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NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

PUBLIC MEETING

BRIEFING ON SEISMIC DESIGN CAPABILITY OF OPERATING REACTORS AND RESPONSES TO OIE BULLETING ON SEISMIC ANALYSIS

Place - Washington, D. C.

Date - Thursday, 28 June 1979 Pages 1-41

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

PUBLIC MEETING

BRIEFING ON SEISMIC DESIGN CAPABILITY OF OPERATING REACTORS AND RESPONSES TO OIE BULLETIN ON SEISMIC ANALYSIS

Room 1130
1717 H Street, N. W.
Washington, D. C.

Thursday, 28 June 1979

The Commission met, pursuant to notice, at 9:45 a.m.

BEFORE:

DR. JOSEPH M. HENDRIE, Chairman

VICTOR GILINSKY, Commissioner

ALSO PRESENT:

Messrs. Gossick, Case, Rathbun, Russell, Eisenhut, and Rothschild.

P R O C E E D I N G S

(9:45 a.m.)

CHAIRMAN HENDRIE: Let's go ahead.

I find that our colleagues are ill this morning. I am not sure whether I have infected them with my late illnesses or whether some member of the staff has assaulted them with his or her diseases. But we hope they will be back with us soon. At any rate, they won't make it this morning.

We have this morning a briefing on seismic design capability of operating reactors and responses to OIE bulletin on seismic analysis, which may spread and talk about a number of associated matters.

Lee, go ahead.

MR. GOSSICK: All right, Mr. Chairman.

Darrell Eisenhut will go ahead with the briefing.

MR. EISENHUT: Thank you.

What we would like to do today is summarize all of the different seismic aspects that are going on and give you a status report, where we are and where we are going in the future.

If I could have the first slide.

(Slide.)

This is a graphic illustration to summarize all of the different aspects that are under way that we are going to be talking about. What we would like to do, the six items at

the top will be summarizing what we have talked to you about in the past. 79-02, 79-04, we talked about before. These are two of the I&E bulletins that went out. We will briefly summarize what they are. We will give you a summary of the status on 79-07, the algebraic summation, a bulletin that resulted also -- that resulted in the five-plant shutdown.

You will recall that after we met and discussed Maine Yankee and return to power, there was an open issue hanging where we said we would be continuing to look at Maine Yankee to decide if any future action was necessary. We added the SEP to this list because the SEP represents 11 of the oldest plants in the U.S., and in fact there is a seismic review that has been under way on those plants now for about a year. There is some feedback coming out of those plants that we are trying to factor into our overall, what I call game plan.

And you will also recall we had recently a UCS petition on seismic reanalysis that has been sent in. This is about a month old now.

Related activities we will also be talking about are two research programs, really, one with NRR that has been sent to Research for managing. These are basically short-term and long-term seismic conservatism programs.

Task Action Plan A-40 was a short-term program meant to address certain selected issues. It is basically a program that Operating Reactor Group started two or three years

that is being wrapped up. It selected specific issues on seismic conservatisms.

MR. CASE: It is one of the unresolved safety issues.

MR. EISENHUT: Yes, it is one of the unresolved safety issues.

The SSMRP is the seismic safety margin review program. That is Research's answer to a request that NRR sent to Research for a broad variety of seismic aspects. It is a program being administered and run out of Research. It is a multi-year program, multi-million dollar program.

Then we will generally discuss the seismic game plan, which is sort of conceptual at this point, and different aspects under that program, in summary.

Bill Russell, who has been sort of the chief project manager of all of the day-to-day work on the five plant shut-downs, will be summarizing the top six items in this chart. Larry Shao, who is on detail to us from Research to help us out on the overall seismic aspects, a wide variety of aspects, will summarize the seismic game plan and where we are going from there.

So, with that, Bill?

MR. RUSSELL: May I have the second slide, please?

(Slide.)

MR. RUSSELL: Back in March, March 8th, we issued I&E Bulletin 79-02. The specific issue we were concerned with

was the installation of concrete anchor bolts. We requested they address flexibility concerns, because we found some of the initial assumptions were related to rigid baseplates and were in fact flexible. We requested they do a testing program and verify that the plan had considered seismic loads. The responses are due on July 6th.

We do have some preliminary results, however. We are finding some plants that have extensive installation defects. Some plants have very few problems, and some of the problems are such as missing bolts on sleeves, more minor problems, misalignment of the anchor bolts, where they are not perpendicular to the baseplate.

COMMISSIONER GILINSKY: Would you identify anchor bolts? Anchor bolts used where?

MR. RUSSELL: On the baseplate piping support, to fasten the baseplate to the concrete wall or floor. It is usually a drill hole into the concrete, and they put an expansion type anchor bolt into it to fasten the baseplate in place.

COMMISSIONER GILINSKY: You would find these throughout the plant?

MR. RUSSELL: Yes, sir.

