ORIGINAL

UNITED STATES
NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

COMMONWEALTH EDISON COMPANY

(Braidwood Station, Units 1 and 2)

DOCKET NO: 50-456 OL
50-457 OL

LOCATION: CHICAGO, ILLINOIS

PAGES: 14747 - 14912

DATE: THURSDAY, OCTOBER 16, 1986

TR.01/01
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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	:	
COMMONWEALTH EDISON COMPANY	:	Docket No. 50-456 50-457
(Braidwood Station, Units 1 and 2)	:	

Page: 14,747 - 14,912

United States District Court House
Courtroom 1919
Chicago, Illinois 60604

Thursday, October 16, 1986

The hearing in the above-entitled matter reconvened at 11:00 A. M.

BEFORE:

JUDGE HERBERT GROSSMAN, Chairman
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, D. C.

JUDGE RICHARD F. COLE, Member,
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission
Washington, D. C.

JUDGE A. DIXON CALLIHAN, Member,
Atomic Safety and Licensing Board
U. S. Nuclear Regulatory Commission

Washington, D. C.

APPEARANCES:

On behalf of the Applicant:

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On behalf of the Nuclear Regulatory Commission Staff:

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U. S. Nuclear Regulatory Commission
7335 Old Georgetown Road
Bethesda, Maryland 20014

On behalf of the Intervenor:

ROBERT GUILD, ESQ.

EXHIBIT INDEX	MARKED	RECEIVED
Intervenors' Exhibits Nos. 164 and 165	14759	14768
Intervenors' Exhibit No. 166	14760	14768
Intervenors' Exhibit No. 167	14768	14778
Intervenors' Exhibit No. 168	14799	14804
Intervenors' Exhibit No. 169	14807	14844
Intervenors' Exhibit No. 170	14839	14844
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TESTIMONY OF

THOMAS B. THORSELL
KENNETH THOMAS KOSTAL

JUDGE GROSSMAN: The hearing is reconvened. This is the 75th day of hearing.

I take it your discovery was fruitful and the Board isn't being called upon to resolve any problems?

MR. GUILD: No, sir.

Applicant was helpful, and Mr. Kostal's associates spent time with me, and it was quick, and we'll see if we can communicate the substance of what we identified were the basis for a number of changes.

I understand that, again, with the cooperation of Applicant, copies of a number of documents that we discussed this morning are available in sufficient number that the Board and parties can follow along, and I appreciate their assistance on that.

JUDGE GROSSMAN: Fine. Thank you.

Any other preliminary matters?

MR. STEPTOE: Judge Grossman, it's just that last night in reviewing the bases for the changes, we got a better understanding of what they were.

I think Mr. Guild will take the witness through those changes.

JUDGE GROSSMAN: I think maybe we should have taken yesterday afternoon off and started this morning.

But, in any event, let's proceed now --

JUDGE CALLIHAN: I have a correction.

I would like to refer to Intervenors' Exhibit 155B, Page 14, that we discusded yesterday afternoon, also, and I'd like to withdraw, and apologize, my challenge of the unit for torque or for moment.

What is there is correct; and yesterday I thought the moment of inertia was moment of force.

Thank you.

JUDGE GROSSMAN: Okay.

Mr. Guild.

CROSS EXAMINATION

(Continued)

BY MR. GUILD:

Q Mr. Kostal, let's start there, if we can, where Judge Callihan pointed us to, Page 14 of Intervenors' Exhibit 155B.

Now, in the lower right-hand corner, there is an X'd-through portion of the calc, the original calc.

And this calc again refers to the analysis of the defect with respect to weld size for the connection of the longitudinal member, the brace, to the gusset plate, which, in turn, is attached to the vertical hanger component; correct?

A (WITNESS KOSTAL) Correct.

Q All right.

Now, do I understand correctly that because this -- that in order to evaluate this weld discrepancy for its design significance, you have to consider the effects of the discrepancy at the centroid of the two welds that are relevant? Those are the welds on either side of the gusset plate, either side of the gusset plate -- the portion of the gusset plate to which the longitudinal brace is connected?

A (WITNESS KOSTAL) That's correct.

Q And, therefore, the reviewer -- or the evaluator performed a calculation using two systems of coordinates, and that in order to translate the analysis performed initially, using a series of coordinates, to the appropriate reference point -- that being the centroid of the two welds -- that there were two -- there were analyses using two sets of coordinates, a global coordinate and a local coordinate, and the analysis had to be translated from the global-coordinate analysis to the local-coordinate analysis reflecting the analysis at the centroid of the two welds?

A (WITNESS KOSTAL) Correct.

Q All right, sir.

Now, the first evaluator in the marked-through

portion of the calculation did, indeed, make that translation to the centroid of the two welds, and that analysis using the initial assumptions, initial data and initial methodology produced the calculated value of design margin of 1.03, 3 percent design margin?

A (WITNESS KOSTAL) Correct.

Q All right.

Now, I believe there's a -- you were kind enough to prepare a drawing reflecting the orientation of the local and global coordinates with respect to this particular discrepancy.

Perhaps if I could -- well, sorry.

MR. GUILD: In any event, Mr. Chairman, members of the Board, Mr. Kostal has a diagram that he described to me today that depicts those two sets of coordinates, the local coordinates at the centroid of the weld and the global coordinates with reference to the longitudinal brace, and I think it would be helpful to look at that.

I understand it's being copied, and we'll have that momentarily.

JUDGE GROSSMAN: Fine.

BY MR. GUILD:

Q All right, sir.

Now, let's talk a little more generally about the bases for the two calculations.

First, as you noted properly yesterday, the calc refers to a Revision 4 to your Calculation Procedure 19.3.1?

A (WITNESS KOSTAL) Yes, sir.

Q And yet I take it that the revision to the calculation procedure, to the best of your knowledge, does not account for changes in the calculations? You didn't make any change to the calculation methodology by those revisions to the procedure, did you?

A (WITNESS KOSTAL) That's correct.

Q All right.

You surmised yesterday that the change in the calculations might have depended on the use of a Braidwood-specific seismic response spectra.

I believe overnight you determined that, indeed, the Braidwood-specific seismic response spectra was used for the initial calculation as well as the revised calculation?

A (WITNESS KOSTAL) That's correct.

Q And, therefore, consideration of a Braidwood-specific seismic response spectra does not account for any changes in the calculational result?

A (WITNESS KOSTAL) That's correct.
Q Now, you also told me that you identified that the changes did not result in any change in the computer model or the methodology for analysis between the first calculation and the second calculation?
A (WITNESS KOSTAL) That's correct.
Q All right.

That the changes are -- were from two sources, having to do with the data that was used in the second calculation, and that the data represented the analysis of the cable loadings on the cable pan hanger in question, Cable Pan Hanger 104, and differing values used in the second calculation as compared to the first for those cable loadings?

A (WITNESS KOSTAL) That's correct.

The first calculation was based on the -- a unit load of 45 pounds per square foot in the pans, which was the initial assumed load at the beginning of the project.

The second computer analysis took into account the actual cable pan -- cable weights that existed in the pan at that point in time.

Q All right.

The 45-pound loading was the design basis for the

cable pan hanger in question?

A (WITNESS KOSTAL) That's correct, the initial design basis, yes.

Q All right, sir.

One set of data that accounts for the change in calculational result was different loadings.

And as I understand the additional piece of data that was considered in the second calculation, not in the first, was a change in the location of one of the cable pans that runs through the hanger?

A (WITNESS KOSTAL) That's correct.

Q And that that change in location of the cable pan running through this hanger was based on an inspection or identification of the as-built location of that pan in the field?

A (WITNESS KOSTAL) What I said was we would -- I didn't know the source of the change in the location, but we would go back into our data base and determine that change, where it originated from.

Q Well, I appreciate that, and that's right.

You said, in particular, that you didn't know whether it was a result of the Rev A Sargent & Lundy walkdown identifying the actual location of that pan or whether it was, for example, a result of the CSR

inspector who inspected the cable pan population for the attributes of location or some other source.

