large number. What that number is, I don't know.

Q Well, would each of the changes that were made in the field when a problem or an interference was found so you had to change from the original design, that would need to be documented in an E&DCR, would it not?

A (WITNESS EIFERT) Yes, sir.

Q So whether or not there are 1800 E&DCR's or whether one or more E&DCR's covered more than one change, each of these exercises of judgment would have been covered by an E&DCR, isn't that correct?

A (WITNESS EIFERT) As we discussed this morning, yes, that is generally correct.

A (WITNESS MUSELER) Mr. Lanpher, it might also have been documented by a revision to the pipe support drawing, the BZ drawing that we discussed earlier. In other words, it could have been done on a revision to the drawing. E&DCR is the more common method, but I don't want to leave you with the impression that that is the only mechanism by which it might be documented.

Q The problem that we were discussing this morning was originally identified in connection with an audit of calculations, not an audit of E&DCR's, correct?

A (WITNESS EIFERT) Yes, it was.

I'd like to point out another audit plan in addition to the E&DCR's, the audit plan with respect to project drawings, which is also a part of attachment 24. Audit plan number 309-1, page 9 of that audit plan -- page 9 of that audit plan, at the top of the page item 3 provides the mechanism by which auditors select parameters from Stone & Webster drawings during an audit

and verify that calculations, if appropriate, have been developed to support that data.

So in response to your inquiries with respect to how the audit process checks the consistency between design and calculations in these attachments, the E&DCR auditing process, the drawing auditing process, as well as the calculation auditing process have as part of them attributes which look for that design consistency.

Q Referring to that page 9 which you drew our attention to, sir, what criteria are implied for determining whether an item is satisfactory or unsatisfactory? I am looking at that last column on the right.

(Panel of witnesses conferring.)

A (WITNESS EIFERT) Mr. Lanpher, the process, if I can explain, the auditor would be auditing a drawing, indicate which drawing in the first column. He would select a parameter or parameters from that drawing which he is going to then verify that a calculation exists to support that.

When he identifies the calculation, he notes that column and probably identifies the calculation number. The "sat" or unsat" is based on whether there is consistency between the information on the drawing and in the calculation.

Q Has Stone & Webster performed any analysis to determine why the problem with respect to the pipe support, with respect to pipe supports that we have been discussing this morning, was not discovered until September 1980, until that time frame?

(Panel of witnesses conferring.)

A (WITNESS EIFERT) I believe your question is, did we do any analysis with respect to why we hadn't identified the problem reported on audit observation 120 in earlier audits.

Q Just so you understand the question, given the subsequent examination that we had this morning, it turns out that about 1800 calculations you eventually determined have to be looked at again. And I'm wondering why that wasn't found earlier. It seems like an awfully large number.

A (WITNESS EIFERT) Okay. First let me say that I didn't go back and do any analysis to determine specifically why we hadn't identified the problem in earlier audits. The situation, as I believe Mr. Museler discussed this morning, in the time frame of 1980, '79, '80, '81, is the time frame when a very large number of supports were in the process of being installed. This was the heaviest time of activity.

Therefore, there is basis for me to believe

that this was a situation that was not a long-standing problem in the particular calculations involved. The problem was identified in 1980 and we have taken full corrective action in recognition of the very important nature of the concerns identified.

I don't see any basis -- at the time I didn't see any basis, nor do I see a basis now, to go back and try to identify why or even if the problem existed and my auditors hadn't found it. The point is, my auditors did find it and corrective action is being taken.

Q Mr. Eifert, did you just say that it would not be relevant to -- it would not be important to you to determine whether your auditors should have found it earlier? Wouldn't that be relevant to judging the adequacy of your auditing process?

A (WITNESS EIFERT) The auditing process found the problem, Mr. Lanpher, in 1980. And I know my auditing process found the problem. But what I am saying is that, together with an understanding with respect to relative activity, is sufficient in my judgment that I'm not going to put a great deal of effort in going back.

My concern is with the effectiveness of the audit program and what we are doing in that audit and the next audit, and not in trying to track back to areas

where there is no clear indication that there is a reason to track back to.

Q Mr. Eifert, turning back to attachment 27. While we're looking at these attachments, I did have one other question on that. Under the page number 702, the first page of section D, which is entitled "Review and Approval" -- are you there, sir?

A (WITNESS EIFERT) Yes, I am.

Q Under the column titled "Independent Review," the second item down, it says "Not applicable. Independent review requirements not applicable to Shoreham." Can you explain that, please?

(Pause.)

A (WITNESS EIFERT) Mr. Lanpher, the reference there -- in understanding that, let me first explain that our engineering assurance procedures that are in effect at Shoreham are standard corporate procedures for engineering design. They apply to all of our nuclear and many of our non-nuclear projects, for that matter. Those procedures are updated and changed in some cases to change our program and maintained as our standard procedures, but not necessarily in all cases do we apply or mandate that our standard practice be instituted on all of the projects.

One of the key factors in a decision on

whether a new corporate standard practice is adopted is the status of the project. In I believe 1976 or 1977, we revised our calculation procedure to adopt changes to our design review practices for calculations at a time when we were making other changes to our design verification programs for many of our engineering and design documents. These changes were primarily instituted to implement a new design verification program that we have described in the Stone & Webster topical report for quality assurance.

The Shoreham program, a decision was made not to upgrade the Shoreham quality assurance program to the latest standard Stone & Webster topical QA program and its later commitments. The indication that we see here that the independent review is not required is an indication that we did not make the new design verification program that we adopted for new plants applicable to Shoreham.

Shoreham's program remained in effect as committed in the specific project QA program that Stone & Webster had, and did not adopt this new practice of independent review.

Q Was it your belief that review of calculations was being performed satisfactorily with respect to the Shoreham project?

(Whereupon, the witnesses conferred.)

A (WITNESS EIFERT) Mr. Lanpher, the Shoreham calculations, as well as all the design, is subjected to design verification. The change in our program was in the method. The Shoreham program as well as all programs at Stone and Webster provide for design review. If you look at that --

Q Mr. Eifert, I was addressing review of calculations. I understand that is just a part of design review. I don't want you to misunderstand my question. You can go ahead and state whatever you want, but I was asking whether you believe that the review of calculations with respect to the Shoreham project was being conducted satisfactorily during the late 1970's.

A (WITNESS EIFERT) I believe that the review of the Shoreham project calculations was being done satisfactorily in the late 1970's and throughout the life of the project.

Q I cut you off before.

A (WITNESS EIFERT) I was going to refer back to the audit plan in Attachment 27. There is documentation there with respect to those calculations that the review

had been conducted. If you look at the headings of that table, there is a heading, Preparation Review Signatures, as well as the additional review that we discussed. The program was being implemented as it was required to be implemented on the Shoreham project.

Q Mr. Eifert, would you agree that the time period July, 1980 -- excuse me, July, 1978, through June, 1979, Stone and Webster determined that they were having continuing problems with respect to the preparation, review, and approval of calculations relating to the Shoreham project?

(Whereupon, the witnesses conferred.)

MR. LANPHER: Judge Brenner, while the witnesses are reviewing the document, I would like to have marked as Suffolk County Exhibit, I think it is 52, for identification an October 2 letter to Mr Gerecke from Mr. Costa of Stone and Webster, October 2, 1979. I was referring to Page 6, the first paragraph, in my question.

(The document referred to was marked for identification as Suffolk County Exhibit Number 52.)

BY MR. LANPHER: (Resuming)

Q Do you have any reason to disagree with that statement?

A (WITNESS EIFERT) Mr. Lanpher, I would like to characterize what this statement represents. Stone and Webster annually provides a report to LILCO indicating the status of the quality assurance program, and includes, as you reference here on Page 6, some analysis of the results of the implementation of the quality assurance program with respect to Shoreham.

This report is generated based on input in this case from the engineering assurance division, where we provide what is referred to as activity analysis with respect to our audits. We use this report as a way to provide some insight to LILCO, our client, for this station with respect to what the program, and in this case the audit program, has found in that time period.

What we see here is the information that was based on the engineering assurance audits. It is based on a review of the audits that we conduct in that time period, and a characterization of the relative importance of the problems that we had identified in that time period. What we see here is an example of calculations, including some required to support the required design. That referred specifically to an Audit Number 28, an Audit Observation 080, which were

discussed last week in this proceeding. The remainder, as you recall the situation with Audit Observation 080, was a situation where calcs in one particular discipline had been identified on the index, but they had not yet been checked.

The evidence there was clearly that there was evidence that it was not a situation where something had gotten through the system and a calc would have been left unchecked. We are confident that the particular discipline would have checked those calculations in due course, but it was the judgment of the auditors that they should have had them checked by the time of the audit.

The remainder of the findings that we are discussing here are characterized as lesser problems which fall into the general category of the important but administrative aspects of calculation control that we have been discussing today as well as last week. This is in terms of the engineering assurance audit activity for the prior year a characterization of what we are finding, comparing the audit, the findings of that year to one another.

A (WITNESS MUSELER) Mr. Lanpher, the audit observation that resulted in comment on checking Audit Observation 080 that Mr. Eifert referred to, we have had

a chance to do some further research into that, to sort of close the loop, as you will, on it. The particular calculations that had not been checked at the time of the audit, even though we believe they would have been checked in the normal course of business, were reviewed and both the calculations themselves as well as the design based on those calculations was found to be adequate, so that no changes were required as a result of the situation, either to the calculations themselves or to the design that was based on those calculations.

Q Gentlemen, I would like to turn to Suffolk County Exhibit 52, the first paragraph on that page. Mr. Eifert, this represents a summation of the status of audit findings with respect to engineering assurance for the previous year or for the year that is identified. It is July 1, '78, through June 30, '79, correct?

A (WITNESS EIFERT) Yes, that's correct.

Q The conclusion was that there were continuing problems relating to preparation, review, and approval of calculations, correct?

MR. ELLIS: I object to the question. It is argumentative. The thing states what it says, and the witness has already explained the significance of it. Mr. Lanpher is just not satisfied with the explanation.

JUDGE BRENNER: I don't think it is at the

point of being fully argumentative yet. All cross examination, or almost all cross examination is somewhat argumentative, and he is allowed to follow up on the witness's previous answer, relating it to a particular incident to get the context of this as an overall review.

(Whereupon, the witnesses conferred.)

WITNESS EIFERT: I think I have characterized this report as those areas that we have identified in the program which we feel are of a nature that tell the story of what was uncovered by the engineering assurance audit in that prior year, and are of such a nature that provide a summary which we feel is useful for our client to recognize.

The reference to the continuing problems in that statement is specifically in reference to the types of administrative control problems that as we have discussed occurred because of Stone and Webster's strict requirements for the administration and processing of calculations, and are not in themselves directly relatable to any technical inadequacies or deficiencies in any way in design. The term "detrimental to quality if left uncorrected," to the best of my recollection, with respect to this particular report was referring specifically to the situation where we had uncovered a situation where calculations which had not been checked,

the results of those calculations had been used. We considered that a very important finding, the practice of which is not considered in accordance with Stone and Webster's design process of approving calculations prior to use of the results.

That particular finding is not something that is repetitive throughout the findings that we have issued on the Shoreham project. The investigation into it turned out that even if the situation had remained uncorrected, it would not have been detrimental to quality based on the information that Mr. Museler and I have been able to gather in going back and researching some of these specific items.

So, in the context of this report, this is a comparative assessment of the results of the engineering assurance audit program for the purpose of advising LILCO of the activity for that prior year, and are not in themselves an assessment of or an attempt to identify or distinguish, if you will, and only advise LILCC of major problems.

MR. LANPHER: Judge Brenner, I am going to have marked as Suffolk County Exhibit 53 for identification a document entitled Shoreham Site Audit Number 11 (Engineering Assurance), and it is on the first page entitled Interoffice Memorandum. It is

entitled Engineering Assurance Audit Report, Shoreham FEO Audit Number 11. It is dated May 5, 1981. And I am going to direct the witnesses' attention to Audit Observation Number 129.

(The document referred to was marked for identification as Suffolk County Exhibit Number 53.)

JUDGE BRENNER: Okay, it is marked as 53.

WITNESS EIFERT: Mr. Lanpher, I would like a few moments to review this. I know you did advise us last night that you would be using this one, but I didn't really get a chance to look at it.

MR. LANPHER: Of course.

(Pause.)

BY MR. LANPHER: (Resuming)

Q Gentlemen, my first question is, referring back to Audit Observation 120, that concerned Shoreham project pipe support design calculations. Audit Observation 129 attached to Suffolk County Exhibit 53 concerns Shoreham site engineering office pipe support calculations. I would appreciate it if you could briefly explain where the various pipe support calculations were being performed for the Shoreham

project and the interrelationship of where the site engineering office fits into this whole thing.

A (WITNESS EIFERT) The pipe support calculations were being prepared both in this case in Boston as audited during the audit which resulted in Audit Observation 120 and being prepared at the site engineering office as audited and reported in Audit Observation 129. The Stone and Webster engineering assurance program provides for us to audit project activities performed in project headquarters normally separate from the activities being conducted at the site engineering office. The program is the same. The procedures that apply to the work are the same, but because of the different offices, physically separated, we schedule and conduct all audits separately.