MR. EISENHUT: If you look at the overall picture, if you have a piece of pipe running through a plant, there are two or three things that are quite important from the

seismic standpoint. One is you put the support in the right place, so that it doesn't vibrate at the wrong frequencies. Another one is that the support is the right size. And the third is that the support is in fact anchored properly.

This is addressing the anchor feature. And a lot of other ones -- for example, the next one is the weight of different components in the system, so that you can see how the piping will wiggle, so to speak, under an earthquake condition.

MR. RUSSELL: We have also had some plants report, in looking to find the anchor bolts during testing, that the entire seismic support was missing. We will be addressing that in the as-built problems later on.

The third slide, please.

(Slide.)

The second issue which Darrell has briefly touched on is associated with the weight of the components and piping. The specific issue was the velan swing check valves. The original ones are 4-inch, 6-inch, 8-inch and 10-inch valves. We want them to identify the systems that were affected and reanalyze with correct weights, to correct any necessary modifications, to actually install them.

Responses were due May 1st, and we have had 65 facilities respond. 5 of them have not yet responded, have been shut down.

Of those 65 responses, 48 actually used the velon swing check valves, with the modifications that were required, that were relatively minor. One hanger was overstressed and there were some miscellaneous hanger adjustments. This is consistent with the earlier briefing that we gave the Commission when we did a worst-case evaluation of a 6-inch swing check valve and showed that the piping would not be significantly overstressed.

COMMISSIONER GILINSKY: Have you considered the valve weight into the analysis?

MR. RUSSELL: The correct weight of the component as it is used in the piping analysis.

COMMISSIONER GILINSKY: And the weight is what?

MR. RUSSELL: The weight of the valve which is in line --

COMMISSIONER GILINSKY: A standard valve, or do they vary in size?

MR. RUSSELL: They vary in size from three inches to ten inches.

COMMISSIONER GILINSKY: Why weren't the right weights not used?

MR. RUSSELL: It appeared to be related to a QA problem. The weights that were on the drawings in some cases were estimates of weights prior to actual fabrication of the valves.

MR. EISENHUT: There is another aspect that can enter into here. If the utilities, for example, needs a line and he needs a valve that can withstand a certain pressure, and he puts it on his drawing that, I am going to -- I need a valve that can withstand 500 psi -- so he initially on the seismic design may estimate the weight of that valve. When he orders that valve from the manufacturer, the manufacturer may say, I have a 3-inch valve that can withstand 1,000 psi. I can give you that right away.

And he may take delivery on the valve and put it in the system. That is over-desing. There is certainly some of that, where they get an off-the-shelf component that is a larger valve than they thought about in the first place.

The second thing is there is certainly some variation on weights of valves, because of minimums -- I mean, some variation on how the valves are manufactured.

CHAIRMAN HENDRIE: Generally in those valve body forgings, you are generally looking for minimum wall.

MR. EISENHUT: That is exactly right. That was my third --

CHAIRMAN HENDRIE: And as a manufacturer takes his error a little bit on the heavy side to make sure he doesn't go under minimum wall and come up against code or spec limits, and if he calculated the weight on a nominal wall basis, his actual weight may come out a little lower.

MR. EISENHUT: The third aspect is related. The requirements have changed over the years as to what is the minimum wall.

MR. SHAO: Usually, when people get valves stronger than design, the designer thought they would do the job, but they forgot to look back at the piping, the effect on the piping.

CHAIRMAN HENDRIE: they thought they were doing a good thing.

MR. SHAO: But it would affect the piping on it.

COMMISSIONER GILINSKY: There was a check lacking after the valve was procured.

MR. SHAO: Right.

MR. RUSSELL: We also found that the valve that was provided by Velan, the weight of the valve is not within the scope of their QA program at that time, so that there was not a check back, such as the valve that was provided, that you had good records of what the actual valve weight was. So even if the licensee had attempted to use the correct weight, he might have had wrong weight provided by the valve manufacturer.

It is a combination of things, and what we are finding out is that valve weights which were used were not representative of what was in the field.

Next slide, please.

(Slide.)

I am jumping in time a little bit. We are discussing I&E Bulletin 79-07, which is the algebraic summation problem. Initially when we issued the show-cause orders to the five plants, we were under the belief that the only plants which were affected with that code were the original five. We found out that Westinghouse had also used a code which used algebraic summation.

About mid-April we issued a bulletin to identify all of the plants that may have used algebraic summation. The results of that were that we identified 25 operating plants which have used algebraic summation.

I have identified some of the codes involved and some of the firms involved in developing those codes: Shock 2, Stone & Webster, Adlpipe, Arthur D. Little, Westdyn with Westinghouse, Daps, which is a General Electric code, and Pipdyn 2, developed by the Franklin Institute.

Of the 25, we completed preliminary review on 16. There are three that are still ongoing. I will cover that a little bit later.