But, indeed, you do understand it to represent the as-built location of that cable pan from whatever source you got that information?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

And I appreciate you did say that you would make an effort to determine where that came from.

All right, sir. So that the two changes that account for the new calculation are the loadings of the cable pan hanger, the cable loadings, and the location of the one pan?

A (WITNESS KOSTAL) That's correct.

Q All right, sir.

Now, I saw some of your associates come in, and perhaps they have copies of the documents.

MR. GUILD: If I could have a moment, Mr. Chairman.

Off the record.

(There followed a discussion outside the record.)

JUDGE GROSSMAN: Back on the record.

MR. GUILD: Judge, I'm going to hand up one

other document.

The first document I handed up says "DV-22 Coordinate Systems" on it, and I'm now handing up a document that says "Local Coordinate System" in the upper left-hand corner.

(Indicating.)

JUDGE GROSSMAN: Okay. The first one is Intervenors' Exhibit 164, and that one, as you indicated, has a DV-22, and then Intervenors' Exhibit 165 has that "Local Coordinate System" on the left side.

(The documents were thereupon marked Intervenors' Exhibits Nos. 164 and 165 for identification as of October 16, 1986.)

MR. GUILD: Does the NRC Staff have a copy of both documents?

MR. BERRY: Yes. Thank you.

A (WITNESS KOSTAL) All three of them; right?

MR. GUILD: Yes. I haven't handed them all up yet.

And, Mr. Chairman, 166 is --

JUDGE GROSSMAN: Okay. But you know that the Reporter hasn't yet gotten his copies of 164 and 165?

MR. GUILD: All right. I'll get them.

The third is entitled "DV-7 Coordinate Systems." It's the third series of documents.

(Indicating.)

And I'm providing copies to the Reporter, Mr. Chairman.

(Indicating.)

(The document was thereupon marked Intervenors' Exhibit No. 166 for identification as of October 16, 1986.)

BY MR. GUILD:

Q All right.

Mr. Kostal, I believe the Board --

JUDGE GROSSMAN: Have you given the Reporter time to mark it?

MR. GUILD: He's got them marked.

JUDGE GROSSMAN: Oh, okay.

MR. GUILD: Mr. Chairman, I believe that the Board and parties and the Reporter all have copies now of what have been marked as Intervenors' 164, 165 and 166,.

BY MR. GUILD:

Q And, Mr. Kostal, can you start with 165, please, and tell us what the two systems of coordinates are that are depicted on that drawing?

A (WITNESS KOSTAL) Yes, sir.

The system in the lower right-hand corner is the global coordinate system which defines, then, the location of that hanger within a global framework, and it defines it in terms of X, Y and Z, which relate to the -- looking at this particular hanger -- the X is in the direction which would be east and west as you are looking at this hanger, the Y is in the vertical direction and Z is in the perpendicular direction to the hanger, which is in the north-south orientation.

The local coordinate system is the system used to define the individual members within the hanger, and the local coordinate system defines A along the axis of the diagonal member, B perpendicular to the A axis and perpendicular in the vertical direction, and C perpendicular in the horizontal direction to the A axis.

Q All right, sir.

Now, the drawing that you have depicted for the local coordinate system depicts the fit-up gap weld discrepancy related to the diagonal member of the hanger --

A (WITNESS KOSTAL) That's correct, sir.

Q -- for Cable Pan Hanger 104?

All right. Now, applying that local coordinate to

the other principal significant defect that was analyzed in Cable Pan Hanger 104 -- and that was the longitudinal brace to gusset plate -- or the gusset plate connection involving the longitudinal brace, look at Intervenors' 164, and would you describe the orientation of local coordinates with respect to that discrepant condition, please?

A (WITNESS KOSTAL) Yes, sir.

The key is the -- is located at the bottom of Exhibit 164.

It shows dashed lines, which will represent the local coordinate system for the longitudinal diagonal member. Those are large capital letters A, B and C

If you look at the sketch, you will notice, in the dashed lines, the local axis A is along the axis of the longitudinal diagonal member; the local coordinate axis B is perpendicular to that longitudinal axis A in a vertical direction; and the local coordinate axis C is perpendicular to the local axis A in a horizontal direction.

Q All right, sir.

Again, the global coordinates are with respect to east-west, north-south and vertical?

A (WITNESS KOSTAL) That's correct. The X is in the

east-west direction, the Z is in the north-south direction and the Y is in the vertical direction; and that is a consistent orientation that exists on Exhibit 165, also.

Q All right, sir.

And how about the shifted axes, the lower case a, b and c, with regard to Intervenors' Exhibit 164?

A (WITNESS KOSTAL) That defines, based on this dashed dot line, the -- and it's using the lower case a, b and c -- that represents the axis at the centroid of the weld in question, which is the weld made between the gusset plate and the vertical tube steel member.

That local system shows a being --

Q Let me interrupt you for a second.

You said centroid of the weld, singular, or welds, plural?

A (WITNESS KOSTAL) Welds.

Q Welds, plural?

A (WITNESS KOSTAL) there are two welds on this particular attachment on either side of this gusset plate.

Q We are considering the effects of the discrepancy on both of them; therefore, the centroid of the two welds is the relevant point of reference?

A (WITNESS KOSTAL) That's correct.

Q All right.

A (WITNES KOSTAL) The A axis is in the north-south orientation, the B axis is in the vertical orientation perpendicular to the A axis, and the C axis is in the horizontal orientation also perpendicular to the A axis.

Q All right, sir.

Finally, Intervenors' 166 depicts the fit-up gap defects -- again, the diagonal brace -- and represents the application of the local and global coordinates to that particular discrepant condition?

A (WITNESS KOSTAL) That's correct, sir.

Q All right, sir.

Now, for that particular discrepancy -- that is, the fit-up gap discrepancy -- there is no necessity for deriving a shifted axis -- that is, by analogy to Intervenors' 164, a lower case a, b, c coordinate system -- and that is because the analysis is performed -- you don't need to derive the centroid -- the centroid of the -- strike that.

The point of analysis is, indeed, the local coordinates that are shown on Intervenors' 166?

A (WITNESS KOSTAL) Maybe if I could clarify it for you just a little bit.

The reason you don't have to shift the axis is

because the work point of the load from the diagonal brace coincides with the centroid of the various welds that are being analyzed.

Q All right.

The work point is the point that's relevant for analysis?

A (WITNESS KOSTAL) That's correct.

Q And that's true for both defects? It's just that for this defect, that work point coincides with the centroid of the member in question?

A (WITNESS KOSTAL) That's correct.

Q And, therefore, you don't need to make a shifted analysis for a shifted set of coordinates to account for -- to account for the work point not coinciding with the center of that member?

A (WITNESS KOSTAL) Yes, sir.

MR. STEPTOE: Excuse me.

"Center of the member," you said?

MR. GUILD: The member.

MR. STEPTOE: Thank you.

BY MR. GUILD:

Q Now, why do you have to make the analysis --

A (WITNESS KOSTAL) May I -- the centroid -- the centroid of the weld root coincides with the applied load from

the member.

Q All right.

Now, why do you have to make the shift for the DV-22 connection that appears in Intervenors' Exhibit 164 in order to analyze the significance of that -- those discrepancies, those weld discrepancies?

A (WITNESS KOSTAL) The reason you make the shift is the -- given that the work point doesn't coincide, there is some additional stress in the weld as a result of the load being applied slightly off the centroid of the weld.

So what you are accounting for is the translation of the load back to the centroid of the weld, and in the process of that translation, you also induce a moment when you shift the axial load back to the centroid of the weld.

Q Is that because of the -- here the longitudinal brace is not attached at the center of the gusset plate or on the edge of the gusset plate, it's attached to one side of the gusset plate?

A (WITNESS KOSTAL) It -- no. It's because the longitudinal brace -- when you take the axial load, the centroid of the axial load, in the longitudinal brace and reflect that onto the weld, it is located below the

centroid of the weld, and the -- my Exhibit 164 shows pictorially where the centroid of the -- where the work point is of that brace load coming down to the weld.