Q Well, Audit Finding 120, which we spent so much time on this morning, does that relate only to calculations being performed in Boston?

(Whereupon, the witnesses conferred.)

A (WITNESS MUSELER) The Audit 120 covered only activities that were going on in Boston. The audit observation and the subsequent corrective action that was taken covered the pipe support design program, which is the same no matter what office it is, so the audit observation in 120 only applied to what they had looked

at in Boston, because that is the only place that audit was conducted. However, the observation was applicable to the entire program, including the FEO.

The site extension office is really no different than if it were on a different floor of the same building in Boston. It is the same engineering organization performing work under the same procedures. So the results of that audit, Audit Observation 120, are applicable to the site, and that was known at the time. The site activities were subjected to the same evaluation as the Boston activities.

Q Gentlemen, in Observation 129, Paragraph 1, there is reference to the STRUDL II program, II. Is that the same program as referenced in Observation 120? Is it a different version of it, or what?

(Whereupon, the witnesses conferred.)

A (WITNESS EIFERT) The STRUDL program is the same basic program. STRUDL II is a specific version of that program. Stone and Webster also has a version, referred to as STRUDL SW. The Audit Observation 120 doesn't make a distinction. It would have been the version in use at that time. Analytically, they are the same, at least very similar, similar programs as far as finite element methodology.

Q What is meant in this observation that the

STRUDL II program is an unqualified computer program?

A (WITNESS EIFERT) The STRUDL program, STRUDL SW, was a next generation or version of that computer program, and when STRUDL SW was developed and documented and qualified, it met the latest Stone and Webster requirements for documentation and qualification. Documentation that goes beyond the technical aspect of ensuring that we have technically qualified and tested the program with respect to results. It also includes preparation of user documentation, for example, in programmers' documentation.

When STRUDL SW was prepared and fully qualified, the decision was made to go back and benchmark prior versions of STRUDL II to the newly developed STRUDL SW for comparison reasons. Until that was done, the Stone and Webster reporting mechanism on status of computer programs, which is a report issued by our computer department, was classifying STRUDL II as unqualified program. STRUDL II has been in use for a number of years at Stone and Webster and we have had test documentation which describes how that particular program was tested, but administratively, with the upgrading of our entire qualification and documentation program, a decision was made to classify STRUDL II as unqualified until it was benchmarked against the newly

developed and documented STRUDL SW.

Q And the personnel on the site -- it's called site extension office, is that right, or site engineering office?

A (WITNESS EIFERT) Site engineering office.

Q The personnel on the site is called site extension office, is that right, or site engineering office?

A (WITNESS EIFERT) Site engineering office.

Q The personnel in the site engineering office were incorrectly failing to mark the calculations resulting from STRUDL II as confirmation required, correct?

A (WITNESS EIFERT) As I indicated earlier, I didn't get a chance to go back and talk to anybody specifically on this audit observation. But the situation with STRUDL II was that because of the management decision with respect to the documentation and comparison to STRUDL SW, there was confusion by the people using it, who always considered STRUDL II a qualified program, which it had been.

They were using it without the understanding that management was now, in the process of tracking all its computer programs, considering this one unqualified until the documentation comparison caught up. So this was a situation, I think, which reflected the confusion by the users of that specific status. I know we have had this situation elsewhere and I am sure that was the same situation here.

The result has been that the comparisons

between STRUDL SW and STRUDL II have been made and STRUDL II is now considered a qualified program in Stone & Webster's overall system for tracking its computer programs. So there was no effect on the design, of any of our designs, using STRUDL II as the program.

Q Mr. Eifert, audit observation 120, which is part of engineering assurance project audit 34, that audit was issued November 17, 1980. Would the site engineering office personnel have been made aware of the results of that audit?

(Panel of witnesses conferring.)

A (WITNESS MUSELER) Mr. Lanpher, we will just take another minute to see if we can confirm our answer. We are looking at the distribution list very quickly. If we can't do it in a very short period of time --

Q Let me ask you a more general question and maybe we can speed this up. In the normal course of procedures at Stone & Webster, would the site engineering office personnel have been made aware of the findings of the auditor in audit observation 120 relating to pipe support design calculations?

(Panel of witnesses conferring.)

A (WITNESS MUSELER) The answer to that question is yes.

Q Mr. Eifert, in audit observation 129, attached to Suffolk County Exhibit 53 for identification, the auditor reaches the conclusion that there is evidence that calculations are not being controlled in a satisfactory manner. These are pipe support calculations that they are referring to, correct?

(Panel of witnesses conferring.)

A (WITNESS EIFERT) Yes, this was an audit of pipe support calculations.

Q And the auditor did state that there is evidence that the calculations are not controlled in a satisfactory manner, correct, looking at the second paragraph on page 1, sir?

A (WITNESS EIFERT) That's correct.

Q And looking at paragraphs 1 and 3 of audit observation 129, the auditor identifies -- excuse me, 1, 3 and 4. Let me start over.

Looking at paragraphs 1, 4 and 5 of audit observation 129, the auditor identifies problems that we have been calling the traceability problem, really. They have not identified calculations which are used in the program or there is not positive traceability, isn't that correct?

(Panel of witnesses conferring.)

A (WITNESS BALDWIN) Your question was 1, 4 and

5, Mr. Lanpher?

Q Yes.

A (WITNESS EIFERT) What I'd like to do, Mr. Lanpher, is discuss 1, 4 and 5 to characterize them as to what they actually are. Item 1 deals with the STRUDL II, the use of STRUDL II as a computer program, and we have discussed that as to what it is and what the background of that is.

Q Mr. Eifert, I am focusing on the first sentence, where it states, "The version and level of STRUDL II is not identified in the following calculations which used this program." It goes on to identify calculations.

Isn't that an example of the traceability problem that we have discussed earlier?

A (WITNESS EIFERT) That is an example where the engineering assurance procedures now require strict identification of the specific version and level of computer programs used in analysis. Prior to that strict requirement, the computer run number, which is a number which is identified, printed, I believe, on the computer output, was the basis for the traceability to the computer program that was indeed available for [illegible] and on the computer on that day.

We had a change in our program, I believe in

1977, to require that in addition to the run number information, that the specific version and level of the program be identified in the calculation.

Q So this requirement, which you have characterized as the strict newer program, had been in effect for approximately four years?

A (WITNESS EIFERT) I believe that is the case. In addition, since 1977 we have systematically gone through all of our computer programs used for engineering analysis to provide an automatic mechanism within the computer program to print out as part of the information on the computer printout the specific version and level of the program, as well as the linkage editor information, which I indicated last week gives us automatic traceability.

STRUDL II was, to the best of my recollection, one of the last programs to be modified to provide for the automatic traceability, to give us the detailed printout on the documentation for the ready traceability that we are looking for in all of our calculation documentation. I think that background keeps this particular item in perspective.

I also believe that they didn't modify STRUDL II to provide that automatic basis because they were in the process of developing STRUDL SW, which was going

into use.

Q Would you turn to item 4 on page 2. Is this an example? The first sentence says, "Specific references for information used in the pipe support design were not identified in the pipe support calculations. It goes on to give five examples.

Is this an example of failure to meet the traceability requirements of your procedures?

(Pause.)

A (WITNESS EIFERT) Mr. Lanpher, this item 4 of audit observation 129 contains examples where the calculation documentation do not provide the ready traceability that we require by our rather strict engineering assurance procedures. Item A discusses the problems with the formulas on design welds. I believe these are the same formulas that we have discussed earlier in audit observations with respect to the information to be found in the text, which has been referred to in calculations by author without the full definition of the text and its edition.

Item B, with respect to the sources of all the loads for standard pipe clamps, those standard pipe clamps are a manufactured item which is a supplied item to the plant, and that information is available in the vendor documentation with respect to those clamps. The

traceability is there. The engineers and designers who work on pipe supports know that they have to go to that documentation to get that. So a specific reference to the catalogue number is an example of providing the ready traceability and not any indication of lack of traceability.

The force of the dual loads, I believe -- and I am not specifically clear on that, but I believe that that is the standard source of loads for all pipe supports, and that is our stress summary, as is the situation with item E, the source of time history loads. The loads as input to the pipe supports are from the pipe stress summaries and we don't need specific reference to them in the calculation to have traceability, But we do want and look for specific reference to provide the ready traceability.

The source of the design criteria for load combinations not being identified, again I'm not positive on this particular situation, but I know that those loads are contained in the FSAR and in the design assessment report, and I suspect that the traceability is directly out of there for those loads. That has been the case in other observations relating to load combinations for the Shoreham project.

Q You don't have any reason to disagree with the

finding, the basic finding in number 4, that specific reference to those sources of information was not provided in the calculations?

(Panel of witnesses conferring.)

A (WITNESS EIFERT) As with all audit observations, Mr. Lanpher, I've got no reason to doubt that the auditor wrote those words. To understand any of the audit observations, we have to look at the specific situation involving the observation and what its meaning is in the context of the specific calculations, in this case, that were audited.

My belief here is that it is a situation where we did not have the detailed specific references that we require, but there is traceability.

Q Item 5 on that same page, Mr. Eifert, is that another example of where the traceability requirements of your procedures were not satisfied?

(Panel of witnesses conferring.)

A (WITNESS EIFERT) Mr. Lanpher, our program requires traceability and I believe we have traceability, as clearly identified here. This does indicate that we didn't provide the details in the calculation to provide the ready traceability that our program demands.

Q Mr. Eifert, looking at item 7 at the bottom of

that page, the first sentence states that there appears to be a lack of coordination in the area of support calculation revisions in the offices that are assigned responsibility for the design of a support revision. Are you familiar with this observation?

(Panel of witnesses conferring.)

A (WITNESS EIFERT) Mr. Lanpher, I am not familiar with the specific details of this aspect of the audit observation. As I indicated earlier, you advised us late yesterday that we would be using this, and I didn't have time. I was down here yesterday and didn't have time to contact anyone specifically.

What this is indicating is that, in addition to selecting a sample of calculations to audit, the auditors also look at the process of who is doing the work, how it's being controlled from a management viewpoint, from an exchange of information viewpoint, as this addresses work that is being done in Boston as well as the site engineering office and our Toronto office.

The audit reflects observations made by the auditor with respect to how those activities were being coordinated and identified from current concerns which in the auditor's judgment reflect the need for some improvement in that coordination.

MR. LANPHER: Judge Brenner, I'm going to go

on to something else, if the Board wants to pursue something.

JUDGE BRENNER: We're going to take a break first of 15 minutes, and then we'll come back and proceed. So we'll be back at 3:25.

(Whereupon, at 3:10 p.m., the hearing was recessed, to reconvene at 3:25 p.m. the same day.)

JUDGE BRENNER: All right. Back on. At the end of the day, I think I will have one or two very preliminary questions about the st s report on emergency planning. Then we will consider the matter and get back to the parties later this week, probably Thursday or Friday.

I discussed during the break with Mr. Lanpher and the Reporter that I would like to bind in solely as a convenience Suffolk County Exhibits 52 and 53 for identification, and we might as well bind it in at this point rather than waiting until the end of the day. So we will bind them in here. Again, we are not admitting them into evidence. This is just as a convenience, since they are loose documents.

(Suffolk County Exhibits 52 and 53 follow:)

Insert 1
SC ex 52

STONE & WEBSTER ENGINEERING CORPORATION

245 SUMMER STREET, BOSTON, MASSACHUSETTS

ADDRESS ALL CORRESPONDENCE TO P.O. BOX 2325, BOSTON, MASS. 02107

W.U. TELEX 94-0001
94-0977

BOSTON
NEW YORK
CHERRY HILL, N.J.
DENVER
CHICAGO
HOUSTON
PORTLAND, OREGON
SAN DIEGO
WASHINGTON, D.C.

DESIGN
CONSTRUCTION
REPORTS
EXAMINATIONS
CONSULTING
ENGINEERING

LILCO STA.

Mr. T. F. Gerecke
Quality Assurance Manager
Long Island Lighting Company
175 East Old Country Road
Hicksville, LI, NY 11801

October 2, 1979
File No.: 12.1
LIL- 14910
J.O. No. 11600.50

Dear Sir:

QUALITY ASSURANCE PROGRAM REPORT
SHOREHAM NUCLEAR POWER STATION

Enclosed are copies of the annual Quality Assurance Program Report and Preventive Action Program Summary, covering activities for the period July 1, 1978 through June 30, 1979.

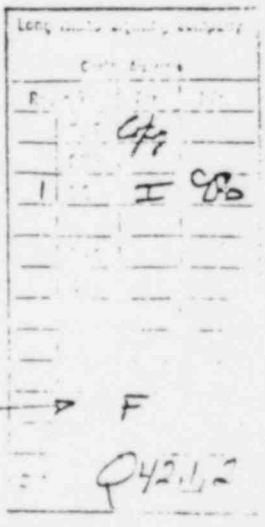
Very truly yours,

Ralph S. Costa

R. S. Costa
Project QA Manager

RSC:bar

Enclosures



STONE & WEBSTER QUALITY ASSURANCE PROGRAM
STATUS REPORT NO. 6
SHOREHAM NUCLEAR POWER STATION - UNIT 1

The following report covers quality assurance activities for the Shoreham Nuclear Power Station - Unit 1 Project for the period July 1, 1978 through June 30, 1979 as delineated in the Final Safety Analysis Report and the Project Quality Assurance Program Manual.