COMMISSIONER GILINSKY: Do they all do this independently or was there some -- were they all guided by some other document that would cause them to --

CHAIRMAN HENDRIE: Some mysterious lemming-like force that unconsciously drew them all --

COMMISSIONER GILINSKY: I can't find any justification for using this kind of a summation technique. I haven't heard any such justification presented. I find it odd that so many different organizations with a great deal of expertise would all make this error.

Is there some standards committee or do they all get together? Do they check the codes against each other?

MR. SHAO: Mainly it was at that time the dynamic analysis was a very new state of the art. People really didn't know what to do on the different subjects. About 15 years ago, there was no dynamic analysis. It is a new art, and people tried to use trial methods.

And one method was using algebraic summation and the other was absolute sum. In general, algebraic summation will get more results than the absolute, but mainly because of the infancy of the science.

COMMISSIONER GILINSKY: But once you use the phase relationships, I don't see how you can possibly use algebraic summation.

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MR. SHAO: At that time, NRC didn't have a position.

COMMISSIONER GILINSKY: I understand that.

MR. SHAO: In '72, we had an absolute sum. But before '72, there was no position.

MR. RUSSELL: With respect to the early part of the question as to any relationship between these, the Westdyn code is really evolved from Adlpipe. And Westinghouse did, in fact, contract with Arthur D. Little, and initially used Adlpipe and then made some developments to that and renamed it Westdyn.

So that accounts somewhat for it.

To the best of my knowledge, the Shock 2 Daps and Pipdyn 2 were all developed independently.

MR. SHAO. There is another possibility. And then 10 years from now, maybe what we are doing now is wrong, too.

(Laughter.)

COMMISSIONER GILINSKY: But one may come to a different approach. But that would be better for one either one way or another. But the algebraic summation seems to be dead wrong.

MR. SHAO: But 10 years from now, people will know --

MR. EISENHUT: There had to be some of this --

COMMISSIONER GILINSKY: There must have been one summer student that started this.

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MR. EISENHUT: One summer student and people have discussions, the technical people. And I am sure in this field there were certainly discussions of the approach being used. And certainly, there is some cross-fertilization, so to speak.

MR. RUSSELL: May I have the next viewgraph, please?

(Slide.)

I thought I would take the opportunity to also fold in where we stand on the remaining four plants shutdown based on the show-cause order.

Surry unit 1, the staff will be meeting with the licensee on the 12th of July to review the results of pipe stress analyses.

We did review some in Boston last Thursday and Friday, and we found that 11 of 42 problems which were being done by Stone & Webster in Boston did require hardware fixes to correct pipe overstress problems.

Of those 11, we reviewed 9 in detail and determined that 7 of the 9 were related to as-built problems. We can only attribute one to the method of the code that was used, as far as the algebraic summation.

The support analysis is still continuing and they expect to complete the analysis in supports inside the containment in August. And I would expect resumption of operation probably in early September.

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We still don't have any status on Surry 2. They are in their steam generator replacement outtage, and we have no schedule yet.

Beaver Valley has completed all but three pipe stress analysis problems and about 50 supports. They have a proposal for interim operation which has been submitted to the staff, which we have under review now.

They are making modifications to the plant at this time and expect to have those completed about the 6th of July.

They do have questions and we are in the question and answer phase on that review, and I would expect that not before mid-July.

Fitzpatrick licensee estimates that they will submit their proposal for interim operation to the staff on July 2nd, at which time we will start that review. Their proposal for interim operation includes completion of all pipe stress analyses and all supports in inaccessible areas. Maine Yankee was approved for start-up on the 24th of May.

CHAIRMAN HENDRIE: Let's see. At both Beaver Valley and "Fitz," there are proposals being considered, either submitted and considered or considered for submission. That would say that we have got this much analyzed and fixed, and this much analyzed. And there are certain things we still have to do. But we think a case can be made that operations

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for some interim period until those fixes are complete is acceptable.

MR. RUSSELL: Yes, sir. That is a very good characterization for Beaver Valley.

Fitzpatrick will not have completed about half of the support analysis associated with accessible areas. So we wouldn't know what the extent of modification would be.

CHAIRMAN HENDRIE: The "Fitz" situation has a third category. This stuff we haven't analyzed yet and that you will want to consider what all of that means.

MR. CASE: We might make some projections about what you might find.

CHAIRMAN HENDRIE: And have a good basis, reasonably good basis for thinking, for projecting the kind of situation there might be.

Now is there a comparable situation on Surry 1?

MR. EISENHUT: Let me comment on that one.

We had been working on Surry 1 following that general kind of approach because out of the 69 problems that had been analyzed, so far we have only seen one that required a fix as a result of algebraic summation.

And as you know, we had been projecting start-up again in some interim mode similar to the Beaver Valley, Fitzpatrick situations early in July. Very recently, earlier within the last week, Vepco has informed us that these

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other problems will, in fact, probably delay their operation for some time. And they are proposing a resumption of operations later this summer.