Q And that's the designation "work point of brace"?

A (WITNESS KOSTAL) That's correct.

Q All right.

And the other set of coordinates, the A, B and C, are above that point?

A (WITNESS KOSTAL) That's correct.

Q And it's the translation of the load to that work point -- that is, the higher work point, the center of the discrepant weld -- that requires the use of the two sets of local coordinates?

A (WITNESS KOSTAL) Yes, sir.

JUDGE GROSSMAN: And just to complete your description on Intervenors' Exhibit 164, you have a "center of" and you have a designation there.

What does that stands for?

A (WITNESS KOSTAL) It's the center of plate.

JUDGE GROSSMAN: Center of plate?

A (WITNESS KOSTAL) Right. "PL" stands for plate --

JUDGE GROSSMAN: Okay.

A (WITNESS KOSTAL) -- which also coincides with the center of -- center of weld -- of the two welds.

JUDGE GROSSMAN: Fine.

MR. GUILD: Mr. Chairman, I'd ask that Intervenors' 164, 165 and 166 be admitted into evidence.

MR. STEPTOE: No objection.

MR. BERRY: No objection.

JUDGE GROSSMAN: Received.

(The documents were thereupon received into evidence as Intervenors' Exhibits Nos. 164, 165 and 166.)

MR. GUILD: Mr. Chairman, I'm going to hand up a series of documents. We're making -- sorting additional copies -- or Applicant is -- and I'd ask these be marked as Intervenors' Exhibit 167.

The top page is entitled, "Horizontal Floor Response Spectra, North-South Component"; there is an East-West Component on the second page; and there is a Vertical Response Spectra on the third page, Byron-Braidwood, Enveloped, Enveloped, Response Spectra."

(Indicating.)

I'm getting copies for the other parties.

(The document was thereupon marked Intervenors' Exhibit No. 167 for identification as of October 16, 1986.)

BY MR. GUILD:

Q Mr. Kostal, do you have a copy of this?

A (WITNESS KOSTAL) Did you give this an exhibit number?

Q Yes.

A (WITNESS KOSTAL) Well, what did you call them?

Q 167.

A (WITNESS KOSTAL) Okay. All three of them are 167?

Q Yes.

A (WITNESS KOSTAL) Did you have them in order?

Q Mr. Kostal, the order I have is north-sort, east-west and vertical.

A (WITNESS KOSTAL) Fine.

Q And that's Intervenors' 167.

All right, sir. Now, as you stated a moment ago, you determined overnight that both the original calculation for Cable Pan Hanger 104 and the revised calculation that appear in Intervenors' Exhibit 155B included the Braidwood-specific seismic response spectra?

A (WITNESS KOSTAL) That's correct, sir.

Q All right.

And that that change in the result in that calculation is accounted for by any change in seismic data?

A (WITNESS KOSTAL) That's correct.
Q All right.
Now, can you describe the three documents that comprise Intervenors' 167, please.
A (WITNESS KOSTAL) Yes, sir.
The documents are of the various spectra in the horizontal north-south direction, in the horizontal east-west direction, as well as the vertical direction for the auxiliary building, turbine building, heater bay at Elevation 451.
The individual spectra have a series of lines which represent the spectra across various frequencies, and these lines move up and down based on the G level associated with a given frequency.
Q That's acceleration?
A (WITNESS KOSTAL) I'm sorry. A G level is acceleration, yes, sir.
The solid heavy line represents, as well as the lines above the solid heavy line -- represents the enveloped Byron and Braidwood response spectra.
This was the spectra that was used for the initial calculations on the cable pan hanger population.
The other lines --
Q Excuse me.

When you say "initial calculations," you mean the design calculations that were used?

A (WITNESS KOSTAL) The design calculations and subsequent calculations that were performed over a period of time till such a point in time that the unique spectra for each plant was used.

Q All right.

But when you say that the enveloped spectra were used in the initial calculations, that doesn't mean the initial calculation for the evaluation of Cable Pan Hanger 104?

A (WITNESS KOSTAL) No. What I mean by initial evaluation and analysis is the analysis that was performed on this particular hanger as well as any other hanger at some point in time, which was the first analysis to determine the various members that would be used, the various connections that would be used and the loads that existed at that point in time.

Q All right, sir.

The --

A (WITNESS KOSTAL) The --

JUDGE GROSSMAN: Excuse me.

When you used the envelope of Byron/Braidwood, you did have available to you the unique spectra for each of

those plants, didn't you?

A (WITNESS KOSTAL) That's correct, sir.

The reason we used the enveloped spectra is it conservatively designs the hanger at either station and envelopes both spectra, so it allows us to make one run, which saves engineering man-hours, and it conservatively then sizes that particular hanger for each plant.

JUDGE GROSSMAN: Okay.

I'm sorry I interrupted your answer.

A (WITNESS KOSTAL) The dashed portion of the line, where it's shown, represents that portion of the spectra that is unique to Braidwood.

In addition, there are other spectras for various damping values that are also shown on this exhibit.

In the cable pan hanger population, the damping value of 7 percent is the assigned damping value for the population.

These various damping values are defined by the NRC, and they also define where you can use different damping values depending on the types of component that are being analyzed.

In the case of cable pan hangers, 7 percent damping is the allowed damping spectra that can be used in the design.

JUDGE GROSSMAN: The higher the damping -- I assume the higher damping reflects the loss of motion from the ground to the particular item that you are applying the spectra to; is that correct?

A (WITNESS KOSTAL) In essence, that's correct.

Maybe a little further explanation is the damping normally also takes into account the ability of the component, due to its characteristics, to absorb a seismic load.

JUDGE GROSSMAN: Okay.

The point is the higher the damping, the less motion is imputed to the item that you are considering; is that so?

A (WITNESS KOSTAL) Yes, sir.

JUDGE GROSSMAN: Okay.

BY MR. GUILD:

Q And does that have to do generally with the rigidity of the component in question?

A (WITNESS KOSTAL) That's one of the elements, yes, sir.

Q All right, sir.

Now, taking an example, for a given component, a given design, there is a known frequency; is that correct?

A (WITNESS KOSTAL) Yes, sir, you can calculate the

JUDGE GROSSMAN: The higher the damping -- I assume the higher damping reflects the loss of motion from the ground to the particular item that you are applying the spectra to; is that correct?

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A (WITNESS KOSTAL) That's one of the elements, yes, sir.

Q All right, sir.

Now, taking an example, for a given component, a given design, there is a known frequency; is that correct?

A (WITNESS KOSTAL) Yes, sir, you can calculate the

frequency of a component.

Q All right.

And you calculate -- Sargent & Lundy does that or the computer does that for you?

A (WITNESS KOSTAL) That's correct, sir.

Q You have a program that does that?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

That value is found in this exhibit along the horizontal axis right at the top of the page, frequency?

A (WITNESS KOSTAL) That's correct.

Q All right.

For a particular component, then, with a given frequency, you find the point on the horizontal axis.

And is 10 a representative frequency for a component of the sort we're talking about, cable pan hangers?

A (WITNESS KOSTAL) I didn't go back -- you know, we talked about this this morning. In our example, we chose 10 as an example; but I can't speak to the exact frequency level of this particular hanger --

Q All right.

Can you --

A (WITNESS KOSTAL) -- in question.

Q Can you tell whether 10 is a representative frequency for cable pan hangers, would 5 be more representative or do you know?

A (WITNESS KOSTAL) I would have to go back and check. It's a number that I can get fairly easily, but I just haven't done that check since you asked me that question this morning.

Q All right, all right.

Well, let's take 10 just as a value for frequency.

You then run down that line until you intersect the appropriate response spectra curve.

In this case, we're talking about a cable pan hanger. It would be the 7-percent curve.

And it's the same for both Braidwood unique and the Braidwood/Byron enveloped response spectra?

A (WITNESS KOSTAL) That's correct.

Q You read over to the vertical axis to the left, and you get a value for acceleration expressed in G units?