A. MAJOR ACTIVITIES

1. Engineering Assurance Division (EA)

a. The Project received from the Services Section, 29 problem reports, all of which required action responses. One Problem Report had not been satisfactorily responded to at the end of the reporting period.

In addition:

- 97 "CR Memos" were issued to inform S&W personnel of power industry construction and operating problems.
- 112 "50,000 - series CR Memos" were issued relating information on problems encountered by S&W personnel on other projects. The "50,000 - series CR Memos" now also include the distribution of NRC IE Bulletins, Notices, and Circulars.

b. The Services Section, Education Group presented 7 instruction lectures on 4 EAP's to project personnel; instruction on preparation of calculations was given three times. Instruction on calculation preparation, the E&DCR system, and the N&D system was conducted at the site with SEO and LILCO personnel in attendance.

c. The Services Section, Engineering Services Group performed the following activities:

- Reviewed 4 Engineering Services Scopes of Work
- Reviewed 4 Engineering Services Purchase Requisitions.

- Conducted 2 Surveys, reviewed 4 Quality Assurance Programs, performed 2 corrective action audits of Engineering Services Suppliers, and performed 2 corrective action reviews of responses to EA engineering and design audit findings on hardware vendors.

d. The Auditing Section performed 4 project audits at headquarters and 2 at the Site Engineering Office. A special review of the large bore isometric program at the site was also conducted.

At the beginning of the reporting period, Engineering Management policy was issued requiring that corrective action for all audit observations be completed within 60 days of the audit report issue date or an extension be specifically requested. At the end of the period, two observations were open with approved extensions. These were pipe stress design calculations and structural mechanics calculations.

e. Continuous project support was furnished by an Engineering Assurance Engineer, who was assigned to the project at the beginning of the reporting period. In addition to coordinating Engineering Assurance activities on the project, he assisted in audits, conducted unofficial reviews in problem areas and assisted in instructing project personnel on Engineering Assurance and project procedures. Divisional support was also given in clarification of procedures, program manual review, including ASME III sections, and preparation of budgets and estimates.

2. Quality Systems Division

a. Specifications reviewed by the Systems Support Section included 37 new/revised specifications and 23 addenda for a total of 60.

b. Systems Services continuing education activity consisted of 9 sponsored presentations with a total of 258 attendees.

c. Quality Assurance procedures issued by the Systems Development Section totaled 27, including new issues, revisions, changes and cancellations.

d. Reports Group activity consisted of the monthly production of N&D Status Reports for both field and shop. Also, the inspection reporting system for PQA activities continues.

3. Procurement Quality Assurance Division

a. PQA activities included specification reviews with vendors, surveys of vendors and review of vendor shop quality assurance manuals.

b. During the reporting period the following were issued: 382 inspection reports, 7 new purchase orders and 15 nonconformance and disposition reports of which 4 remain open. Also performed were 10 vendor surveys and 5 manual reviews.

4. Field Quality Control Division (FQC)

a. General site activity included 4895 receipt inspections and issue of 1440 new hold tags. The total number of hold tags cleared for this period was 1339, leaving 333 outstanding.

- A total of 9302 electrical inspections were performed on cable pulls, raceways, terminations and equipment installations.

- Sixteen hundred and ninety (1690) mechanical inspections were conducted including alignments, hydrostatic tests and equipment installations.

- Structural erection of approximately (118) tons of steel was checked, and approximately 1600 linear feet of welding for tanks and vessels was inspected.

- Forty-one hundred and twenty-seven (4127) cubic yards of concrete were placed with 98 cubic yards rejected or 2.4%.

- One hundred and eleven (111) surveillance inspections were performed and 115 surveillance inspection nonconformities issued; of which 16 remain open.

- Out of 125 soil density tests performed, 8 were rejected or 6.4%.

- During the reporting period, 539 nonconformance and disposition reports were issued, 421 N&D's were dispositioned and 398 N&D's were closed. As of August 24, 1979, 398 N&D's remain open.

b. An annual audit by Stone & Webster's Quality Assurance Cost and Auditing Division (QACA) was performed to monitor compliance with the Company ASME III Program Manual; compliance was determined to be generally satisfactory. In addition, there were seventeen (17) audits performed by the NRC, 171 audits by Client personnel and 4 site audits by the QACA Division.

5. Nondestructive Test Division (NDT)

a. The NDT Division continued to provide technical assistance through surveillance visits to the construction site to monitor, evaluate and review nondestructive testing activities to insure conformance to approved procedures. During the subject reporting period, a total of five surveillance visits were made to the construction site.

b. NDT Division support activities included:

- Review of 40 vendor NDT procedures.

- Performed a total of 12 calibrations of NDT equipment used by S&W personnel at the site.

- Assisted PQA by participating in 5 radiographic film reviews at vendor's facilities.

- The Certification Section of the NDT Division continued to provide support for the Project through NDT training courses held in Boston and at the Project site.

- Technical assistance was provided to the Project through the assignment of Boston NDT personnel to control the QA activities of a private vendor at the vendor's office. (Six month assignment).

- Technical assistance was provided to the construction site through the assignment of Boston NDT personnel for the performance of Radiographic, Magnetic Particle, and Liquid Penetrant examinations.

6. Quality Assurance Cost and Auditing Division (QACA)

a. The QA Cost and Auditing Division conducted Management Audits on the following Quality Assurance Department Divisions as part of the Quality Assurance Department Audit Program: Quality Systems Division, Field Quality Control Division, Nondestructive Test Division, Procurement Quality Assurance Division and the Engineering Department, Engineering Assurance Division.

b. In addition to Management Audits, one audit was performed on the S&W Quality Assurance Program of the project, four audits of the Shoreham site which concerned Lilco approved QA Category I activities, and one audit of the Courter and Company, Inc. Quality Assurance Program. All of the findings were classified in accordance with the criteria of Appendix B 10CFR50, and then tabulated by the number of occurrences. Those criteria with the greatest number of occurrences were further reviewed to determine the causes of the infractions and to establish a basis for corrective and preventive actions.

B. ACTIVITIES ANALYSIS

1. Engineering Assurance Division

a. An analysis of audit findings revealed only one condition which would be detrimental to quality if left uncorrected. This condition concerns continuing problems with preparation, review and approval of calculations. Examples of these problems are: calculations not checked (including some required to support the current design); lesser problems with correct indexing, identification of superceded calculations, use of distribution sheets, identification of computer programs used and calculation page marking.

b. In addition to corrective action, preventive action was initiated consisting of classroom instruction on the preparation of calculations. Recent calculations were reviewed for procedural conformance. Frequency of audit of Site Engineering Office prepared calculations was increased. Evidence indicates there has been a marked improvement in these areas.

2. Quality Systems Division

The ASME III Program interfaces between S&W and Courter & Company, Inc. were finalized and included in their respective QA Manuals. QSD worked closely with FQC, Project Engineering, LILCO's and Courter's Quality Assurance staff to identify, establish and finalize interfaces. This will ensure the code compliance of site work while minimizing overlapping activities.

3. Procurement Quality Assurance Division

A significant concern relating to the legibility of vendor documentation arriving at the construction site was identified. Procurement Quality Assurance has been actively working with LILCO personnel in reviewing the illegible documentation and obtaining clearer copies of the documentation from the vendors and/or their suppliers.

4. Field Quality Control Division

Courter & Company identified a significant deficiency with Code Class 1 attachments involving lack of penetration of weld at its root. This problem was reported on Courter Nonconformance Report No. 880 which remains open.

5. Nondestructive Test Division

The NDT Division continued to provide technical assistance to the Project, Engineering and PQA through participation at meetings held at Boston, Montreal, and the construction site to resolve problems concerning radiography of valve castings supplied to Velan by Manoir-Pompey. As part of the problem solution, Boston NDT personnel again supervised the radiography and witnessed the repair of questionable castings.

Code radiography of castings still continues to be a generic industry problem for all Projects. All clients are continually being appraised of any new developments, including corrective actions that are recommended by Stone & Webster.

6. Quality Assurance Cost and Auditing Division

a. The Quality Assurance Cost and Auditing Division utilizes a system for the tabulation of attributive checks made during an audit to determine a quality performance indicator (QPI) as a general means of evaluating the quality assurance program. The QPI is the ratio of the number of satisfactory attributive checks to the total number of attributive checks times 100 resulting in an overall percentage of satisfactory attribute checks. The 1978-1979 QPI of 95.5 percent reflects a minor decrease from the previous year's QPI of 96.2. However, the current QPI is consistent with the QPI for other nuclear projects.

b. A review of the findings of audits conducted by the Quality Assurance Cost and Auditing Division during the period, indicated that the majority of observations were related to the categories of:

b. Continued

Control of Special Processes; Handling, Storage and Shipping; Nonconforming Materials, Parts, or Components; and Control of Instructions, Procedures, and Drawings. Each finding contained recommendations for corrective/preventive action. The QA Cost and Auditing Division followed up each observation until such time as the item/activity was found to be satisfactory.

7. NRC Audits

The NRC conducted 17 audits during the reporting period. In six of these audits the NRC reported no items of noncompliance. However, the reports outlined unresolved items, items examined with no discrepancies and previously identified unresolved items. Corrective action was implemented for all violations.

8. ASME Audits

An ASME survey was conducted in October, 1978 and NA and NPT Certificates of Authorization were issued to Courter and Company, Inc. and an ASME N Certificate of Authorization to S&W for the Shoreham site.

9. Summary

The quality assurance program has continued to be effective in maintaining quality work as defined in the Final Safety Analysis Report and the Project Quality Assurance Program Manual. The audit findings and quality trends identified in this report have been brought to the attention of S&W management for appropriate action and problem areas continue to be monitored for compliance with the QA Program.

PREVENTIVE ACTION PROGRAM SUMMARY

JULY 1, 1978 THROUGH JUNE 30, 1979

P.A.F. NO.	DESCRIPTION	DISPOSITION	RECOMMENDED ACTION	IMPLEMENTATION STATUS
0001	N/A	Returned to originator - QA Category II	N/A	Closed
0002	N/A	Returned to originator - QA Category II	N/A	Closed
0003	Deficient Installation of Anchor Bolts	"As-Built" version of hanger identified on N&D 1310 was recalculated and found acceptable.	100% of all Category I Anchor Bolts be inspected for size, length and embedment	Sent to LILCO for Concurrence on 3/28/79
0004	Radiographs of Velan Valve Casting do not meet acceptance standards of ASME III	Unacceptable areas of valve have been ground and/or reradiographed and previously unacceptable areas are now acceptable.	Follow the requirement for radiographic examination of castings already established for Jamesport (refer to Attachment 1 to PAF Transmittal 0004.)	Pending transmittal to LILCO for concurrence
0005	N/A	Returned to Originator - QA Category II	N/A	Closed
0006	N/A	Returned to Originator - QA Category II	N/A	Closed
0007	N/A	Returned to Originator - Determined to be an isolated noncompliance.	N/A	Closed

P.A.F. NO.	DESCRIPTION	DISPOSITION	RECOMMENDED ACTION	IMPLEMENTATION STATUS
0008	Incorrect use of welding symbols on control drawings and incorrect use of weld technique sheets.	Unico to be advised of welding with the appropriate weld technique. The welds are acceptable as-is since the techniques and joint confugurations are recognized as prequalified to AWS D1.1.	Provide an extensive training program to FQC and Construction personnel, and apprise all contractors of problem, emphasizing importance of the use of proper techniques and qualified welders.	Pending transmittal to LILCO for concurrence.
0009	Insufficient fillet weld sizes on the inside and/or outside of slip-on flanges	Welds of the type identified by N&D 1873 will be examined to determine if code (ASME III) and specification requirements are fulfilled. Those welds not meeting these requirements will be reworked.	Inform PQA and vendor of the problem to insure personnel are aware of the code requirement and to require fillet sizes be indicated on all future shop sketches.	Sent to LILCO for concurrence on 3/1/79.
0010	Deficient welds on the "Reactor Polar Crane" assembly	N&D 1925 awaiting disposition.	Inform and discuss problem with vendor and S&W PQA personnel. An instruction QAD for weld inspection is presently in the review cycle.	Pending transmittal to LILCO for concurrence.
0011	Deficient Pipe Support Designs	Bergen-Paterson and SEO have revised their drawings to show rework required. N&D 1364 remains open, as additional supports are reviewed and found deficient, N&D 1364 will be dated.	Awaiting response from responsible engineer.	Open

.F.F. IO.	DESCRIPTION	DISPOSITION	RECOMMENDED ACTION	IMPLEMENTATION STATUS
)012	N/A	Returned to Originator - Determined to be isolated noncompliances.	N/A	Closed

Insert 2

OC Ex 53

T-383

PROPRIETARY

"This audit was conducted on behalf of and under contractual agreement with LILCO the client. The information contained herein may not be divulged to any outside parties without the mutual agreement and consent of Stone & Webster and the client.