They also asked for a meeting on July the 12th to discuss the situation.

CHAIRMAN HENDRIE: I see.

MR. EISENHUT: So we don't really know at this point exactly when it is. The significant aspect there, we will be discussing a little bit later in Larry Shaw's part, where we talk about the as-built situation.

MR. RUSSELL: May I have the next slide, please?

(Slide.)

I have a summary slide that identifies the specific plants which used algebraic summation. The computer code which was used and some remarks to indicate whether it was used extensively. And by that I mean essentially all of the safety-related systems in the unit. Or whether it was limited.

For instance, one or two lines analyzed with the code. The X indicates those plants which we have resolved on an interim basis, at least.

I would like to point out Brunswick units 1 and 2 and Indian Point unit 3. Those we have resolved to the extent we concluded it was acceptable to continue operation while remaining analysis was complete. And that was based on

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an evaluation of the methodologies that were used and how the computer code was using analysis and conservatisms which the licensee could show in the methods they used.

We were also able to see the results of the earlier analysis projected to what the stresses would be after re-analysis to give us additional confidence.

We have issued safety evaluations on both of those that identify what those conservatisms were. The remaining units, the re-analysis has been completed. Staff has reviewed them. And for those are indicated as resolved. In Point Beach 1 and 2, we have not had the manpower to put the detailed review into it.

The licensee has completed the review and its associated system which are of lesser safety significance. It is lower on our priority list.

CHAIRMAN HENDRIE: Just radwaste cooling lines?

MR. RUSSELL: Cooling lines associated with radwaste modification. Salem is shutdown, Salem 1, and we are actively pursuing that because it is extensive. We hope that we will have that resolved.

Cooper --

CHAIRMAN HENDRIE: Point Beach is operating?

MR. RUSSELL: Yes, sir. Very limited use, and it is not a system associated with safe shutdown or accident mitigation. And it can be isolated.

gsh

CHAIRMAN HENDRIE: Tell me again. Brunswick and IP-3 are up or down?

MR. RUSSELL: They are operating.

MR. CASE: Based on staff review.

CHAIRMAN HENDRIE: You just said that and I was drifting some place else. Okay, onward.

MR. RUSSELL: I would like the next slide, please.

(Slide.)

COMMISSIONER GILINSKY: You would require in the case of Salem 1 that these problems be resolved before resumption of operation?

MR. RUSSELL: At least to the extent the staff is satisfied that the operation during the remaining re-analysis was acceptable similar to what we have done.

MR. EISENHUT: Our philosophy is simple: We have put together this matrix and it had all of the operating plants. And we checked off whether they were operating or not. And if a plant was coming down or was down, we required a justification and an understanding sufficient that we were confident that the plant was safe before restart-up.

Plants like Brunswick 1 and 2 and the Pilgrim, the plants themselves voluntarily shut down while we were undergoing this debate discussion to resolve it to the point were we all had confidence that the plant was safe to return to power.

gsh

So there was a period of time when the Brunswicks, the Pilgrims, and I think some other plants actually voluntarily shut down while we were having the discussion.

MR. CASE: And made some modifications, too.

MR. EISENHUT: Yes. There are some -- even though as you see on this slide, there is a second group of plants, IP-3 and Brunswick, that have the use of the algebraic summation that was extensive throughout the plant. On both broad variety of systems, there is some significant difference between that set of plants and the previous set of plants that makes them quite different from the five plants that are shut down in the way that they use the algebraic summation first, and in the way their seismic analysis was originally done.

There are some major differences.

COMMISSIONER GILINSKY: What I am getting at is: Are we using a consistent standard for all of the plants?

MR. EISENHUT: I think we are.

CHAIRMAN HENDRIE: That was a long way to say yes.

MR. EISENHUT: That was a long way to say yes to a question that I didn't quite understand.

MR. CASE: It is fair to say that it is a consistent technical standard. Now in the five, the orders were issued in plants that were shut down. We have reached an accommodation of what would be done before they started up

gsh

without need for an order. Technically, they were --

MR. EISENHUT: I might add to enforce that -- to reinforce that, if we were sitting here today and on a plant that could not give us the justification, such as Pilgrim and Brunswick 1 and 2 did not start up, and in fact, their operation was delayed until we did have the issue resolved.

The other plants that are shut down under an order have been unable to resolve it even as of this time.

I think that there is even today, in retrospect, a consistent approach being used -- for including the 5 shutdown plants.

MR. RUSSELL: Next slide, please.

(Slide.)

At the time that we briefed you on Maine Yankee was the second Maine Yankee briefing. It was identified that there was a significant difference between the original Spectra, which was the basis for the design, which was the Housner Spectra anchored at .1G, and what we would expect if we were to review that site today.