A (WITNESS KOSTAL) That's correct.

Q All right.

And for 10, it's 2 --

A (WITNESS KOSTAL) That's correct.

Q -- 2 G?

Now, how is that value, the acceleration value of 2

G, applied in the design of a cable pan hanger?

A (WITNESS KOSTAL) That's applied at the note point where the loads are put into the computer model.

The note points represent the attachment points of the hanger to the horizontal members, so at a given attachment point -- let's assume that we have a weight at that attachment point equal to 100 pounds.

What you would, in essence, do is apply a horizontal load at that note point in the north-south orientation equal to 100 pounds times 2, because there is an acceleration G level of 2 associated with the frequency of 10 and a damping value of 7.

So, in essence, from a simplistic point of view, it applies a 200-pound reaction in the horizontal north-south direction at that note point.

Q All right, sir.

And in order to derive a full evaluation of the seismic stresses imparted on a member, you would look not just at the north-south, but the east-west, and derive the value in the same fashion?

A (WITNESS KOSTAL) Yes, sir.

Q And then in the vertical direction from the third page of Intervenors' Exhibit 167?

A (WITNESS KOSTAL) Yes, sir.

Q And the combined effects of those forces on those axes would give you the resultant seismic stress for the particular member in question?

A (WITNESS KOSTAL) Yes, sir.

Q All right, sir.

Now, what accounts for the difference principally in the Braidwood-specific or Braidwood-unique response spectra and the Byron/Braidwood enveloped spectra?

A (WITNESS KOSTAL) Each of these plants is founded in different soil media, and the difference that exists between the two spectra is a result of the inclusion of the various soil media at Byron and Braidwood.

Q Byron's on rock, Braidwood's on soil?

A (WITNESS KOSTAL) That's correct.

Q Now, although that's helpful, but while a factor that influences the evaluation of defects on components -- hangers, in this case -- again, no changes in seismic stresses are reflected in the revisions from the original to the revised calculations for Cable Pan Hanger 104?

A (WITNESS KOSTAL) If I could, can I restate the question and answer?

The only changes that exist between those two analyses is that the loads, the weights, that we

referred to in the last example are multiplied by the seismic response spectra values, and that results in a unique change, purely because if the weight is slightly less, the applied G level to a slightly less weight will be different, which will result in a different stress --

Q Understood.

A (WITNESS KOSTAL) -- associated with the seismic loading condition.

Q Understood.

The spectra have not changed, though?

A (WITNESS KOSTAL) The spectra have not changed.

MR. GUILD: Mr. Chairman, I ask that Intervenors' 167 be received in evidence.

JUDGE GROSSMAN: Any objection?

MR. STEPTOE: No objection.

MR. BERRY: No objection.

JUDGE GROSSMAN: Received.

(The document was thereupon received into evidence as Intervenors' Exhibit No. 167.)

JUDGE GROSSMAN: I take it the reason there's a difference between the soil readings for Braidwood and the rock readings for Byron is that it's assumed that there's some damping value to having ground waves

propagate in soil at Braidwood versus the ground waves propagating through rock at Byron; is that so?

A (WITNESS KOSTAL) That's correct.

JUDGE GROSSMAN: And I take it in the FSAR you have consistently used the envelope of Braidwood/Byron?

A (WITNESS KOSTAL) Yes, sir.

JUDGE GROSSMAN: And that's not changed, has it?

A (WITNESS KOSTAL) No, sir.

JUDGE GROSSMAN: Okay, fine.

And I guess one reason why you have that conservatism for the envelope of Braidwood/Byron is that these ground-motion calculations or the understanding of what happens is not as exact as perhaps some seismologist would like to believe; is that so?

A (WITNESS KOSTAL) No, not quite, Judge Grossman.

The real reason for the enveloped spectra is the initial analysis -- the engineering effort required would have been doubled if we did an analysis based on the Byron spectra and then a separate analysis on the plant based on the Braidwood spectra.

It was a decision on the part of Commonwealth Edison that we would envelope the spectra, which is a

more conservative criteria, and use that as the design -- for the design of the plant, which was similar at both stations, and only use the unique spectra when we had unique conditions at either of the two plants.

(Indicating.)

BY MR. GUILD:

Q All right, sir.

Let's turn to Intervenors' Exhibit 155B again. That's the calc package for Cable Pan Hanger 104.

Now, again, there are two discrepancies that have different points for the bounding or limiting case depending on whether we are looking at the original calc or the revised calc.

The first of those appears beginning at Page 7, and that is the fit-up gap and weld size associated with that 1/8-inch gap for the diagonal brace; correct?

A (WITNESS KOSTAL) Yes, sir.

Q And the second of those is beginning at Page 13, the undersize weld, Section BB; that is, for the longitudinal brace, the gusset plate attachment to the vertical hanger member?

A (WITNESS KOSTAL) Yes, sir.

There are other calcs that were made with the second run.

Q Yes.

And let's look at the second of those two defects; that is, beginning at Page 13.

Now, if you would, let's start with the revised calc, and can you now, having had a chance to review the basis for the changed calculation, explain to me what the steps were and the data utilized in the revised calculation for this particular detail?

A (WITNESS KOSTAL) The original calculation that was performed demonstrated, and on Page 15, that the design margins remaining in this particular connection detail were greater than the code allowables.

Q It was 3 percent greater, 1.03?

A (WITNESS KOSTAL) It was greater than the code allowables.

So we had already determined this to be a Z discrepancy, and we have already determined that the design significance consideration was taken into account and that there was no design -- no design significant discrepancy based on the fact that the as-built connection met the allowable code limits.

In performing the -- this first analysis included all the parameters that we would include in our normal calculation analysis, meaning the forces resulting at

the weld and the transferring of those forces to the centroid of the weld if the work point was not at the centroid.

The second calculation was performed based on the use of the loads that were generated from the second seismic run on 8/22/85, and those loads were less than the loads applied to this particular connection in the computer run that was performed on June -- let me get the date -- on June 1, 1985.

Since those loads were less than, we performed a check to see what the new range of design margins are, which we knew, based on the fact that the loads were less, the design margins would be even greater.

In that particular second calc, we performed the calculation associated with the loads in the -- applied to the member in the global coordinate system.

We didn't perform the second phase of that analysis, which was shifting those loads to the new -- to the centroid of the weld.

So what you see in the second calculation is a more simplified calculation, which showed the range of the increase in margins that occurred as a result of that simpler -- that simplified calculation.

That showed that the design margin with that

simplier calculation would be 1.89.

Q All right, sir.

Now, let me interrupt you.

If you, indeed, had done the full calculation the second time around, made the translation to the work point, you would have derived a design margin not of 1.89, but of 1.28?

A (WITNESS KOSTAL) That's correct.

I explained to you when you were in my office that we performed that additional calculation to show what the effect would be, and it still was -- based on our original design being greater than 1.0 and given that we knew the loads were less than the original loads, it gave it -- we performed that analysis last night, and that particular value of design margin is 1.28.

Q All right, sir.

So as I understand, you did not, then, replicate the use of the local coordinate analysis that appears at Page 14 when you did your revised calculation, and, therefore, it's simply -- the original calc for that calculation -- the original calc for that set of coordinates is simply X'd through here and replaced with the results of the computer run?

A (WITNESS KOSTAL) That's correct.

Q Okay.

A (WITNESS KOSTAL) If I could clarify further, that computer run does contain the shifting of the loads to the local axis and does contain that interaction coefficient within the computer run for that location of weld.

Q All right, sir.

A (WITNES KOSTAL) Maybe if I could explain a little further, one of the considerations in performing reassessments is reviewing the time that is spent on these re-evaluations.

There is a certain judgment on the part of the engineers that is used in determining the level of the detailedness of the calculation.

Given the fact that he already knows that the exact calculations with a higher set of loads had a design margin greater than 1, in an effort to save engineering hours and cost, this particular simplified version was used.

Q Well --

JUDGE GROSSMAN: Excuse me.