It should also be noted that the information contained herein is incomplete and preliminary pending detailed reviews and responses."

Document Subject: Shoreham Site Audit #11 (EE)

Specific Handling Instructions: _____

PROPRIETARY

INTEROFFICE MEMORANDUM

▲ 040.88

81/337

J.O. OR W.O. NO. 11600.50

SUBJECT ENGINEERING ASSURANCE AUDIT REPORT
SHOREHAM SEO AUDIT NO. 11

DATE May 5, 1981

FROM DCShelton

TO EJBrabazon
JCarney (SEO)

CC Dist. Attached
CMOland:dad

PURPOSE

This audit was performed to evaluate the adequacy of, and compliance with, procedures applicable to management systems utilized to control various SEO activities and to compile an assessment of each audited subject for cognizant Project and Engineering Management review. The audit was conducted in accordance with EAP 18.1. The activities audited are identified on Attachment 1.

AUDIT RESULTS

The audit results indicate an overall satisfactory level of performance for work currently being performed by the SEO. However, there is evidence to suggest that the administrative controls for Pipe Support Calculations are inadequate and fail to fully implement all applicable procedures and guidelines. The controls to ensure changes to Interim Issue Drawings are properly incorporated are unsatisfactory. In addition, QA Records are not adequately protected against unauthorized access as described by Project Procedures.

The audit of SEO Originated Drawings was not conducted due to the lack of auditable material.

Details of the conditions are described on the attached Engineering Assurance Audit Observations (AOs) 11600-127, 128, and 129. The reply forms associated with these AOs have been previously provided. The forms should be completed and returned to EA by May 13, 1981.

A post audit conference was held April 8, 1981 at the SEO. Attendees are listed in Attachment 1.

C.M. Oland
Audit Team Leader

D.C. Shelton
Chief Engineer
Engineering Assurance

Attachments

81/337
Attachment 1

SHOREHAM SEO AUDIT NO. 11

SUMMARY OF ACTIVITIES AUDITED

Activity	AO No	Participants: Projects	Participants: EA
Collection and Retention of QA Records	11600-127	DGeoffrey	CMOland
Interim Issue Drawings	11600-128	PCastrichini	RDGriffiths
Large and Small Bore Pipe Support Calculations	11600-129	JCarney/ PCastrichini	EFHunter/ DLopaus
SEO Activities	---	JCarney/ RJJaquinto	CMOland

POST AUDIT CONFERENCE APRIL 8, 1981

ATTENDEES

JCarney
PGCastrichini
RDGriffiths
EFHunter
DPLopaus
CMOland
RJJaquinto

STONE & WEBSTER ENGINEERING CORPORATION ENGINEERING ASSURANCE AUDIT OBSERVATION	AO No. 11600-127 Page 1 of 1

Organization Audited Shoreham SEO — Audit Date 4/6-8/81

Activity Audited Collection & Retention of QA Records — Auditor CMOland

Persons Representing Audited Organization DGeoffrey — References PGI Addendum No. 69

Required Reply Date May 13, 1981 — Action Assigned JCarney

Description:

QA Records at the SEO are not adequately protected against unauthorized access.

DETAILS

Second record copies of Pipe Stress/Support Calculations, maintained on microfilm cassettes at the SEO, are not stored in locked cabinets as specified by Project General Instructions, para. 3.4.4.

STONE & WEBSTER ENGINEERING CORPORATION ENGINEERING ASSURANCE AUDIT OBSERVATION	AO No. 11600-128 Page 1 of 1

Organization Audited: Shoreham SEO — Audit Date: 4/6-8/81

Activity Audited: Interim Issue Drawings — Auditor: RDGriffiths

Persons Representing Audited Organization: PCastrichini — References: SNPS PI 19, DP-P-11.1-1, EDTP 6.2

Required Reply Date: May 13, 1981 — Action Assigned: JCarney

Description:

Interim Issue Drawings prepared since January 1980 were reviewed for compliance with above listed references. It appears that the SEO does not adequately review interim issue drawings to ensure revisions are properly incorporated. All drawings utilize a non-standard method of recording drawing change references.

Details

1. Project Procedure 19, para 2.5.c specifies changes to interim issue drawings be circled and identified with the current issue number followed by the next sequential alpha designation (e.g., 3B).

   A review of four Interim Issue Drawings revealed revisions are not always circled or do not otherwise identify the revised area.

2. E&DCR, N&D and MSK changes incorporated on the drawings were not always entered in the drawing change block (EDTP 6.2.) A separate block entitled "Interim Issue" does contain these references. However, the "Interim Issue" block information is not carried forward on subsequent interim issues. Therefore, the incorporation status is not maintained on the drawing. In addition there is no procedure describing the purpose or use of the "Interim Issue Block".

3. E&DCR's and N&D's are being referenced on Interim Issue drawings as having been incorporated when in fact the E&DCR's or N&D's did not change the drawing.

4. The revision number/letter of Interim Issue Drawing 11600.02 - BZ-44B-8 is incorrectly identified in the Description of Change Block. The latest issue of the drawing (as indicated in the Description Block) is 1 while the interim issue is numbered "2a" on sheet #1 and "2" on sheet #2 (SNPS PI 19 par 2.5 b).

STONE & WEBSTER ENGINEERING CORPORATION ENGINEERING ASSURANCE AUDIT OBSERVATION	AO No. 11600 - 129 Page 1 of 2

Organization Audited SHOREHAM SEO

Audit Date April 6-April 8, 1981

Activity Audited SEO Pipe Support Calculations

Auditor EFHunter

Persons Representing Audited Organization JCarney/PCastrichini

References EAP 5.3, Project Procedure 3/.PGI-4.5

Required Reply Date May 13, 1981

Action Assigned JCarney

Description:

Calculation title pages do not always include complete revision, cancellation, or distribution information. Some assumptions requiring confirmation at a later date, sources of input data, and computer programs used are not adequately identified.

In addition, there is evidence that calculations are not controlled in a satisfactory manner.

Details:

1. The Version and Level of STRUDL II was not identified in the following calculations which used this program (EAP 5.3, Attachment 1.4.): 1B21-PSA 531-3 and 1M41-PSS 105-2. In addition, since STRUDL II is an unqualified computer program these calculations must be marked "Confirmation Required" until the documentation for this program is complete.

2. The information shown on the title page of SEO Pipe Support Calculations is not always complete. Examples Include:

   A. The "Rev. No. or New Calc. No." block was not completed for Revision 2 of Calculation No. 1M141-PSS 105-2. In addition, the "Supersedes Calc. No. or Rev. No. "Block for Revision 1 was not completed to indicate the superseded calculation number.

   B. Calculation Number 1M41-PSA010-1 does not indicate the number of the superseded calculation, the 'Supersedes Calc. No. or Rev. No". Block should be completed to indicate this fact.

   C. The "Copy Sent" Block for the following calculations were not checked (✓) to indicate that they were transmitted to Boston for distribution: 1B21-PSA 531-3, 1E21-PSSP-0807, 1N11-PSSH-0166.

3. Assumptions made in Calculation number 1M41-PSA-010-1 are not specifically identified as requiring confirmation. The title page identifies the Calculation as requiring confirmation, however, it is not identifiable what information must be confirmed, as required by EAP 5.3, Attachment 1.4.

Description (Continued):

4. Specific references for information used in the Pipe Support Design were not identified in the Pipe Support Calculations, examples of typical items are noted below:

   A. Sources of various formulae used were not identified (Examples: 1E11-PSSP 811-1, 1M141-PSS 105-2, 1M41-PSA 010-1, 1B21-PSA 531-3). Subject areas include the design of welds, base plate design, etc.

   B. Sources of Allowable Loads for standard pipe clamps were not identified in Calculation No. 1M41-PSA 010-1.

   C. Sources of Dual Loads were not identified in Calculation Numbers 1M41-PSA 010-1, 1M41PSS 105-2

   D. Source of Design Criteria for load combination was not identified. (Examples: See 4.A. above)

   E. Source of time history loads used in Calculations Numbers 1E11-PSSP 811-1 was not referenced.

5. Programs used in the Design of Pipe Supports were not specifically identified by S&W Computer Department Library Reference Number, and Version and Level in the Pipe Support Calculations as required by EAP 5.3, Attachment 1.4 (Examples - Calc. Numbers 1M41-PSA 010-1 and 1B21-PSA 531-3). Loads taken from the NUPIPE Stress Run were only referenced in the Calculations by Run Number and Date. Traceability to the Program Version and Level used is therefore not provided in the Calculations.

6. A Computer Log containing a listing of those runs used in the final calculation prepared according to the EMD Calculation Instruction Manual invoked by EMAG-41, was not included in the Pipe Support Calculation Package.

7. There appears to be a lack of coordination in the area of Support Calculation revisions and the office(s) that are assigned the responsibility of the design of a support revision. For example, Support Calculation Number 1B21-PSA 531-1 was sent to the Toronto office to be included in their responsibility. The Boston office controlled file shows this issue as their latest issue of the Calculation. The Toronto Office has processed issue 2 of the calculation and transmitted this issue to the NEO who, in turn, processed issue 3. In addition, there is no evidence to indicate that issue 2 and issue 3 were transmitted to Boston for their records.

DISTRIBUTION

RSCosta	4
EBFleming	5
JGGallagher	9
AEHechemy	4
GRHeine	4
PJHolden	4
DJKing	9
LSMaciejewski	6
CBMiczek	10
SMorss	4
JCRyan	10
WRSheridan	4
ALVanSickel	8
SJYerardi	4
PAWild	10
EA Audit File/ DMLark	2 (5 copies)

MR. LANPHER: Judge Brenner, I would just like to wait until some convenient time along the way for moving things into evidence.

JUDGE BRENNER: Fine, and consistent with that, we are going to finalize what will be the agreement with the other parties after the ground rules of admitting all these documents into evidence consistent with the use which was made of them.

JUDGE MORRIS: Gentlemen, we have been focusing on trees and maybe some saplings, and I have kind of lost sight of the forest. I would like to spend a little time just trying to get some perspective on what we are talking about, so that we can relate these individual details that we have been focusing on to the overall picture.

Mr. Eifert, I understand you have been involved in this engineering assurance effort for some time with Stone and Webster.

WITNESS EIFERT: Yes, sir. I joined Stone and Webster in 1972 in the engineering assurance division. I have been involved since 1972.

JUDGE MORRIS: With all of the nuclear plants that Stone and Webster has been involved in? Are you familiar generally with the assurance programs for those programs?

WITNESS EIFERT: Yes, I am.

JUDGE MORRIS: So you are also familiar with some conventional power plants assurance programs?

WITNESS EIFERT: Yes, we apply our engineering assurance program to our non-nuclear business areas as well. We, for example, are applying right now our auditing program, structured slightly different, in schedulding, but the types of audits we do are basically the same, and we are applying that to contracts that the company has for designing coal-fired power plants.

JUDGE MORRIS: In all of these plants, I heard a very large number of pipe supports. That is not really quantified for us. We have been talking about these 1,800 that had a "problem", but roughly how many pipe supports are there in the nuclear plant?

WITNESS MUSELER: At the Shoreham plant, sir, there are approximately 11,000 large bore supports and approximately 15,000 small bore supports. The break is pipe supports for two and a half inches or larger pipe are large bore supports, where two inch and under are their small bore supports. So the total between the two is 26,000 pipe supports.

JUDGE MORRIS: And the kinds of problems that have been identified, I guess, in many of the cases where they have been identified relate to field

changes. Is that correct?

WITNESS MUSELER: The bulk of the discussion we have been having here is related to changes that were made as a result of installation. Yes, sir.

JUDGE MORRIS: In your opinion, is the number of such changes at the Shoreham plant comparable to those that occur at other plants?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: Sir, I believe the number of modifications made to the Shoreham plant is comparable to any nuclea plant that is of the same vintage and has been subjected to the same number of design changes through the years. In other words, ten years of construction of the plant, primarily the MARK II changes. I believe it is certainly comparable to any of the BWR's of Shoreham's vintage, and the reason the number may seem like a very large number in terms of the number of changes is just strictly because of the documentation requirements as a result of any change to a design component in the plant. Any change, even if it is based on a very clear engineering judgment, has to be documented.

JUDGE MORRIS: I am focusing only on the physical modifications, not the documentation, for a moment.

WITNESS MUSELER: I believe Shoreham is comparable to the other plants that it could be compared to at this point, BWR's of our vintage.

JUDGE MORRIS: So is it correct that your opinion is that the number that occurred is not surprising or unexpected?

WITNESS MUSELER: No, sir. In my opinion, it is not surprising or unexpected at all.

JUDGE MORRIS: And I guess there have been two kinds of things we have been talking about. One is the physical modification, and the other is the documentation of a change either in the design drawing or in the calculations, and I want to talk about each of those three. If we talk about just the physical modification, it is my understanding that that modification will be reflected either in a revision to a BZ drawing or an E&DCR? Is that correct?