We estimated that it would be probably a regulatory guide 1.60 spectra anchored between 1.3G and 1.2G. We looked at this issue for, I guess it was approximately 2 to 3 weeks after that period of time and developed the overall seismic conservatism and provided that response to the commission.

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And the staff's basis for where we thought it was acceptable for them to operate --

We do have some ongoing stat plans on which Larry will be discussing.

MR. SHAO: I would like to say something about Maine Yankee here.

I wasn't involved in the previous meetings. But in the past, when we used Housner Spectra, which has a lower curve than the 1.60 spectra, the Housner Spectra always coupled with lower damping values.

CHAIRMAN HENDRIE: Much lower.

MR. SHAO: Much, much lower like the piping is .5 percent for OBE and maybe 1 percent for SSE. 1.60 is always coupled with 1.61, which is the damping value for 1.61. The damping value for piping is 2 percent, 3 percent for OPE and SEE. When you couple 1.60 and 1.61 and Housner Spectra with the olc -- the final answer comes out almost the same. The change is very small.

But the G load is a different story.

CHAIRMAN HENDRIE: Tell me again where you are going.

MR. RUSSELL: Next slide, please.

CHAIRMAN HENDRIE: I thought it was settled, or are you still poking around here?

(Slide.)

MR. EISENHUT: On Maine Yankee?

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CHAIRMAN HENDRIE: The Maine Yankee seismic design basis.

MR. EISENHUT: On Maine Yankee's, we said that we would look at it and consider whether we needed to, and if so, what kind of additional review needed to be done on Maine Yankee.

We felt that we needed to look at and make that decision in the overall scheme of things, which is basically why we are trying to put all of these things together, actually why we asked Larry to come over originally. Since then, he has picked up a few extra duties to help put together this overall package.

CHAIRMAN HENDRIE: It is time that he went back to work on the staff.

(Laughter.)

MR. EISENHUT: My sentiments rfectly.

What we are trying to do is to make that decision on Maine Yankee as to the scope of what is needed. Again, in sort of a consistent manner both in the seismic inputs and from the structural response, what needs to be done, recognizing we have these other programs underway, recognizing we have the UCS Petition, et cetera.

MR. RUSSELL: I will discuss the systematic evaluation program seismic reviews. First, I would like to give you a little bit of the status of where we stand now.

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We have two plants which do not have a specific seismic design basis. The older plants. We have two plants which were designed to uniform building codes.

CHAIRMAN HENDRIE: I guess it wouldn't violate anybody's private overriding privacy considerations if I knew which two were in the first category and which two were in the second?

MR. SHAO: Yankee Rowe, LaCrosse, first one. Big Rock and Dresden, the second.

COMMISSIONER GILINSKY: Would you explain what that means?

MR. SHAO: Yankee Rowe and Lacrosse didn't have any specific seismic design basis. They were not designed for seismic load. Big Rock and Dresden 1 were designed to the uniform building code which is essentially static analysis.

CHAIRMAN HENDRIE: I did a reactor to the uniform building code, and you can save a lot of money on seismic analysis doing it that way.

MR. SHAO: I appreciate the next question would be (inaudible).

COMMISSIONER GILINSKY: Where did the uniform building code come from?

CHAIRMAN HENDRIE: In the absence of -- there is in the uniform building code, and there has been for many years, a seismic design basis for structures that fall under -- that are built to that code, which is a generally accepted public building code by the standards of current nuclear plant seismic analysis and standards.

It is a terribly unsophisticated and, in our view, sort of by nuclear standards, unconservative basis.

Nevertheless, it is a whale of a lot better than not having any guidance at all on -- in which case, the structural designer simply ignores possible seismic loadings. The uniform building code divided the country up into seismic zones and said

in zone 1 you would use this approach, zone 2, and so on. And the approaches were typically to simply add to the design loads of the basic structure static forces.

MR. SHAO: They put it at the base of the building and and put (inaudible) on the structure and most of the buildings are designed for the uniform building code.

CHAIRMAN HENDRIE: If you didn't have any guidance in the nuclear area and you came along and you said, "Well, what will I use; should I consider earthquakes and it seemed prudent to do so, and what will I use?" Well, I don't know. And there is the uniform building code as one of the few documents around generally recognized and accepted for structural design guidance, and so it was used for a while. As I say, I built one that way.

COMMISSIONER GILINSKY: It is still there?

CHAIRMAN HENDRIE: It hasn't fallen down yet. Do you want me to make one of those speeches, "I haven't had an earthquake in a dog's age on Long Island."

COMMISSIONER GILINSKY: To what standard were the first two built? There must have been some requirement.

MR. SHAO: There was no requirement.

COMMISSIONER GILINSKY: No seismic requirement. But what fixed the strength of the structure?