What figure did you use instead of the 45 pounds per square inch that you had used originally?

A (WITNESS KOSTAL) We used the actual.

JUDGE GROSSMAN: Per square -- per linear foot, is it?

A (WITNESS KOSTAL) Square foot.

JUDGE GROSSMAN: Per square foot. Okay.

A (WITNESS KOSTAL) There are nine cable trays in this particular hanger. There is actual cable weights associated with each cable tray; and we used the actual cable weights that are tabulated in what is known as our CIS 4 or Cable Information System, and that is a system which tracks all cables in and all cable trays, and provides an output of the load of those cables at specific discrete points along the cable.

Using that information, we derived the actual weights for these cables associated with this particular hanger.

JUDGE GROSSMAN: I see.

BY MR. GUILD:

Q Now, just returning to the last point, if the computer did the translation, in your revised calculation now, from the -- involving the use of the local coordinates to the work point in question, why didn't you state the value of 1.28 as the resulting design margin and not 1.89, when you documented this calculation?

A (WITNESS KOSTAL) The computer will give you the value

based on the connection being per as designed.

This is a calculation to take into account the discrepancy that exists.

Q I see. All right, sir.

So when you say that the computer made the translation from the two coordinate systems, it didn't do that for the defective as-built condition?

A (WITNESS KOSTAL) That's correct.

Q All right, sir.

So you eliminated the calculation, the original calculation, aspects, the coordinate translation aspects of the original calculation, appearing at Page 14?

A (WITNESS KOSTAL) That's correct.

Q All right.

Now, Page 15 of the calc package, again, focusing on the revisions, what are the revised values, therefore, that are utilized in the calc at Page 14 -- Page 15?

Excuse me.

A (WITNESS KOSTAL) The revised values that are utilized are the forces that are shown in the cloud on Page 14, and those forces are, in the global coordinate system, FX equal to 0, FY equal to 12.22 kips, FZ equal to 3.493 kips, and moments MZ, MY and MX equal to 0.

The calculations on Page 15 reflect the stresses along various planes.

For example, FZ is the stress that exists along the Z axis based on the load of 3.493, which came out of the computer analysis, divided by the area of the weld group, which is 2.34.

That stress level revised is equal to 1.49 in the cloud.

The stress along the Y axis is in the next calculation, which shows the Y force, 12.22, also divided by the area, 2.34, and in the cloud is the stress of 5.22 kips per square inch along that axis.

The next line performs an analysis to get the resultant of those two vector components, and in there, under the square root sign, is the value of 1.49 squared times the value of 5.22 squared. The square root of that gives you the resultant stress of -- in the cloud of 5.43, and that's compared with the allowable for this particular weld of 19.75 kips per square inch.

The as-built condition is the next set of calculations, which, again, goes through that same set of calculations, defining the FZ stress, which is the area of -- which is the force, 3.493, divided by the area of the as-built weld, which is 1.219, and that

stress level in the cloud is 2.865.

The next line represents the stress in the Y direction, which is the Y force, 12.22, divided by the area, again, which is 1.219, and that stress is equal to 10.024.

To get the resultant stress, you multiply -- you square those two forces and you get the square root, and the resultant stress is 10.425, and the interaction is the resultant stress over the allowable stress, which is in the cloud as 10.425 divided by 19.75. That gives you a value of -- in the cloud of 0.52 as compared to an interaction value of 1.

The next calculation is the R value calculation, which is the ratio of -- I've got to find that. Oh, it's the ratio of the stress, 5.28, which is over the previous interaction coefficient of 2.-- .275, and the R value is in the cloud equal to 0.52. The design margin for this particular methodology is 1.82 as defined in the cloud next to --

Q 1.89?

A (WITNESS KOSTAL) I'm sorry.

-- 1.89.

Q All right, sir.

Now, looking at the as-designed portions of that

calculation that appear towards the top of the page, that is the result -- the revised calculation is a computer product as opposed to the result of the hand calc as was the case with the original?

A (WITNESS KOSTAL) This is a hand calc. The product of the computer run are the forces.

Q All right, sir.

I just don't see you replicating -- look at the first line for the force at Z, formerly the force at a.

Originally you had a multi-component equation there, and you simply X'd through all of the variables in that equation and replaced them with a circled value of 4.393?

A (WITNESS KOSTAL) Right.

Q You didn't pull that out of the air.

I take it the computer generated that number?

A (WITNESS KOSTAL) No. As I indicated before, this was a more simplified version of the calculation -- the more exact version of the calculation was the original calculation that was done on 6/1/85 -- as a result of the run on 6/1/85, which did take into account the work point location of the force translated to the centroid of the weld group.

Q I see.

So now in your revised calculation, the simpler method, the force at Z is simply equal to -- well, is it force of Z divided by A?

A (WITNESS KOSTAL) Right.

F -- little fz is actually a stress --

Q I see.

A (WITNESS KOSTAL) -- in the Z axis.

Q All right.

The same -- similar -- similar principle applies to the calculation of the force at Y --

A (WITNESS KOSTAL) Yes, sir.

Q -- the next calculation?

All right. Now, you didn't recalculate an R value -- or the reviewer didn't recalculate an R value using the revised data.

Again, you had already done the calculation; you didn't need to have a new R value.

A (WITNESS KOSTAL) We --

Q Why didn't the reviewer recalculate the R value?

A (WITNESS KOSTAL) We calculated an R value.

As indicated in the second to the last line, it was equal to 0.52 in the simplified version.

Q I see.

You didn't recalculate the R value using the

original calculation methodology, the -- involving the translation of coordinates?

You did that in your office this morning, though?

A (WITNESS KOSTAL) That's correct, I did it for you in my office this morning, and the value came out to be 0.528.

Q All right, sir.

Still less than 9 -- less than .9, still required evaluation?

A (WITNESS KOSTAL) Correct.

Q All right, sir.

MR. GUILD: Mr. Chairman, Mr. Kostal and his people were assembling a package this morning that talked about the computer model, and we did not have time to get through -- get to that or it wasn't available at the time we completed our discussions.

It is a topic I'd like to speak to Applicant off the record about, and perhaps return to, but I'm going to pass from that subject at this point with the Board's permission.

JUDGE GROSSMAN: Well, okay.

Then I have just one or two questions.

Back to the response spectra. Did you say that you don't recall at this time what frequency was used with

regard to this item?

A (WITNESS KOSTAL) The -- what -- the frequency exists within the computer output. It's not normally printed out, because it's automatically taken into account in the analysis.

In essence, what takes place within the program, there is a subroutine step which calculates the frequency of the given hanger geometry. Then with that given frequency, it goes to the appropriate spectra curve and takes the appropriate G level from that spectra curve and does the analysis with those particular acceleration levels.

We can pull out -- or we can ask the -- for a print-out of that particular value.

We didn't do it because we -- it's -- you know, it's normally built in.

I would have to go back, put the run in and generate that particular value to know what the exact frequency is of this hanger.

JUDGE GROSSMAN: Well, I would like to find out what that figure is, so if you can do that --

A (WITNESS KOSTAL) Sure.

JUDGE GROSSMAN: -- we'd appreciate it.

Now, I take it, then, you used the unique value

with regard to that individual item? You did not use any kind of suggested value for that particular item; is that correct?

A (WITNESS KOSTAL) A unique value relative to seismic response spectra?

JUDGE GROSSMAN: Yes -- well, a unique value for the frequency to which you applied the response spectra.

A (WITNESS KOSTAL) The frequency that's calculated is calculated based on the as-designed welds. The frequency is not calculated based on the discrepant weld conditions.

So the frequency is the -- in essence, is the frequency that has existed in the -- in the computer runs calculated based on the members being built as exactly as we --

JUDGE GROSSMAN: Okay. That's not exactly what I was driving at.

It was my recollection, and perhaps erroneous, that there were values that are suggested with regard to frequencies in the Reg Guides for particular kinds of equipment, and my question was whether you used those recommended values, those guideline values, or whether you used a unique value.