WITNESS MUSELER: Sir, they will all be reflected finally in a revised drawing. Our drawing revision program calls for incorporating all the E&DCR's into a final as built drawing, so that it is all in one place rather than in one revision plus E&DCR's. At the present time, any configuration in the field is represented by the latest revision of the drawing plus any applicable E&DCR's. It is just two different ways

that it might be documented. In the end, it will all be documented in a revised as built drawing.

JUDGE MORRIS: What happens to previous revisions of those drawings?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: We have retrievability of all revisions of the drawings, but the drawing logs which indicate the latest applicable revisions would show that -- would show what the latest as built revision of the drawing is. Any superseded additions of that drawing are just kept for historical purposes, but they are available also. It is the latest as built drawing that is the one of most concern.

JUDGE MORRIS: And that is reflected in the current index as to what revision is currently applicable? Is that correct?

WITNESS MUSELER: Yes, sir. That is correct. And the index also indicates the latest revision and any applicable E&DCR's. In other words, if there are E&DCR's against a latest revision, that is indicated in the appropriate logs.

JUDGE MORRIS: Is a superseded drawing or an E&DCR identified in any way? Let me phrase it differently. If you go from Revision 10 to Revision 11, is there any marking put on Revision 10 to indicate that

it has been superseded?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: In the field, sir, we would remove the superseded drawing. Mr. Eifert advises that in Boston they would mark it as being superseded.

WITNESS EIFERT: I am indicating that the basic procedure is to remove the superseded drawing from the work area. If an engineer had some reason to retain a drawing he is allowed to retain if he clearly marks it to indicate that it is superseded.

JUDGE MORRIS: I guess such a process is not instantaneous. Can you give me a feeling for how quickly that might happen? The drawing that is superseded gets identified as being superseded?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: It is difficult to characterize exactly the time frame that this process takes. As a general matter, when a drawing reaches the site from Boston it gets logged in, gets reproduced, and gets distributed to the appropriate disciplines, and once it gets there, the process is to, if it is an E&DCR, put it in the appropriate location. If it is a drawing, change out the drawing. That can take typically a week or two at this point in the project. At various other times it has taken longer than that,

because of the volume and some other reasons.

Typically, today's drawing turnaround, it's a couple of weeks to process. I would note that if it is a matter of some urgency, in other words, if it were -- if the particular drawings in question are holding up the inspection or a final -- whatever the final work that needs to be done is, that process gets expedited by hand carrying through, but the typical process is a couple of weeks on the site at the present time.

JUDGE MORRIS: So we will assume there is some kind of distribution in that couple of weeks, and it might be quite long in some cases. Did you understand what I was saying? In some cases, it might take a month or two? Is that possible?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: I believe you are correct, sir. There are over 105,000 documents that are controlled on the site, and that process, the tail of the process, as you characterize it, might in some isolated instances take longer than the standard time.

JUDGE MORRIS: Is there a mechanism to assure yourselves that that followup actually is taken, the superseded documents are so marked?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: Sir, there are several

mechanisms that form that followup function. One is that the transmittals of these documents require someone to acknowledge receipt, and they signify that he has received them, and also put them properly into the files. Secondly --

JUDGE MORRIS: That relates to the new document, right?

WITNESS MUSELER: That relates to the new document or changed documents. Secondly, there are two auditing organizations, Mr. Kelly's and Mr. Arrington's, which audit that process. They audit not just the distribution process, but they, I guess, audit the end products. They audit the various files in the various disciplines to ensure that the latest revisions of the documents are in those files.

In addition to that, in addition to just distributing the documents, the logs or the weekly log and the monthly log are distributed to the various organizations that have to maintain these design control documents. So, in addition to receiving the documents, they also receive a log which tells them what the latest status of their files should be. So those are a number of mechanisms that ensure that that process does in fact work, and there is a lot of continuous auditing to keep track of that process and make sure that it is performed

properly, and that the files in the various locations are maintained up to date.

JUDGE MORRIS: Well, we may hear more about that some time later, but when a change is made in a drawing of, let's say, a pipe support, which is something that needs to carry a load of some kind, the design is done as you described before, in conjunction with an analysis. For example, using one of the STRUDL codes, one of the STRUDL versions, I should say. Is there a mechanism which flags the fact that the field change has been made which could affect the input to the calculation done by STRUDL?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: The input to the pipe support calculation, the pipe support design is the load that the piping system stress analysis indicates is going to be imposed on that particular pipe support. So, the load would remain the same unless the pipe support were moved to a different location.

JUDGE MORRIS: I would include that in a modification.

WITNESS MUSELER: If a pipe support were moved beyond the tolerances that are called for, then that in the process of approving either the revised design or the E&DCR, that would flag the stress analysis branch

that they had to address that particular question, that the load might change and it might affect other things in the stress analysis.

JUDGE MORRIS: How is that communication made?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: Sir, in the case of those that would have an effect on the stress analysis, the approval of that, either revised drawing or E&DCR would have to be made by the stress analysis division in Boston. In other words, that kind of a change could not be made without being submitted to that particular group in Boston for analysis and approval. Changes to the -- If you don't change the stress analysis, in other words, if the modification to the pipe support does not affect the stress of the line, and therefore the load on the pipe support, then that would be handled in the field generally by the site extension office.

JUDGE MORRIS: So someone at the site would make the judgment of whether or not there might be a significant change in the stress analysis were it made?

WITNESS MUSELER: There are specified tolerances within which the pipe support can be moved. It is a few inches. If you go outside of that tolerance band, it has to be approved by the Boston engineer.

(Whereupon, the witnesses conferred.)

JUDGE MORRIS: Did you want to add something?

WITNESS MUSELER: No, sir. I am sorry.

JUDGE MORRIS: Focusing now on the stress computer codes, the STRUDL series, they apparently get updated like most programs do. There is an initial STRUDL, a STRUDL II, and a STRUDL SW. When a change is made in that computer program, how is that documented?

WITNESS EIFERT: We have an engineering assurance procedure that describes our process for documentation of computer programs. The procedure provides for maintenance of a user's manual as well as qualification documentation for all of the computer codes used for engineering analysis. The changes that you referred to or any change to a computer code is documented in that support documentation of the qualification, as well as the source code itself. That is converted to machine readable language, and the qualification and user documentation upgraded to what is a new version of the program in effect.

So, any change to a computer program is given a new version or level. I might explain that we have been talking about STRUDL II, and there have been various versions and levels of STRUDL II applied, because each change comes out as either a new version or

a level. Version and level is a general characterization of -- well, it is significance of the change. Minor administrative aspects of the documentation, how the engineers input to the computer program, for example, I believe, would be indicated as a level change. If you were to add a significant new capability, analytical capability to a given program, that would be characterized as a version change.

STRUDL II has gone through several of those changes. I don't know how many, but they have gone through several of those. STRUDL SW is basically the same program, another version of STRUDL II. It was decided to name it STRUDL SW for reasons which are not exactly clear to me, but it was decided to put it in that terminology for the record and use purposes.

JUDGE MORRIS: If there is a change in the programming of this code that would result, for example, in calculating a different stress for a different component, how is it decided whether or not to redo the calculation?

(Whereupon, the witnesses conferred.)

WITNESS EIFERT: When the change is made to a computer code, as I indicated, the qualification document must be updated to be current with that change. The process of qualifying the new version or

level that includes the change provides for ensuring that the new method provides an adequate methodology and a program that will provide adequate results. The one practice that is used is a comparison of the output from the two versions in this case of the program.

The situation as you described it is not an expected, normal practice. If we were to identify in any way a concern with one of our computer codes, we have what is called a bug notice system whereby all the users of that computer code are advised that some concern has been identified and directed to evaluate the effect of that on any work that they have performed using that computer code. And that process in my experience with it has been used to identify such problems, but typically the problems have not been significant to any prior work, and if it did have an effect on prior work, the mechanism ensures that the design analyses that were used, that used those programs, were revised.

JUDGE MORRIS: Is there some feedback mechanism if this were the case to go from, say, STRUDL II Level I to Level II? Is there some feedback to the as built design drawing saying that the calculation has been updated or modified in any way?

(Whereupon, the witnesses conferred.)

WITNESS EIFERT: I am sorry. I am not sure I understand the question, Judge Morris.

JUDGE MORRIS: Well, let me turn it around. We discussed earlier, if there is a field change, that field change is reviewed to make a decision as to whether or not a new analysis is required, so if there is a change in the calculation that supports the field design, is the fact that there is a new calculation done, is that reflected back on the drawing?

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: I think I can -- I believe I can answer your question. The drawing itself does not reflect the particular calculation, but the calculation does reflect the drawing, so if the calculation were redone, it would reflect whatever the latest state of the drawing was, either the drawing itself or the drawing plus an E&DCR.

JUDGE MORRIS: I am groping a little bit here. I am looking for this hypothetical case where supposing this process had taken place, you had been Level I to Level II within STRUDL II, and it changed the analysis of the particular component, but then there was another modification made to that component, and the field judgment was that it didn't need another analysis because it was unaware of the second analysis back in

Boston.

WITNESS EIFERT: I think that the existence of various computer codes, different versions and levels, and in this case from STRUDL II to STRUDL SW, is being confused with a particular analysis or the set of analyses that support calculations. When a support is designed, the analysis is performed and the drawing is produced using the latest accepted for use qualified computer program to do that type of analysis. The analysis provides traceability to that computer program via either specific reference or through the run number and date which was the old practice at Stone and Webster.

It is necessary to change a support design that results in a need to redo the analysis. The analysis may be performed with the same program that was used for the original analysis, or it may be performed using the latest available -- it would always be performed to the latest available, excuse me. It would be performed to the latest available STRUDL computer program. The link for design traceability purposes for a given pipe support design is to the analysis and to the computer program that was used.

Our program for documenting qualified computer programs provides methods to provide -- to maintain a bank of computer programs that are available for

engineers to use that are fully documented and qualified.

JUDGE MORRIS: I guess what you told me before applies, that what triggers notifying Boston of a potentially required new stress analysis is whether or not the modification went outside of predetermined tolerance levels.

WITNESS MUSELER: Yes, sir.

JUDGE MORRIS: Mr. Eifert, you described the situation with STRUDL II as having been used to perform certain calculations, and STRUDL SW was being qualified. Did I understand that STRUDL II also subsequently became qualified?

WITNESS EIFERT: Yes, sir. That is how I described it. But I qualified that response to indicate that STRUDL II had been a program that has been used extensively by Stone and Webster, and we have always maintained test documentation, comparison computer runs as evidence that STRUDL II was providing accurate results. In the change to STRUDL SW, we provided additional documentation and qualification records to the Stone and Webster standard engineering assurance procedures, and they made additional comparison runs between STRUDL SW in comparison to STRUDL II to be able to administratively link the qualification documentation

of STRUDL SW to the prior version of the program in terms of STRUDL II.

JUDGE MORRIS: Is STRUDL II still being used, or would you now use SW?

WITNESS EIFERT: As a general practice, STRUDL SW is the program that is used. I believe there are occasions yet where STRUDL II has been used.

JUDGE MORRIS: But in those cases it is considered qualified?

WITNESS EIFERT: Yes, sir.

JUDGE MORRIS: Were there any substantive changes in the code itself, not the documentation, before and after qualification of STRUDL II?

WITNESS EIFERT: I didn't perform that, or develop STRUDL SW, but my understanding in the involvement that the engineering assurance division has had in the development of STRUDL SW, at least in the static analysis area, which is applied to the pipe supports, is that there have been no substantive changes.

To be specific to your question I would have to get back in contact with the people responsible for that program and confirm that, however.

WITNESS MUSELER: Judge Morris, I discussed the same matter briefly with some of the structural

engineering personnel, and they indicated that there was very little substantive difference between the two versions of the code, and the main differences go to a usability and certain capabilities of ways to manipulate it, but in terms of the answer that you get for a structural member, that they are very much the same. There is no substantive difference between the two versions in the results.

JUDGE MORRIS: So the fact that STRUDL II was labeled unqualified at a given period in time really didn't affect the results obtained using that code either before or after?

WITNESS EIFERT: That's correct. It did not affect the results in any way.

JUDGE MORRIS: There was discussion about the delay and the auditors discovering the problems, and I think the problem was the time of discovery was the time of maximum activity, and this, I guess, came some time after Stone and Webster had changed its engineering assurance requirements in terms of becoming more strict, as you characterized it. Were these more or less coincident in time, or were there a couple of years in between?

(Whereupon, the witnesses conferred.)

WITNESS EIFERT: Judge Morris, our program has

undergone many changes at the detailed implementation instruction level over the years. In 1978, with respect to calculations, that was the first year that we became very specific with respect to such things as identifying the source by the page within the source that contains the information being used in the analysis. That year is early or just before, I guess, the heavy involvement with the installation of pipe supports at the field. But that, I think, is just coincidental. Without giving it some greater thought, I see no connection there specifically.

JUDGE MORRIS: In describing changes taking place over time in the engineering assurance program, was there, I won't call it a step function, but a rather pronounced change at some time or other in the strictness of the requirements and related to the calculation or documentation?