MR. SHAO: Even though, like the first two plants were not designed for seismic loads, they were designed for

other loads. The reason is: Most power plants are better in seismic loadings than other structures, most are designed for pressure loading. The minute you design for pressure loading, you have inherent seismic resistance. Usually, the pressure loading gives you circumference stresses which is equal to pi over t, and the longitudinal stress is pi over tts. But earthquake stresses lead to the longtudinal stresses, so you have some resistance because you design for pressure stresses.

For instance, there are a couple of earthquakes in Nicaragua a few years ago. It was conventional power plants. It wasn't designed for any earthquake. It was hit more than .2 g, and the earthquake was a few miles from the plant. The plant was almost intact -- very little damage. Mainly, the power plant, by its nature of the design, is designed for pressure loading and is designed for wind loading and tornado loading. When you design for other loadings, you have inherent resistance to earthquake loading.

CHAIRMAN HENDRIE: In spite of all that, he won't buy that condominium in Managua, huh?

(Laughter.)

CHAIRMAN HENDRIE: He might buy a power plant in Managua, though.

MR. EISENHUT: That's right.

CHAIRMAN HENDRIE: Piping systems compared to things like masonery, building structures, piping systems are really

enormously ductile and tough objects. You can shake them.

COMMISSIONER GILINSKY: We are switching from buildings to piping structures.

MR. SHAO: Buildings are designed for wind loadings and tornado loadings. When you design for wind and tornado loadings -- and some of the buildings are designed for pipe break inside or outside containment, so the building is also designed for other loadings.

COMMISSIONER GILINSKY: Throughout here we have been talking about, really, piping. And the building only gets into it in that it shakes the pipe.

MR. SHAO: Right.

COMMISSIONER GILINSKY: What sort of loads will the piping structures be designed to deal with?

MR. SHAO: Piping is designed for pressure loading. Piping, the major loading in piping is the pressure loading in pipe plate loading, and also earthquake loading.

Also, there are thermal training loading, too.

COMMISSIONER GILINSKY: It is all static analysis.

MR. SHAO: Right now we do dynamic analysis.

COMMISSIONER GILINSKY: I am talking about the older plants.

MR. SHAO: The older plants, the pressure loading essentially is a steady loading. It is less like a Mark I type of loading, dynamic loading. But normal pressure loading is a

static loading.

CHAIRMAN HENDRIE: For plants of the vintage of the Yankee Rowe or for conventional power plant piping for the high-pressure stuff, would they have thrown in some allowance for water hammer, possible water hammer effects? Do you know whether that was a practice? A little impact loading?

MR. SHAO: They designed for lower level. I don't think they really addressed the water hammer. But the allowable in the past was very low. The history of design, they used first the so-called "section 1" of the ASME code and section 8, and then they switched to section 3 of the ASME code.

CHAIRMAN HENDRIE: These plants antedate Section 3.

MR. SHAO: Mostly section 8. The difference between section 8 and section 3 is: Section 8 only used 62 percent of the yield, and section 3 uses 75 percent -- 67 percent.

CHAIRMAN HENDRIE: Anyway, let's see, we sort of stopped you after two items. You hardly got your -- this item developed. Why don't you go ahead?

MR. RUSSELL: The remaining seven plants were, in general, designed to a G value similar to what we would be doing today. That does not imply, however, that the G value would be that which we would come up with today. The six oldest plants, the licensees are actually conducting the analytical studies. With the newer five, they are being analyzed by the staff and our consultants.

The Dresden 2 evaluation is nearing completion.

CHAIRMAN HENDRIE: Dresden 2?

MR. EISENHUT: It is also one of the SEP plants we picked --

CHAIRMAN HENDRIE: Because it has a POL?

MR. EISENHUT: Yes. Remember, we had, I believe it was, like the first seven or eight or some of the older plants, and then we added on those plants that had POLs.

CHAIRMAN HENDRIE: Yes. There were something like two or three of those.

MR. EISENHUT: Yes. We added on two or three of them. We may not have gotten them all. I think there may have -- I think we got most of them.

MR. RUSSELL: We have been working on the seismic review of these plants for some time, and there are some lessons which we have learned thus far from reviews.

What we are finding is that the structures are generally adequate; however, we must address the torsion effects. Piping is generally adequate if you use a more sophisticated inelastic method of piping analysis.

COMMISSIONER GILINSKY: What do you mean, you "have to address"?

MR. SHAO: The torsion effect, the earthquake is a torsional mode. The vertical horizontal, and there is a torsional mode. In the past, sometimes we neglect this. That

mode should be addressed.

MR. CASE: You have to calculate it --

MR. SHAO: And see whether it withstands torsion. In some cases, it may be important, so that we have to look at it.

MR. EISENHUT: Most are going to sharpening the pencil, doing new calculational methods, like the piping is generally adequate if you go to the more advanced --

COMMISSIONER GILINSKY: And, of course, (inaudible) on whether you think they will.