And I understand you to say you used a unique value?

A (WITNESS KOSTAL) No. We used the recommended guideline value; and for cable pan hangers, the guideline recommends 7 percent damping.

JUDGE GROSSMAN: Okay.

But does it also recommend -- I recall that there are some different damping values.

But are there also recommended ranges of frequency for different equipment or not?

A (WITNESS KOSTAL) No, no, sir.

JUDGE GROSSMAN: No, there aren't. Oh, okay.

Mr. Guild.

BY MR. GUILD:

Q Well, will the frequency of the hanger as built with defective welds be the same as the frequency as designed with the welds assumed to be as specified?

A (WITNESS KOSTAL) In order to input the welds, you then have to input the geometry properties at the connection.

Our model is based on the properties that this particular connection is a pin connection. The other members, the horizontal members, are fixed connections.

In order to take into account --

Q Stop one second.

"This particular connection" meaning what, the longitudinal --

A (WITNESS KOSTA) The longitudinal diagonal brace we've been talking about is a pin connection because it acts as a truss, and truss members are stiffer in the axial direction as compared to the flexural capacities of the vertical member. Therefore, it carries no load and transfers no load. It really acts like a pin, pin meaning transferring no moment.

In order to get a frequency -- an exact frequency for this particular hanger, we would have to make a more refined computer model, taking into account the joint stiffness characteristics of each joint and also taking into account the characteristics of these particular discrepancies.

In essence, what would happen in this particular detail, since the discrepancy is associated with the size of a weld, you will have a joint that will be less stiff, therefore, more flexible, and you would input that more-flexible condition into this more refined detailed computer analysis.

What would basically happen is, since it becomes softer or less stiff, it will pick up less loads than the previous computer run, and it will redistribute the

loads to other joints that are stiffer and can carry the load.

So what you will get in a more detailed refined analysis is an optimizing of the stresses in all the connections, because the stiffer connections will carry a larger load than the less-stiff connections, just based on purely stiffness characteristics, so what, in essence, will happen is you will show that the stress level in the weld is going to be less than this particular calculation.

We have done those calculations in the past, and, in fact, we had done those at Byron in support of my testimony under system control, and we did them on three hangers, taking into account the unique discrepancies that existed on the three worst hangers that we found at Byron.

The results of that analysis that were performed showed that --

Q Let me stop you right there.

How about this, Mr. Kostal: I always ask one more question than you want me to.

A (WITNESS KOSTAL) Well, can I finish?

Q No, you can't.

JUDGE GROSSMAN: Well, I would ordinary let

you finish an answer, but that's beyond the response to that question, and --

A (WITNESS KOSTAL) Fine.

JUDGE GROSSMAN: -- it's just not a fair way of getting in that testimony.

MR. GUILD: I'd be happy to have you educate me on what you did on Byron off the record, too, Mr. Kostal, and then perhaps we can talk about that on the record; but that's the protocol.

We are going to enter a new section and --

A (WITNESS KOSTAL) Fine.

JUDGE GROSSMAN: One more question on these items.

You indicated that in your recalculation you also took into account the changed location of the item; isn't that correct?

A (WITNESS KOSTAL) In the recalculation, we took into account the changed location of the cable pan.

One of the cable pans was located differently than in its original location, and that basically moved the note point on the horizontal member from its original location.

JUDGE GROSSMAN: Well, did you get an increased or a decreased load from moving that?

A (WITNESS KOSTAL) I can't -- I didn't look.

Locally what would generally happen -- and I'd have to go into the calculations -- the pan moved slightly to the center, which would mean that you would have locally some changes in the connections, end connections of the horizontal member from which that pan had been located, so there could be -- would be some different stresses in that connection.

Exactly how that changed, I would have to look at the two note points to determine what that new stress level is in the end connections.

But, also, at the same time, when we did shift the pan location, we also inputted the actual weight of the cable, so that would also, then, modify the end reactions.

BY MR. GUILD:

Q Well, let me just be clear.

If you -- you've got a horizontal member supporting two pans, and it's --

A (WITNESS KOSTAL) One pan. That is one pan.

Q Okay. Supporting one pan.

Then if the pan -- and as the pan is designed, it's supposed to be in the center of the horizontal?

A (WITNESS KOSTAL) No. The pan is located in space in

some location.

Q Wherever it's supposed to be?

A (WITNESS KOSTAL) Relative to where it is on the horizontal member of the hanger.

Q You've got two welds, a weld at either end of the horizontal.

What's the effect on the stress on Weld A at the north side of the horizontal if the -- if the cable pan is closer to Weld A than as designed?

A (WITNESS KOSTAL) You would get a greater shear stress on Weld A. If the pan was located closer to Weld A, you would get a slight -- you would get a shifting of shear and moment in each of the joints.

Q All right.

And less stress on Weld B if Weld B is at the opposite end?

A (WITNESS KOSTAL) Further away, yes, sir.

MR. GUILD: May I have one moment, please, Mr. Chairman.

Mr. Chairman, I've handed to the witness and Board and parties a document that I'd ask be marked as Intervenors' 168, please.

(The document was thereupon marked Intervenors' Exhibit No. 168 for

identification as of October 16, 1986.)

BY MR. GUILD:

Q Now, Mr. Kostal, I've handed you a multi-page document. It's Bates No. AR006904 through 09.

(Indicating.)

These are documents that you had prepared at my request in discovery, and they list the R values and the design margins for the electrical items, the BCAP CSR sample items that Sargent & Lundy evaluated and performed calculations on; correct?

A (WITNESS KOSTAL) These are the values I prepared for you at your request when you came into our offices, which formed the basis of my conclusions that are documented in my testimony for each population regarding the lowest design margin remaining and the average design margins in the various populations.

Q All right, sir.

Well, that I understand; but reflect on my -- the question I asked you, sir.

Are these not the R values and design margins calculated for the electrical items in the CSR population that were evaluated by Sargent & Lundy?

A (WITNESS KOSTAL) Yes, sir.

Q They also happen to be the basis for your testimony?

A (WITNESS KOSTAL) Yes, sir.
Q All right.
The first page is conduit hangers. On to the second page, the third page, is cable pan hangers, as is the fourth and fifth page. The last page is electrical equipment; is that correct?
A (WITNESS KOSTAL) Yes, sir.
Q All right.
We have no cables and we have no conduits.
There were no calculations made for those populations?
A (WITNESS KOSTAL) No, sir.
Q Now, sir, if we turn, please, to Bates No. AR006906, and that is the first page for the cable pan hanger population.
Do you see Cable Pan Hanger Sample Item 104?
It's the second to the bottom.
A (WITNESS KOSTAL) Yes, sir.
Q All right, sir.
Now, on the basis of your testimony today, you would agree, would you not, that the design margin for 104-4, if you used the complete calculational method used in the initial calculation for 104, the 1.89 there should be changed to read 1.28?

A (WITNESS KOSTAL) Correct, sir.

Q All right, sir.

I want to make that change in my exhibit.

And that the R value, using the complete calculational method consistent with the original calculation approach, should be increased from .52 to .528, or .53 if you round up to two significant digits; correct?

A (WITNESS KOSTAL) Yes, sir.

JUDGE GROSSMAN: Excuse me.

You say consistent with the original calculation approach?

BY MR. GUILD:

Q The first calculation done in the calculation package for Cable Pan Hanger 104 that used the two local coordinate systems to translate the load to the work point as opposed to the revised calculation, which used the simplified approach, which did not make that translation?

A (WITNESS KOSTAL) May I -- actually, we would not change it at all, because based on that definition, the R value still remains at 0.52 based on the original calculation.

Q All right, sir; all right, sir.

1.28, though, would be the calculated value for the design margin using the new data but the original calculation method?

A (WITNESS KOSTAL) Yes, sir.

Q How many other electrical equipment CSR sample items, Mr. Kostal, are there for which you made revised calculations; that is, for which there were original R values or original design margin values that were calculated that are not the values that are shown on Intervenors' Exhibit 168?