WITNESS EIFERT: I think there were several changes over the years that affected, if I will, the administrative controls, and the early engineering assurance procedures provided, for example, that we have traceability as necessary, or identify documents as necessary to provide traceability. Some time, I believe, in 1973, or thereabouts, we added to that a requirement that when you reference another calculation

in a calculation, identify it by number.

In 1978, then, we revised it and gave very specific instructions with respect to such things as identification of texts and the need for more than just the author. The procedure was changed again in 1979. The procedure format was changed, and the information was presented different, but the requirement of that detail in effect was the same.

I think what we have seen in discussion of the problems with input identification reflects those changing requirements, as well as the interepretation of those requirements by the engineers and by the auditors. The fact that we have changed those requirements and provided different interpretations and clearer interpretations is in one sense the cause of the many audit observations that have occurred on that subject over the years.

JUDGE MORRIS: And what you call ready traceability, I was going to test you on clear and complete documentation as a description.

(Pause.)

JUDGE MORRIS: Do you want to respond?

WITNESS EIFERT: I assume you want me to. When I think of the term "complete" with respect to a calculation I relate more to the technical completeness

of it as an analysis.

JUDGE MORRIS: I was relating to traceability, what you term now -- what previously was called, I guess, positive traceability. You have been using the expression "ready traceability." And I was just asking almost as an aside whether the words "clear and complete" fit your concept.

WITNESS EIFERT: I think "clear" does fit with mine. "Complete" does with respect to documentation, but as long as you don't use the term "complete" in any way to indicate that there was lack of traceability.

JUDGE MORRIS: During the period, say, '78 to '79, what was the attitude of the engineers to the additional requirements imposed by engineering assurance?

WITNESS EIFERT: That is a difficult question for me to answer. I did not in that time period conduct any audits myself. I think that I can characterize in general form that the engineers characterized some of the stringent requirements with respect to such things as traceability as excessive, and for that reason, we have revised our training programs on calculations to emphasize more of the basis for some of these management requirements, so that they understand why management has imposed these requirements as contrasted with training,

which simply identifies the fact of the requirement and what is expected.

I don't want to give the impression that the engineers in any way considered their responsibilities for assuring the technical adequacy of the work as being in any way excessive. Some of the administrative details that indeed they feel are more administrative and rightly the responsibility of the administrative staff is the requirements that I was referring to.

Currently at Stone and Webster what we are doing is working with just that, our administrative staff, the supervision and management of the division administrative staff, the people who staff the projects, the administrative people responsible for maintaining files and controlling distribution and maintaining records, with the intent being to see if we can allow them to assume more responsibilities for some of these administrative requirements, not only in calculations, but our discussions have been primarily with respect to calculations, to see if we can relieve the engineers of some of the responsibility for this detailed administrative control.

We haven't made any final conclusions there, but it looks like we will probably within the next year be changing the process somewhat to give that

responsibility to the administrative staff on the project.

JUDGE MORRIS: So you might characterize it as some resistance on the part of the engineers to spend a disproportionate amount of their time on administrative details as opposed to engineering?

WITNESS EIFERT: Yes, that is how I would characterize it exactly.

JUDGE MORRIS: And your group, the engineering assurance division, has attempted through training sessions to show the reasons why this is important, why management thinks it is important?

WITNESS EIFERT: That is correct.

JUDGE MORRIS: What sort of support do you get from management in this effort?

WITNESS EIFERT: Total support.

JUDGE MORRIS: Do they participate in some of these training sessions?

WITNESS MUSELER: Judge Morris, management does participate in some of these training sessions directly. But perhaps a more definitive example of how some of these requirements are promulgated can be made by stating that in certain cases -- and I can't name you the exact cases right now, but I do know that in some cases the Stone & Webster project engineer, if it were a particular discipline, would have the discipline engineers in that discipline on the project, get them together, and explain why the process needs to be done a certain way. So that hopefully that engenders some motivation that way.

But more importantly, perhaps, it tells the appropriate people that that's the way they are going to do business. Now, sometimes that has to be told several times before the condition gets to the point where it is deemed to be acceptable. But I know that process does go on and I know that the engineering management in Boston does enforce those requirements on the people who work on the project.

JUDGE MORRIS: I believe, Mr. Eifert, you referred to the fact that things are getting better. You split things one-third and two-thirds, I believe, before and after some period. Do you still see an improving trend or are things beginning to level out or

drop off exponentially?

WITNESS EIFERT: I would characterize it as still seeing an improving trend. I think that our efforts this year, if we're successful in relieving the engineers of some amount of the administrative responsibility, following that we will see greater degrees of improvement in the short term.

JUDGE MORRIS: Let me ask one final question. If there had been no engineering assurance audits, if that function didn't exist in Stone & Webster, would these differences between design and calculational support have been caught in the normal process of Stone & Webster's activities or LILCO's activities?

(Panel of witnesses conferring.)

JUDGE MORRIS: I recognize the answer has to be speculative because of the conditions I put on the question. But I am looking to see if there were mechanisms which would have been operative.

WITNESS MUSELER: Sir, all the ones we have reviewed, I believe that the vast majority, if not all of them, would have been picked up in the normal course of the engineering process. In the specific case of audit 120, that particular situation would have been the subject of review in the final stress reconciliation program which is going on at the present time.

I can't say that specific one would have been reviewed this way, but in the ones we have reviewed and in that particular one because of the stress reconciliation program, which is not mandated by engineering assurance, they would have been subjected to the kind of review that most probably would have determined the same things that the engineering assurance audit did.

JUDGE MORRIS: Can you describe that program in about two sentences?

WITNESS MUSELER: Well, I guess I'll try to use two examples, one being EA audit 120 and the other being one of the other examples that we used before, the first one being --

JUDGE MORRIS: I mean the stress reconciliation program.

WITNESS MUSELER: The stress reconciliation program, yes, sir. In the stress reconciliation program, it's really composed of two parts. One is getting the as-built condition of the piping and the pipe supports. The other part is getting all the other input data to that particular design problem, whether it be a line operating parameter, a system operating parameter, the latest earthquake loads, the latest Mark II loads, whatever the inputs to that particular design

are; making sure that the latest proper inputs are identified, compared with the latest as-built physical information, and then looking at the last time the analysis was done, and taking all these parameters, all the input parameters, as well as all the as-built parameters and saying, do these all match up, and if they don't match is there a need to redo the calculation?

Again, there is some judgment in that process. If something is an inch or two off here, the calculation would not be redone. But if there is anything substantive that would affect the output of the calculation, it would be redone at that point in time, and that would include such things as we talked about in audit 120, of a six-inch difference of a member between the as-built condition and the last as-stressed condition.

JUDGE MORRIS: What is the scope of applicability? Is it all systems, structures and components in some class or other?

WITNESS MUSELER: The stress reconciliation program covers all of the safety-related piping systems and pipe supports, and a large portion of the non-safety-related pipe supports and piping systems, the ones that are thermal, the ones that require seismic

analysis. There may be some domestic water systems, for instance, that would probably not fall into that category. But all of the power systems in the plant, the rad waste systems, and the ASME systems, would be included in that review.

JUDGE MORRIS: Thank you, gentlemen. I do think I have a better perspective on what we are talking about.

JUDGE BRENNER: Some of those questions were for my benefit, and I guess I still need some more help. Could you explain to me again, Mr. Eifert, what Stone & Webster has identified as the cause of the problem in audit observation 120?

WITNESS EIFERT: The primary cause is that the field changes that have been made and documented on the E&DCR's and the judgments that were made by the engineers with respect to the need for revising the analysis to support the revised design, the situation was that the engineers were making those judgments, as indicated by their approval of the E&DCR's, and indicating that the analysis was adequate as documented.

The judgment of the auditor was that the changes may be sufficiently different than the design that the analysis was based on that an analysis revision

was also necessary in addition to the design.

JUDGE BRENNER: The situation of engineering judgment being applied to whether field changes should result in redoing calculations is not unique to this pipe support area and the STRUDL code, as I believe you stated earlier today, am I right?

WITNESS EIFERT: That's correct.

JUDGE BRENNER: Yet you also stated that -- and I am paraphrasing, and please correct me if I am doing it wrong. I believe you also stated that there were no other situations in which the calculations differed from the design, and I don't understand how that can be the case.

WITNESS EIFERT: I may have worded it that way. If it was, I didn't specifically mean it quite that strictly. What I intended to say was that in our audits -- and we have audited the other disciplines as well -- we have not had any findings, therefore any concerns, with respect to the calculations that support the design.

There may be situations, and I'm sure there are situations, where changes have been made and judgments made that the analysis did not need to be revised. When my auditors, if they looked at those areas -- and I'm sure we did in some cases -- we didn't

question the judgment as being less than 100 percent accurate.

In the case of pipe supports, it was the relative significance of the change with respect to the STRUDL model versus the design that the auditors questioned, whether or not it was reasonable to accept those changes based on judgment without the analysis.

JUDGE BRENNER: When a judgment is made that a calculation need not be rerun for a particular change, whether it be a field change or some modification in the design, but before it is actually built, is there any indication for the source of input to the calculation noting that there is this discrepancy, even though the calculation is not in fact rerun due to the engineering judgment that it need not be?

(Panel of witnesses conferring.)

WITNESS MUSELER: Judge Brenner, excuse me. Could you repeat your question, please?

JUDGE BRENNER: I will state it differently, if that helps. And if it doesn't, I'll go back to the original phraseology.

If the situation is that a calculation has not been rerun because an engineering judgment was made that, although there was some change in the design, it is not such as to require that the calculation be rerun,

would somebody referring to that calculation have a direct positive expressed indication that, although that is the last calculation that was run, it doesn't reflect the current design?

(Panel of witnesses conferring.)

JUDGE BRENNER: Maybe it doesn't reflect the current design. Maybe that's ambiguous. It doesn't include the same input as the calculation was run as the design condition currently existing.

WITNESS MUSELER: I think we understand your question.

(Panel of witnesses conferring.)

WITNESS EIFERT: Judge Brenner, before I forget, the first point is, a calculation is a basis for determining some conclusions that are the basis for design. So a change that is made to the design that is looked at back to the conclusions of the analysis is not, at least in our accepted terminology, considered as an input to that analysis.

Typically, when -- if we wanted to make a change to the detailed design, the inputs have remained the same, our procedures do not specifically require that each time an engineering judgment is made on a matter such as this that that be specifically documented in the analysis. Our procedures require that all design

changes be reviewed and approved, either by means of a drawing revision or an E&DCR, and in the case of drawings there are many such changes that would have to be made that would, I believe, be clearly within reasonable judgment without any specific documentation of the thought process.

In many cases -- and I'm really going back in my own memory now -- a conclusion from a calculation might, for example, give the minimum or provide the basis, at least, for the minimum dimensions or member sizes for structural steel. If there was a need -- the design then is based on that analysis and would pick some standard member size that would be acceptable within that calculation.

A field change that would change the member size would not have an effect on the analysis unless it was in some ways less than the sizes established in the analysis. So it would not be common practice or efficient practice in any way to expect for each judgment decision that is made in that case to go back and add what I believe in many cases would be confusing documentation to the analysis itself.

WITNESS MUSELER: Judge Brenner, I believe, though, that this is a case which sort of gets to one of the subjects we've been talking about, and that is

traceability versus ready traceability. I believe that it is possible for someone to look at the documentation that is available and determine whether or not the calculation did have a design change made to it without changing the calculation later on.

For example, if the original calculation were made only on the basis of the design drawing, the BZ drawing in the case of a pipe support, and that's the basis of the calculation, the calculation will say that it's based on drawing XYZ. If at a later point in time an engineer were to change that design and it were of such a nature that it was by engineering judgment determined that the calculation did not require any updating, the calculation sheet will remain unchanged. It will reflect only the original drawing number.

If someone wanted to know whether or not the final as-built condition of the drawing had any changes made to it subsequent to the calculation, that would be easy to determine by looking at drawing logs. If the calculation only indicated the base drawing number and the drawing log indicated that there were more E&DCR's against that, you could double check it by looking at the dates, but just the fact that there were E&DCR's listed and the calculation listed only the base drawing, that would indicate that there were changes made to that

design subsequent to the calculation.

So I believe this is a case where someone could find out whether those judgments were made. It would take a little doing to do that, but I believe that I've been sitting here and I can't think of a case where we would not be able to do that one way or the other. So it could be done, but it's not "readily doable."

JUDGE BRENNER: Is that in fact what the auditor did in audit observation 120, item 4? How did the auditor know about that discrepancy? I assume the auditor had to take the latest BZ and then go back to the calculations, since you've now told me that just by looking at the calculation the auditor would not have known that the calculation did not reflect the latest either design or as-built condition.

Am I understanding that right?

WITNESS EIFERT: I'm not sure which way the auditor approached the audit. The concerns reported in that audit could have been identified if the auditor was looking at a specific analysis and then went into the drawing file and established the latest design for that support as reflected in that analysis and identified the differences at that point.