MR. EISENHUT: Yes. We have a pretty broad group of -- a large team set up.

So far, we have a quite large seismic team set up, which includes a large number of the consultants in the country. For example, New Mark is one of the principal people on it. There must be a half-dozen people on the [illegible]nt team that is working with the SEP.

MR. RUSSELL: Supports general[illegible] require a case-by-case review, whether it is equipment support, pipe support, or cable tray support. We will find we have to look at those. And the controlling path of the five plant shutdown, a review of the supports in the areas where we are having difficulties.

We are also finding that a few types of equipment, batteries and small lines which have motor-operated valves, require case-by-case reviews. And the questions on operability and functionability of equipment requires a closer examination

because the testing was not done earlier.

Generally, at that time, the quality assurance requirements were not as rigid as they are today, so that even if they had specified in the procurement document something be provided that is capable of withstanding a .2 G loading, they may not have gotten the testing of the document or documentation to show that it was done to that level. So, it becomes a problem in documenting the adequacy of the equipment after the fact.

Can I have the next slide, please.

(Slide.)

The Union of Concerned Scientists petition, which was dated March 28, '79, requested that the licensee for operating reactors be required to reevaluate the magnitude of the safe-shutdown earthquake and to determine the free-field ground motion effects to determine motion of structures, plant equipment, and piping, and compare those loads under appropriate load combinations with allowable loadings, and basically followed what we currently do in identifying the standard review plan today.

They also requested that the plants be inspected to determine whether the as-built plant conforms to the design specifications for the plant.

This petition is one of the factors which we are folding into our seismic review program.

MR. CASE: It appears it is older than a month.

MR. EISENHUT: It was submitted on March 28, and had a tendency to -- the action was delayed for a while.

MR. RUSSELL: Can we go back to the first slide, please.

(Slide.)

CHAIRMAN HENDRIE: I will ask you to continue, but to step briskly along.

MR. RUSSELL: Yes, sir. This is perfect timing, because I am ready to turn it over to Larry.

(Laughter.)

CHAIRMAN HENDRIE: Larry, step briskly along.

MR. SHAO: I will be very brief.

Next slide, please.

(Slide.)

I think, as Darryl said, the three areas, these are the three areas we should address. The first is: changing criteria. As Bill just said, some of the earliest plants were designed to little or no seismic loading. Sometimes they were designed to uniform building codes. And some plants were designed to the so-called "quality dynamic loadings," dynamic analysis. And the later plants were designed to refine the dynamic analysis in the same way that in seismic criteria there have been great changes over the last 15 years.

So, we had to look at different plants, see how does

it affect these plants.

The second area we should look at is the computer codes. In the past, we only did an audit review. The people asked why didn't we do a detailed review. I think the staff would like to do a detailed review, but it is not very practical to do it. It takes millions and millions of dollars to do the calculation of one plant.

When we look at the staff in a year, in I&E or NSSS there are hundreds of people working on seismic analysis. We don't have the resources to do all of this detailed checking. What we are doing is audit checking.

Now, we learned a lesson. We asked the licensee to do other work, and, hopefully, they will do a good job. But it looks like they are not doing as good a job as we would like to, so we would like to do more. We would like to develop the capability in computer codes in the structural and mechanical areas. At least, when the staff wants to check some of the computer codes, we would have the capability to do that.

The third item is the quality assurance. For some cases, we found the facilities are not constructed as designed. The calculations do not reflect as-built conditions, and the equipment was not procured as specified.

Can you flash to backup slide 1, and Bill can address that slide.

(Slide.)

MR. RUSSELL: This slide identifies 11 operating reactors from which we have identified significant differences -- by "significant," I mean the effects on the seismic analysis -- between the original design of the facility and the as-built condition. These range from having supports missing and having mislocated supports or the wrong type of supports, difference in pipe geometry where you specify a straight rod and there is a bend that offsets the pipe by six feet in a 13-foot run of pipe. We are finding that supports are undersized.

We have had several licensees shut down their facilities to correct these problems, and we are finding that on the reanalysis of the plants which were originally shut down where the algebraic summation problem, that the as-built problem is actually the one that is causing the majority of the pipes to overstress conditions, and also the support overstress conditions.

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MR. RUSSELL: We feel this is a significant problem that has been identified and we are going to be issuing a bulletin this week with the inspection scope of that bulletin to verify that the plant was designed and built in accordance with the application as it was amended. The inspection scope will include safety-related piping systems greater than two inches in diameter, and we would be verifying basically for the seismic analysis input parameters.

Our Office of Inspection and Enforcemnt has a couple of slides to describe this bulletin in more detail. Generally, we will be giving them 60 days to do a portion of the inspection, 90 days to complete the remaining portion of the inspection, and where they find nonconformances to the requirements of existing technical specifications with respect to equipment and system operability.

MR. SHAO: Next slide, please.