A (WITNESS KOSTAL) I don't have that data in front of me.

I would have to go back and tabulate that number.

Q Are there any?

A (WITNESS KOSTAL) Well, there was at least one, because we looked at one which was Hanger -- Cable Pan Hanger 104.

Q All right, sir.

You don't know whether there are any others?

A (WITNESS KOSTAL) No, sir.

Q I may have just shot blind and hit the target on that one.

All right, sir. How many are there on this exhibit, Intervenors' 168, where, in the second revised

calculation -- or the revised calculation, you used a simplified calculational method that, by analogy to the instance of Cable Pan Hanger 104, produced a value that is higher than the value that would be produced if you used the complete calculational method utilized in the original calculation?

A (WITNESS KOSTAL) Again, I don't have that data with me.

Q All right, sir.

Are there any others aside from Cable Pan Hanger 104?

A (WITNESS KOSTAL) I would have to look through the data.

Q All right, sir.

MR. GUILD: Mr. Chairman, I'd ask that Intervenors' Exhibit 168 be received into evidence.

JUDGE GROSSMAN: Any objections?

MR. STEPTOE: No objection.

MR. BERRY: No objection.

JUDGE GROSSMAN: Received.

(The document was there received into evidence as Intervenors' Exhibit No. 168.)

JUDGE GROSSMAN: Whenever you want to go on

to a new topic, it's time for lunch.

MR. GUILD: I believe it's appropriate for a luncheon break at this point in time, Mr. Chairman.

JUDGE GROSSMAN: Okay.

Why don't we reconvene, then, at 1:45.

(WHEREUPON, the hearing was continued to the hour of 1:45 P. M.)

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	
COMMONWEALTH EDISON COMPANY	Docket No. 50-456 OL 50-457 OL
(Braidwood Station, Units 1 and 2)	

Met pursuant to recess.

Thursday, October 16, 1986.
1:45 P. M.

JUDGE GROSSMAN: We're back in session.

Mr. Guild.

MR. GUILD: Thank you, Mr. Chairman.

BY MR. GUILD:

Q Now, Mr. Kostal --

JUDGE GROSSMAN: Before we start -- okay, fine.

BY MR. GUILD:

Q Mr. Kostal, I had asked you earlier about Sargent & Lundy's role in supplying the lists of more-highly-stressed components for the BCAP sample selection process, and you were kind enough this morning

to make available to me a list of the items from the populations in which you identified more-highly-stressed items, lists of those items to represent items identified by Sargent & Lundy, items supplied to the BCAP Task Force, and I'd like to show you some of those lists and ask if you can explain a little bit about them, please.

Let's start with a list of cable pan hangers, if I might, and let me see if I can round up enough copies for the Board and parties.

Do you need a copy, Mr. Kostal?

A (WITNESS KOSTAL) Yes, sir.

Q Okay.

(Indicating.)

MR. GUILD: It looks like it's Intervenors' 179, Mr. Chairman, if my notes --

JUDGE COLE: 169.

JUDGE GROSSMAN: 169.

MR. GUILD: I'm sorry. 169.

Excuse me.

(The document was thereupon marked Intervenors' Exhibit No. 169 for identification as of October 16, 1986.)

BY MR. GUILD:

Q All right, sir.

Now, I take it this document was prepared in response to a request that I made?

It's a newly-created listing, is it not?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

The left-hand column, I take it, is the CSR package identification number?

A (WITNESS KOSTAL) Yes, sir.

Q The next column is the support number.

That's the number that's used to identify the hanger on the Sargent & Lundy drawings?

A (WITNESS KOSTAL) Yes, sir.

Q Then there is the drawing number, the -- from which the -- on which the hanger is shown.

Then there are a series of columns, one headed "Byron," the last "Braidwood." In the "Bryon" column is "HS IC" and "Current IC."

What are the data in the Byron column, the first Byron column?

A (WITNESS KOSTAL) This data represents the interaction coefficients from the list of highly-stressed that was based on the data base of more-highly-stressed in the cable pan hanger population which has in the past

referred to the number of 1,433 hangers.

These are the interaction coefficients that existed in that point in time at which the -- the point in time at which this particular list was created, which was a Byron list of hangers which were in the process of further analysis, and these are those interaction values on these particular hangers that became part of the BCAP sample.

Q All right.

Now, that was the list that was used for the selection of Braidwood CSR highly-stressed sample items?

A (WITNESS KOSTAL) That's correct.

Q All right.

Now, what was the threshold value that was used to derive a list of Braidwood -- Byron highly-stressed items?

A (WITNESS KOSTAL) The threshold value was supposed to be .8.

Q Again, the interaction coefficient here is the reciprocal of the design or safety margin?

A (WITNESS KOSTAL) That's correct.

Q All right.

So a value of greater than .8 reflects a higher level of stress relative to the allowable stress for the

particular component?

A (WITNESS KOSTAL) That's correct.

Q All right.

And 1 -- a value of 1 for the interaction coefficient reflects a value of stress equal to the design allowable?

A (WITNESS KOSTAL) That's correct.

Q Above 1, exceeding the design allowable?

A (WITNESS KOSTAL) That's correct.

Q All right, sir.

Now, are there values in here -- are there items in here with interaction coefficient values of lower than .8?

A (WITNESS KOSTAL) There are a few.

Q All right.

And let's -- the first I notice is for 042, about two-thirds of the way down in the first page.

Do you know why that particular hanger was included in the more-highly-stressed list despite that lower value?

A (WITNESS KOSTAL) At the point in time, I do not know why this one was -- I do know why it was chosen.

We had a list of 1,433, which was the list that existed at Byron, of more -- of hangers that were being

evaluated at Byron, and that list represented hangers which were believed to be .8 or greater -- .8 or greater interaction values.

Q Now, let me stop you a second.

That list of 1,433 you believed, using this measure, to represent those hangers with interaction coefficients of .8 or higher?

A (WITNESS KOSTAL) Right.

Q All right, sir.

A (WITNESS KOSTAL) In looking at this list, there are a few.

016, which is the fifth line down, has a .53 interaction.

Q Yes, I just missed that one.

A (WITNESS KOSTAL) 042 has a .74 interaction; and there is -- on the third page, 141 has an interaction of .59; and there is another one on the -- on the fourth page which has a value of .45 for 164.

Q 164 or 5?

A (WITNESS KOSTAL) 165. Excuse me.

Q Yes.

And, again, do you know why those items with lower interaction coefficients than .8 were included in the list of more-highly-stressed cable pan hangers?

A (WITNESS KOSTAL) Again, they were on the list of hangers; this 1,433 at that point in time we believed had interaction values greater than .8.

Q Well, now, as I understand it, you reconstructed this list in the present time; correct?

A (WITNESS KOSTAL) That's correct.

Q Because you didn't retain the data from the original list when it was sent over; it was just sorted and sent over without the values for interaction coefficients being retained, I take it?

A (WITNESS KOSTAL) No. We do have a list of interaction coefficients associated with this 1,433.

Q You have the original basis interaction coefficients that you --

A (WITNESS KOSTAL) Yes, sir.

Q Oh, you do?

A (WITNESS KOSTAL) Yes, sir.

Q Oh, is that what this list is?

A (WITNESS KOSTAL) This is an extract from it of the ones that are in question, which you asked for, which is the 68 that were in the population inspected by BCAP for the cable pan hanger.

Q Indeed.

So it's not a reconstituted list? This is the

original list, original interaction coefficients; correct?

A (WITNESS KOSTAL) Yes.

Q Now, then, I was, I guess, surmising about an explanation for why these 4 items with lower than .8 interaction coefficients might be on a list today if it was a reconstituted list, but it was the same list you had when you went over the BCAP.

Presuming those same items had at that time the same interaction coefficient, why did you send them ones with less than .8?

A (WITNESS KOSTAL) My only explanation is there were a few that were less than .8.

The original intent of BCAP was to sample at least 60 highly-stressed, and excluding these few, we did, indeed, sample 60 highly-stressed.

Q All right.