The auditor may have selected some up to date drawings, the latest drawings, including any F&DCR's,

for a given support and then gone back into the calculation file to find the calculation of record, and then compared to see if there were any differences. Either way, he could have identified that type of problem if it existed.

JUDGE BRENNER: I want to go back, Mr. Eifert, to your straightening out my terminology on the use of the word "input" because it may reflect a misunderstanding on my part. The reason I used a description, something like the design input to the calculation -- and more directly, I was thinking of a design input into the STRUDL run -- was that I thought that was the problem in this audit observation, that the latest design condition is an input into the STRUDL run and that the run actually made did not have the up to date input.

So is that a wrong understanding of what happened?

WITNESS EIFERT: In that context, the design would be an input to the STRUDL model. If I can explain, the way I use the term "input," if I had the task of designing a pipe support I would have to obtain certain information before I can start, specifically what load the support will be required to carry. And I go to the pipe stress summaries for that, the material

properties and requirements, and I will go to the specification, the Stone & Webster specification, and find out what standard materials are being specified and used for pipe supports.

I have that basic design information. I then know that I have to put a support, and the stress summary also will indicate where the support is located. And I am then designing the support.

Finite element computer analysis requires that you do input the actual configurations. So I design that support conceptually, if you will, and then model it and analyze it by computer to see how well I did with my conceptual approach. In that sense it is an input to the analysis, and I think you have a proper understanding of that as you described it.

JUDGE BRENNER: Okay. The only reason I asked is not to split hairs on definitions, but to see if I'm conceptualizing this correctly.

WITNESS EIFERT: I think I confused that. I'm sorry.

JUDGE BRENNER: I want to see if there's a link between this problem in audit observation 120 and the traceability or ready traceability of calculations. And this morning you distinguished the two problems, particularly referencing, I guess it was, audit 30. You

don't need to look at the particulars of that, but you referenced that as a traceability problem to be distinguished from this problem.

As I understand, the reason why management and you are interested in traceability of calculations -- and basically what you're trying to explain to the project engineers as to why they should assist you in this interest -- is that some years from now after the engineers, however good they are, have their memory somewhat dimmed, if you have to go back to look at that calculation, to see if some change is important, you want to be able to identify what went into the calculation in order to, I guess, see what the sensitivity of the result originally is to this latest problem or concern or whatever, five years from now. Is that essentially right?

WITNESS EIFERT: Yes, sir. That is an appropriate characterization of management's concern. The number of years that goes into designing a power plant, we do have some personnel changes and it makes our overall engineering process at Stone & Webster more efficient. In that sense, it makes us more competitive in the architect-engineering world.

In addition and almost more importantly, it provides a product to our clients that they can readily

use. For example, where our client is going to use his own engineering staff during the operating phase, the documentation that is readily usable by his people, without having to have a total and complete understanding of the Stone & Webster design process and documentation process that was originally used in the development of the Shoreham design.

JUDGE BRENNER: Just a few minutes ago in our dialogue, however, you told me you didn't think it was necessary for the calculation to -- and in this case we were talking about a calculation that includes a computer run, a STRUDL run -- you didn't think it was important, and therefore I infer not necessary, for this traceability concept for possible future use, for the calculation to include some notation that it was not, when last run, it was not run for the current as-built condition, because the engineering judgment was applied, and I am assuming validly, that the calculation, the results, would not have been changed and the calculation need not have been rerun.

WITNESS EIFERT: The difference in the two situations, the records that are being generated, including the records that will index the pipe support designs and the records that will index the calculations, will be available at a later date for the

people who are going to or who may need to modify the plant.

They will be able to identify the calcs and the drawings. In that sense, they have ready retrievability of the design information. If an experienced engineer, pipe support design engineer, then looks at the analysis and the support design, okay, he will be able to readily see any differences and apply his experience and judgment to understanding those differences.

So it's a different characterization with respect to how a design and a calculation would be used as compared to, if he needs to modify that analysis, being able to trace back to other documents that provided input data that the engineer used who was performing the analysis.

JUDGE BRENNER: Well, maybe this will help me. Maybe it will confuse you, and I'm sorry if it does, but feel free to tell me if it does. As a hypothetical situation, suppose in the future some error is discovered in either the STRUDL code itself or the way it was applied at power plants in general, including Shoreham, and therefore some review has to be made to check the effect by some sort of, I suppose, preliminarily a sensitivity analysis to what the

previous results were, to see if actual physical modifications are necessary or whether you still have enough margin and therefore no physical modifications are necessary.

In making that review, would the reviewers pull out the old calculational results and take a look at those results and say, oh well, there's plenty of room, this error won't amount to anything, in ignorance of the fact that those results were not actually run for the present as-built condition?

WITNESS MUSELER: No, they would not do it that way. What they would do would be to assemble a package of all the appropriate design documents, the latest calculation and the latest as-built design drawings of the plant. So they would have in front of them the as-built configuration and the as-analyzed condition, if it happened to be different because of an engineering judgment that had been made.

So if they reran it, they would -- if they had to rerun it because a glitch came up in the codes at some time in the future, they would rerun it the vast majority of the time, unless there was some specific reason why they would run it without using the as-built condition, they would run it with the as-built condition, because in fact that's the way the plant is

and that's what you would want to ensure is okay.

So they would not just review the calculation. They would review the calculation plus the latest as-built documents, as-built design drawings, and/or E&DCR's of the plant.

JUDGE BRENNER: Tell me again how they will fairly easily know that the last application of the calculation, which includes that STRUDL run, does not reflect the current as-built drawing?

WITNESS MUSELER: They would know because the package of as-built information, if it were -- and it would be the same drawing number. If the revision of the drawing listed on the calculation -- and the calculation would list the revision of the drawing that it was done to -- if the latest as-built information listed a different revision to the drawing or E&DCR's and any kind of change document that indicated that there was a change made from the drawing listed on the calculation, that would tell them that the as-analyzed condition was somewhat different than the final as-built condition, and they would take that into account.

JUDGE BRENNER: Okay. No longer on that hypothetical, but back in the present time frame, as I understand it there are therefore situations where it's perfectly acceptable for the drawing referenced as the

source of data for the calculation not to be the latest drawing, because the engineering judgment was reached that the calculation need not be run, correct?

WITNESS MUSELER: Yes, sir, that's true.

JUDGE BRENNER: How does auditing this situation distinguish such a situation from a situation where, through inadvertence or error of some sort, the latest as-built drawing was not encompassed in the calculation when it should have been, or else because it was not the result of a soundly reached engineering judgment not to do it? There are a lot of negatives in there and I can repeat it if you need it.

WITNESS EIFERT: I can speak with respect to our engineering assurance auditors. We have engineering assurance auditors who are qualified graduate engineers, who can understand the process and the judgments that people have to make and make their own judgments with respect to how well that process is being implemented.

In the case of many of the technical subjects, we have our auditors, who have attended special technical orientation and training programs with respect to how work is done in the industry, as well as specifically at Stone & Webster. So in some respects our auditor is doing the same function on an audit basis that the calculation preparer or the engineer who is

approving a design change is going through. He's going through the same engineering thought process in judging how well the engineers are making that judgment.

JUDGE BRENNER: Let me interrupt you and then if you want to come back to it I'll let you, because I probably didn't ask my question clearly. I'm not worried, for purposes of that question, as to whether or not the engineering judgment was reached correctly. I am contrasting a situation where no engineering judgment was applied to reach the conclusion that the calculation need not be rerun, but rather through some error it was never considered expressly as to whether the calculation should be rerun or not.

And I'm wondering how the auditor knows that, since the discrepancy will appear to be the same in both situations by looking at the calculation. Maybe it's a sideways way of asking.

Again, more precisely, how is the fact that the engineering judgment was made not to redo the calculation, how is that documented and where is that documented?

WITNESS EIFERT: I think, as we have indicated, in the case of audit observation 120, the BZ drawings that may have been revised or the E&DCR's that changed support designs were reviewed and approved as

those changes being acceptable. That is the documentation we have with respect to this process, that the judgments were made.

WITNESS MUSELER: Judge Brenner.

JUDGE BRENNER: Let me follow up on one point. In the course of that, does it state reasonably expressly that the calculation need not be rerun to support this or some thought to that effect, in the course of approving the E&DCR and ultimately the drawing change?

WITNESS EIFERT: I don't know, Your Honor.

JUDGE BRENNER: Mr. Museler, I didn't mean to cut you off forever, just for that second.

WITNESS MUSELER: What I was going to say, Judge Brenner, was that, as we discussed in audit observation 120, an auditor looking at that process is looking at items that are what I will characterize as small changes from the structural size of the members that were included in this, and he raised a question as to whether or not there was too much latitude being employed in engineering judgment.

In the course of finding a situation where a change was made that was a significant change and the judgment was not applied to it, what the auditor would be looking at is not evidence of whether the judgment

was made or not. What he would be looking at, a major change versus an as-analyzed condition that differed substantially from that change, and that's how he would determine that something had been done, and he wouldn't know at that point whether the judgment was incorrect or the judgment has been applied. But that's how he would surface the facts of the situation.

JUDGE BRENNER: Yes, I understand that. It occurred to me that an ostensibly small change might bear closer review by an auditor if there were the absence of a normally present indication that somebody had expressly considered whether to redo the calculation and had reached the judgment that it not be done. But not everything is written out in life, as we know.

On your last point, though, Mr. Museler or anybody else, that is the latitude in engineering judgment not to rerun the calculation, how did the situation come about in audit 120 where the auditor disagreed with the engineering judgment not to rerun the calculation, if there are these fairly clear guidelines that if it's more than a few inches it has to go to the Boston office for approval and is looked at then, and so on?

WITNESS MUSELER: Sir, the tolerances I was referring to are the tolerances on the location of the

pipe support relative to the piping systems. And the analysis that is affected by that parameter is the piping stress analysis, not the structural analysis of the support itself.

Those specific types of guidelines do not apply to the structural design and the structural analysis of the supports themselves. The supports themselves have a lot of members that all have a tolerance on the drawing, and there are a lot of ways to orient structural steel to take the same load from one pipe.

So in the particular case in audit 120, it's a much more judgmental situation than the case of the location of the pipe support along the piping line itself.

JUDGE MORRIS: Just as a matter of curiosity, Mr. Museler, what is "TS 4 by 5 by .5," if you know?

WITNESS MUSELER: I believe it is tube steel 4 by 5 by a half-inch wall thickness. So it's a piece about this big in cross-section and a half-inch wall (Indicating).

JUDGE MORRIS: Thank you.

JUDGE BRENNER: I think I have your answer, but just to make sure, where there are some quantified margins on the engineering judgment before it has to be

reported to Boston relates to the actual pipe stress analysis, and you then have to look as to whether this change and where you are placing the support affects, I guess, the new pipe run in that case.

WITNESS MUSELER: That's correct, sir.

JUDGE BRENNER: I'm not going to worry today about which version of the NUPIPE they looked at.

That's all I have. Thank you very much for helping me.

JUDGE CARPENTER: I would just like to ask a couple of questions, also in the spirit of trying to see the forest, given the leaf of audit inspection 120. I think that's why we're having so much trouble, trying to see so far based on this tiny example.

As I understand your testimony today, seven percent of the pipe supports calculations have or are being redone; is that correct, or that seven percent that have been looked at, that's the 1800 out of the 25,000?

WITNESS MUSELER: As a result of audit observation 120, 1800 of the pipe support engineerings were redone, that's my understanding of the situation. Many more of those calculations have been redone over the course of time for the normal process of changes that have occurred to the plant. But relative to this

particular situation, it is my understanding that 1800 of the calculations were redone.

JUDGE CARPENTER: Coming back to the contention in the sense that the design review needs to be done, can you give me crisply what criteria did you use for selecting the 1,800 out of the 26,000? Why not do the whole 26,000? What is the basis? Was it a numerical standard?

WITNESS MUSELER: It wasn't a sample, if that is what --

JUDGE CARPENTER: No, I say, was it a numerical standard?

WITNESS MUSELER: I am sorry. 16,000 of the pipe supports are small bore pipe supports, which are designed under a completely different method, so they are not applicable to this particular problem, so this particular problem was a large bore pipe support problem applicable to this type of situation only. Now, just give me a moment and I will see if I can come up with an answer that will make it clear.

(Whereupon, the witnesses conferred.)

WITNESS MUSELER: Judge Carpenter, some of them wouldn't have required reanalysis because they were not -- because the actual physical situation was exactly the way the analysis was done. That is one class that would just not have been looked at. Another group would have been done at some point in time and not fall into

the same kind of problem. A number of them, when they were looked at, would have been judged to be within the bounds of engineering judgment.

For instance, if a number of them were found to have dimensional differences of an inch or two in clearly non-sensitive areas, those would not have been redone, and I don't have how many were in each one of those categories for you. What we were left with was the number that were judged to require recalculating because the numbers were judged to be potentially on the outside of that acceptable band, and it turned out that there was some small number that did fall outside the band, but it was very small. It was about 1 percent of the 1,800 that we judged we did need to take another look at.

Again, let me emphasize that through this program and the stress reconciliation program, all of the pipe support calculations have been looked at again subsequent to this point in time.