(Slide.)

MR. SHAO: This is the proposal to resolve the seismic issues we have planned for the plants. What should we do with the rest of the plants? These are some of the proposals which are very conceptual in nature. The first one I think we should do — we should make a study of all of the criteria that are used for each operating plant. Based on this study, maybe we can determine priorities of operating facilities which should be analyzed first.

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We should look at seismic input, response spectra, damping values, load combinations, et cetera. From this study you have some idea that you should look at it this year and some plant can wait a couple of years, and with some plants you don't have to work on it at all.

These arent' conceptual studies. The second item we should look at is utilizating the findings from systematic evaluation programs. We should incorporate all of the seismic issues that are generic to this study, and study modifications that should be imposed on other operating facilities, and using finalized SEP results to develop long-range programs. We should continue to quantify seismic conservatisms. Right now we have Task Action Plan A-40, which results in showing the issues. But we have the blank research program and we should look at effective G-load against P-acceleration. When you measure acceleration from the instrument, and this is not really the value you should use for design. We should develop capability in verification of computer codes and the major design of systems and equipment components we should develop benchmark problems.

Next slide, please.

(Slide.)

We should review the impact due to the difference between as-built and designed conditions and other quality assurance problems and to make sure proper actions will be

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taken.

We should investigate foreign data, like Japan has a lot of testing data, to better assess and qualitify seismic conservatism -- to quantify, I'm sorry, it is a typographical error, to quantify seismic --

CHAIRMAN HENDRIE: It is a wonderful title. It falls squarely beteeen qualitative and quantitative and leaves it absolutely clear. We would like to store that -- right, we might store that away for a suitable use when we are not quite sure which we have got.

I'm sorry, go ahead Larry.

MR. SHAO: I think that's all I have.

MR. EISNEHUT: I think those are the items that you can see, the last six items of the areas we are working in. Some of these areas have proceeded further than others. We obviously are working on code verification benchmark problems and some codes. We are obviously going down the road on the SEP program trying to get out of it and see the factors that have been learned there. And on that program, if we find something that needs to be fixed in the short term, we will take the short-term action.

We are proposing this I&E Bulletin that is going out this week, which will entail also some verification checks to see if the plants are as built compared to the drawings. There may be some follow-up actions as we go through this

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program, so it shouldn't really be a surprise if down the road there are additional follow-on bulletins, follow-on letters, et cetera.

MR. CASE: It is a dynamic program, to learn as you go along.

CHAIRMAN HENDRIE: Is that some kind of a pun?

MR. EISENHUT: As opposed to a "static" program.

(Laughter.)

MR. SHAO: But the program should be formulated on what we learn from the SEP program and also the research programs.

CHAIRMAN HENDRIE: And you will keep us informed of the general stragegy and thrust of dealing with the whole seismic area, and periodically we will expect to see you and discuss some of these things.

MR. EISENHUT: You will be seeing the response to the UCS petition.

CHAIRMAN HENDRIE: We will see a response to that fairly soon.

MR. EISENHUT: Yes.

CHAIRMAN HENDRIE: I assume in configuring this broad staff effort on seismic issues, you talked to the ACRS from time to time?

MR. EISENHUT: Yes. Last month, Bill briefed the ACRS on the status of the five-plant shutdown. We will be

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keeping them informed as we go along. The seismic programs, the research quantification programs are also reproted to the ACRS. The SSMRP, there is a standing committee of senior consultants.

CHAIRMAN HENDRIE: How much is A-40 and the safety margins research program likely to feed into this effort?

MR. EISENHUT: A-40 should very directly. That is the short-term quantification program. The major part of it was started in DOR for this basic purpose. From the management point, it is in research under Larry. Larry is also the principal agency person running the SSMRP.

I feel we can ensure that it is well coordinated.

CHAIRMAN HENDRIE: How long has that been underway?

MR. SHAO: About a year ago, it is a five-year program. Hopefully, we will get some by-products before the end of the program.

MR. EISENHUT: It also has on it a committee that has a couple of NRR representatives, of which I am one, that is sort of a steering committee to help ensure that since that program was in response to an NRR user's letter to help ensure that, in fact, what comes out of the program is, in fact, of use to NRR, both in the short term and the long term, and it itself is broken down into, I guess, a short term and long term work.

MR. SHAO: In the past for seismic issues we have

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many branches, geoscience branches, structural branches, looking at the structures, mechanical branch looking at the mechanical components. It was never really integrated. The SSMRP tries to integrate all of the work into different branches and put it into one problem. Maybe you change one variable, it doesn't really affect the final results that much.

We want to find out which part is most important to the final results.

CHAIRMAN HENDRIE: Any questions?

COMMISSIONER GILINSKY: I don't have anything further.

CHAIRMAN HENDRIE: All right. Thank you very much.

(Whereupon, the meeting was adjourned at 10:42 a.m.)