JUDGE CARPENTER: What do you mean, looked at?

WITNESS MUSELER: Either compared, either the calculations compared with the as built condition and any other changes that have come along and said that this does represent this because there is no reason to

redo the calculation or the calculations have been redone. Thrown into this particular situation is the fact that the stress analysis itself has been changing over the years, so the input parameters which obviously would also cause a change in the calculation have been changing. So that automatically triggers a redoing of the calculation with the latest as built conditions.

JUDGE CARPENTER: I hate to belabor it, but I am still having trouble with the testimony before lunch, which indicated that there was some surprise that out of this 11,000 supports there were some that needed to be looked at again. I would have thought in any big project like this one would expect that. Can you give me some -- I am trying to get a feel now for why this reaction.

WITNESS MUSELER: The reaction you may have observed was -- it is not a surprise that we have been continuously engaged in redoing pipe support design and pipe support calculations. That is not a surprise at all. And the number of calculation redos or the number of times we have repeated calculations and repeated stress analyses is large, and that is not surprising given the changes in the design criteria, the MARK II loads, earthquake loads over the years, and various system transients, and how transients in the plant are

defined. All of that affects the input parameters. So it is not surprising at all that we have redone the pipe support calculations the number of times we have.

It is surprising to me as an engineer -- well, let me say it is not surprising to me that this particular situation revealed what it did, that is, that we had some very small number of pipe supports that required a minor modification. That is what I would have expected. I would have expected that somewhere in the process of applying these engineering judgments that there might be a situation where we ate up the margin a little bit and had to make some small changes, but again, it would have been surprising to me if any of these affected the actual capability of the plant, and none of them did.

So, this particular situation doesn't surprise me. If we gave you that impression, the outcome of this doesn't surprise me. The fact that we had to do it in this particular case, I think, is just an example of the kind of added evaluations of the engineering process that goes on today, and it is a result of the engineering assurance program.

The outcome is not surprising. The outcome, I think, indicates that the judgments were really uniformly correct, that the plant was okay.

JUDGE CARPENTER: Mr. Museler, I can't believe that you are going to have meetings with management about routine situations that you are not surprised about. I still don't have this thing in perspective. You see, I am looking at the leaf here when I am pointing to Audit 120, and I am trying to see the tree, which is not the whole forest of 11,000 pipe supports, but I get the feeling that the field judgments were on the edge for some period of time, perhaps associated with either administrative policies or individual that led to this review, and I can't get anybody to tell me that. I keep sitting here trying to guess that.

WITNESS MUSELER: I would not say that the field judgments were on the edge. I think the field judgments as borne out by what the results of this show were on the conservative side. The judgments that were made that said, if I change this particular number, then I have over the required margin, I have 100 percent margin, and in addition to that that I might use up some amount of that, those judgments were not marginal judgments. They turned out to be 99 percent accurate judgments based on what this shows.

In 99 percent of the cases we did not eat into the allowable margins. In 1 percent of the cases, we did eat into the allowable margins, but never got to the

point where we used up those margins, and I think that indicates that the judgments that were being made were not on the edge of being non-conservative. I think they were in the main conservative judgments.

JUDGE CARPENTER: Well, one last question, since it is late in the day. I keep seeing this reluctance of people to sign their names. You have tried for ten years to get people to sign instead of print their names. Is this an emotional characteristic of engineers? We are not supposed to look at the -- I mean, there are pages and pages of auditors hammering on people to sign their names. Is there something substantive that I am not aware of in terms of legal responsibility, that some people have illegible signatures and they insist on printing? What is this all about?

WITNESS MUSELER: Sir, I have been trying to think of a useful analogy for what is going on in this particular area in the ready documentation, as we have characterized it, of input source documentation. I think it is something like what happens when, if you build a house yourself, and you build the house, and you presumably have designed it correctly, and you build it, and you put it up, and you even paint it, and you get to near the end of it, and in the living room you have

finally exhausted all possible energy you may have, and you didn't put the trim up, the molding up in the living room.

I think that your wife will never let you forget that the molding isn't up there, and you will hear about that every day until the molding is up there. I don't mean to make light of the situation, but when you asked Mr. Eifert before as to how the engineers used this, I am afraid that that is in many cases how the engineers viewed it, and just as your wife will never let you forget that that has to be done, and it will get done, wives are better than Mr. Eifert's people, but they are persistent, and they will make sure that that molding gets up there, and I really believe that, and that is the kind of situation we have been talking about in the case of the ready traceability and the name printing instead of the name writing.

JUDGE CARPENTER: I am curious as to why either printing or regular signature isn't acceptable.

WITNESS MUSELER: So am I, sir.

JUDGE CARPENTER: Obviously, there is an administrative reason.

WITNESS EIFERT: I don't recall the reason. That was an early requirement in the program. I suspect somewhere along the line someone thought that for purity

of documentation, a signature has more weight than a hand lettered. I think hand lettered was what the procedures in the early days said, not just printed, thinking in terms of more drafting lettering as identification.

JUDGE CARPENTER: Going back to the county's contention of a pattern, certainly there is a pattern in the material we have been looking at in the last three days over ten years of failure to develop this, and I just wanted to be sure I was not missing the point if there was some very serious reason that you felt printed identification was not acceptable vis-a-vis a signature.

WITNESS EIFERT: No, sir. There isn't any serious -- I am confident, and I have been a part of discussion that we have had in interpreting regulations that what the regulations require is identification of who did the work, who reviewed the work, and certainly the printed would provide that identification and signatures would not be a significant difference in any way. That was a change very early in the program.

JUDGE CARPENTER: They do confuse the audit score sheet quite substantially.

Thank you very much.

JUDGE MORRIS: Judge Carpenter, for whatever

it is worth, when I visited Indonesia, I found my name in a visitor book at a reactor site. My host said, my goodness, I can read your signature. It is unheard of in Indonesia.

JUDGE BRENNER: I don't know what to say. I was thinking that Mr. Museler is a brave man with some of his analogies. I am sending a copy of this record home to everyone's house.

(General laughter.)

WITNESS EIFERT: I don't want one.

(General laughter.)

(Whereupon, the board conferred.)

JUDGE BRENNER: I know it is late, but I would like to ask some preliminary questions with respect to the status report on emergency planning Phase 1 contentions dated today and provided jointly by the parties. And these are preliminary questions. Don't take them as an indication of any quick thought. I just thought the quick answers might help us in our deliberations.

As I recall the staff's final report of its on-site analysis is going to be out October 1st. Is that right, Mr. Black?

MR. BLACK: That's correct.

JUDGE BRENNER: All right. Received on that

date.

MR. BLACK: Yes, sir.

JUDGE BRENNER: With respect to the contentions listed in the report for which settlement is being pursued, there is no other date indicated. Do I infer that the parties are asking us to wait until October 12th, the present date of testimony, to find out if they are settled or not?

MR. REVELEY: We are proceeding on the assumption, Judge, that they will either be settled or we will file testimony on them, and that provides quite an incentive to get on with it, and we think the county should be equally inspired. Thus, you will either get testimony or settlements on the 12th, so far as we know.

JUDGE BRENNER: That is acceptable, with one footnote. For example, Contention 7, I believe, and maybe one other in the order -- I haven't reread our order in the last few days, the order admitting the contentions -- required also by September 21st that we receive a further specification of the contention, and the reason for that was that if the contention is not in fact settled, we imposed the requirements for the reasons expressed in the order that parties get some further specification prior to having to finally

complete their testimony and file it on a subject.

So, I hope the parties are alert to that little footnote. That is, it sounds like you are proceeding okay, and I am willing to let it go, but protect yourself and also our interests as expressed in the order against running into a situation where a contention, and I can think of at least one, but I think there is another, where we have required further specification suddenly is neither settled or specified, and the date for filing testimony is upon is.

MR. REVELEY: That is a problem on more than simply Contention 7. There has not been progress on that front as yet. We are thinking about sending the county some written questions to see if that can spur the process. It remains something of a dilemma at the moment.

JUDGE BRENNER: Well, Mr. Lanpher, as far as we are concerned, we opposed today as a deadline for those. I know you are not deeply into emergency planning, but you are somewhat cognizant, and that deadline is today, and we have received no requests for extension.

MR. LANPHER: Judge Brenner, I am going to have to just find out if that slips through the cracks or what.

JUDGE BRENNER: All right. On the other hand, I am reluctant to say you are late, get it here tomorrow, if you are on the edge of settling the contention. There could be give either way, but I guess I want another very tight interim date for those, so that the matter doesn't drift until the time for filing testimony. So, if you could consider that, and then the parties talk among themselves.

MR. REVELEY: It might be fruitful, Judge, if there were an interim date set by which the parties were told either to settle or let the board know that settlement was not going to occur.

JUDGE BRENNER: Today was the date we set, so come back and propose another date.

MR. REVELEY: We will do that.

JUDGE BRENNER: And no later than the 28th sounds reasonable, unless the parties jointly believe they are so close to settling it that we should not impose that date. We will wait to hear from you, and as I say, we will come back later this week on emergency planning in general.

The board can use a copy of the final staff draft report. I neglected to bring mine with me. I did receive it in the office last week, and I hope somebody has a copy available up here that we can get first thing

tomorrow morning.

MR. BLACK: That shouldn't be labeled as a draft report. It is the final confirmatory action letter.

JUDGE BRENNER: Okay. Thank you.

MR. BLACK: I do not have a copy of that with me.

MR. REVELEY: I think I have got one. I will check and see. If I do, I will provide it.

JUDGE BRENNER: All right. If the cleaned up version is not available, I will go with a marked up one, if anyone has that here.

MR. REVELEY: I am pretty sure I have one.

JUDGE BRENNER: Judge Morris says he thinks he has a copy of that earlier one.

MR. LANPHER: Judge Brenner, could I inquire? The board said you were going to address emergency planning in further detail later this week. Is this something that I should ask for my colleagues to be here for? I would be happy to do that, but just for planning purposes, I would like to know.

JUDGE BRENNER: Are they going to be in these parts anyway?

MR. LANPHER: I never know where my colleagues are. They were up here today on matters, and

yesterday.

JUDGE BRENNER: I think it would be useful if they are going to be here anyway, but the discussion is not going to be so extensive, and I think my comments here will tip you off. Basically, we have to rule on whether to extend the date for the filing of testimony on the contentions which the county claims have reasonable potential to be affected materially by the staff's on-site review, and therefore by the final report. I think that is the only thing before us immediately.

MR. REVELEY: It was not my understanding that the county meant by that reference to suggest that at least three of the four, and I believe there are four, or five, might not settle. I think the county was reserving its rights, as I understand it, to argue whatever it wanted to, but that the settlement process continues on all of those except, I believe, 14-C.

JUDGE BRENNER: You have anticipated my next question. It wasn't clear to me whether the county was asking for a later date for the filing of testimony, and I perceived some anomaly between that possible request, which was not expressly in here, and the fact that settlement will either take place or not take place by October 12th.

MR. REVELEY: This is all hearsay, of course, but I asked exactly that question this morning when I read this thing. What does "wrong with two" mean? And the answer I got, not directly from the county, was that it did not mean that settlement was not likely, feasible, et cetera, as to all of them, except 14-C, but obviously the county will have to speak for itself.

JUDGE BRENNER: All right, Mr. Lanpher. Maybe we can save your co-counsel a trip unless they are here anyway. I guess the question comes down to whether the county is asking for an extension of the filing date for testimony for 14-C. And if so, how much later, assuming the staff report is received as scheduled on October 1st? If I am wrongly limiting the question only to that contention, feel free to tell me, but I think when you look at the report you will see why I am limiting it to that contention.

So, right now, with the exception of that contention, unless we hear arguments to the contrary that we have misunderstood the situation, October 12th is the receipt date for the Phase 1 emergency planning testimony other than those that are, of course, settled, and we also need to hear about an interim date for specification which we had required be done by today, the idea of the interim date being that if there is no

settlement there would still be enough time between that specification and the filing of testimony, and we thought that three weeks would be about the right amount of time, which would be today. So now it is going to get compressed, and we are willing to adjust. I would have preferred a request for extension.

I won't go beyond that. We say a couple of things about the time period in the discovery order also. All right, if we could get the answers to those questions tomorrow or early Thursday, that would give us a chance to contemplate matters if we need to issue a ruling, and by that time we will have reviewed the staff's status report and the Contention 14-C and decide what to do about that. Now, if there is agreement on a date for filing 14-C, we will be happy to hear about that sooner rather than later also.

Okay. It has been a long day. I guess I told the witnesses they could go, but I am sure they have been fascinated by the last 15 minutes. We do thank you for a long day. It has been warm in here for all of us, and probably particularly for the witnesses.

We will be back in this room at 9:00 o'clock tomorrow morning.

(Whereupon, at 5:25 p.m., the board was recessed, to reconvene at 9:00 a.m. of the following

day.)

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: September 21, 1982

Docket Number: 50-322-OL

Place of Proceeding: Hauppauge, New York

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Susan A. Harris

Official Reporter (Typed)

Susan A Harris

(SIGNATURE OF REPORTER)