I can count as well, too. I accept that's true.

But we just don't know why they are on the list?

A (WITNESS KOSTAL) That's correct, sir.

Q Okay.

Now, as I gather from your testimony and from the testimony of others in this part of the proceeding, Applicant's rebuttal case, the design of the use of

more-highly-stressed sample items was to test items in the field whose design margins at the outset were smaller, where discrepancies might be presumed to have a more -- a higher likelihood of having a significant effect, from a design standpoint, on the ability of that item to perform its function in service?

A (WITNESS KOSTAL) That's correct.

Q All right.

Well, bear with me a moment, Mr. Kostal.

If you would look at Intervenors' Exhibit 168 -- that's your listing of the R values and design margins for the BCAP discrepancies evaluated -- and help me a moment.

Let's take -- do you have that document, sir?

A (WITNESS KOSTAL) Well, I've got to find it. Hold on for a second.

Yes, sir.

Q Do you need a copy?

A (WITNESS KOSTAL) No, sir.

Q You've got one?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

If you turn to the cable pan hanger population in that document, and let's look first at Sample Item 41,

please.

A (WITNESS KOSTAL) Yes, sir.

Q Okay.

For Sample Cable Pan Hanger 41, I see an R value of .53 and a design margin of 66.7.

A (WITNESS KOSTAL) Yes, sir.

Q All right, sir.

That's 66.7 times the design requirements for that particular hanger, even after the notable defect?

A (WITNESS KOSTAL) Not the particular hanger. It's the particular -- the most notable discrepancy, which was the discrepancy who had an R value of .53, and this is the associated safety margin for that particular discrepancy.

Q Oh, I see. All right.

Well, so it doesn't relate to the hanger as a whole, it relates to the particular discrepancy on the hanger?

A (WITNESS KOSTAL) That's correct.

Q All right.

Well, let's look at that same sample item in your list of more-highly-stressed cable pan hangers.

Now, for 041, for 41, I see a Byron highly-stressed interaction coefficient of 2.10; is that correct?

A (WITNESS KOSTAL) At the point in time when this was created, that's correct, that particular hanger had a connection which had an interaction value of greater than 2.1.

Q Well, it had a connection with an interaction value of greater than 2.1, not the whole hanger?

A (WITNESS KOSTAL) It had a given element within that hanger which had a connection equal to 2.1.

Q Okay.

And what element was that?

A (WITNESS KOSTAL) One of the elements within the hanger. I don't know which element that is.

Q All right.

So one of more than one connections; is that the --

A (WITNESS KOSTAL) This list was created based on the interaction -- the highest interaction value that existed on some portion of the component of the hanger that were being evaluated, so this reflects the highly-stressed interaction coefficient of the -- of one element of that hanger.

Q Oh, I see.

So that the CSR discrepancy does not necessarily occur at the same connection of the component that was the connection analyzed for purposes of declaring the

component more highly stressed?

A (WITNESS KOSTAL) That's correct.

We used -- in a hanger, you have multiple connections. Therefore, you have multiple analysis and you have multiple design margins or interaction coefficients.

Q All right, sir.

A (WITNESS KOSTAL) We characterized the hanger as highly stressed if, in fact, there was a given joint or connection that had an interaction value that exceeded the value of .8.

Q Well, then, sir, this particular connection, the particular connection in which there was a defect -- that particular connection was obviously not more highly stressed, because even after a reduction in its capacity of almost a half, 47 percent, it's got 66.7 percent -- 66.7 times the design requirements at that particular connection?

A (WITNESS KOSTAL) That's correct.

Q Well, what would happen, Mr. Kostal, if the BCAP discrepancy, the R value, the reduction in capacity of almost 50 percent, occurred at the point on this particular hanger where it had the more-highly-stressed connection, and that was the connection with, at least

for screening purposes, an interaction coefficient of 2.10?

A (WITNESS KOSTAL) We would have to do an analysis to determine what the new interaction value was on the Braidwood-unique hanger.

Q I see.

So for purposes of providing more-highly-stressed items for the BCAP sample, the likelihood of a defect adversely affecting the design margin of the component is also a function of whether the defect occurred at the particular connection in the component that was the basis for selecting that component as more highly stressed in the first instance?

A (WITNESS KOSTAL) State that question again.

MR. GUILD: Could I have it read back?

JUDGE GROSSMAN: Yes. Mr. Reporter, please.

(The question was thereupon read by the Reporter.)

A (WITNESS KOSTAL) That's correct.

BY MR. GUILD:

Q So it's a joint probability function here? It's not a sample probability of the occurrence of a defect; it's a probability of the occurrence of the defect and then a probability of the occurrence of the defect at the weak

link, at the point that's the basis for the more-highly-stressed identification?

A (WITNESS KOSTAL) No. The basis for the more-highly-stressed identification was based on hangers that existed at a point in time in -- at Byron, which were under further evaluation, which were further along in their design and assessment than Braidwood was.

Q Now, you are --

A (WITNESS KOSTAL) That particular --

Q I don't think you are responding to my question.

A (WITNESS KOSTAL) I am.

Q It's a function, first, of where the defect happened and the probability of the defect?

A (WITNESS KOSTAL) No, that's not how we chose the sample of highly stressed.

We chose the sample of highly stressed based on the hangers that had joints whose interaction coefficient exceeded .8.

Q You are still missing me here.

I think what I am trying to focus on, Mr. Kostal, is not how you picked the more highly stressed. I think I've got that clear now.

The question is:

When you couple your selection of more highly

stressed, as you now describe the way you sampled more highly stressed, with the BCAP discrepancy, what was found, and the way you evaluated those discrepancies, the likelihood of a discrepancy having design significance is a joint probability function? The function in the first instance is the probability of the defect occurring and in the second instance the probability of the defect occurring at the point of the more-highly-stressed connection?

A (WITNESS KOSTAL) That's true.

The results of BCAP program demonstrated that for highly-stressed connections, the level of the discrepancy found was assessed, and determined in those particular connections not to -- were determined to show that the results of those discrepancies in the highly-stressed joints still resulted in the joint being within the code allowable.

Q All right, sir.

Well, let's take cable pan hangers as a population now.

In how many instances did the defect, the notable defect, that was subject to evaluation occur at the connection which was the basis for selecting the item as a more-highly-stressed sample item, if any?

A (WITNESS KOSTAL) I don't have that data.
Q Do you know if it happened at all?
A (WITNESS KOSTAL) We -- I don't have -- I'd have to look at the population in the data base.
(Indicating.)
JUDGE GROSSMAN: Excuse me.
How many connections are there usually in the cable pan hanger?
A (WITNESS KOSTAL) Well, in a -- in a -- in the hanger that we discussed this morning, there are -- which is Hanger 104, there are -- there are 10 horizontal connections, there are 4 vertical connections and there are 4 diagonal connections, so in terms of total connections, there were 10, 12, 14, 16, 18; and in each connection, you have different stress planes for transferring the load through the connection, so there were, you know, a multiple of the number of connections in terms of the number of evaluations that were performed.
JUDGE GROSSMAN: So do I understand, then, correctly that the odds are at least 17 to 1 against the highly-stressed connection, on which you base your selection, being the one that has the defect?
A (WITNESS KOSTAL) In that particular example, that's

correct.

But in another example, which is a cable pan hanger, which is a cantilever off of a wall, there is only one connection.

BY MR. GUILD:

Q Okay.

Now, going back to Intervenors' Exhibit 169 -- that's your list of more-highly-stressed cable pan hangers -- the screening basis for this selection, the Byron highly-stressed interaction coefficients, does not represent the final calculated interaction coefficient for those items?

A (WITNESS KOSTAL) They represented the -- that's correct. They represented the interaction coefficient for those items at that point in time.

Q I see.

Now, under the Byron column in Intervenors' 169, we've got current interaction coefficient.

I take it that's the current Byron?

A (WITNESS KOSTAL) That's correct. That's the calculations that exist on Byron today of the interaction coefficients on those particular hangers.

Q And for Cable Pan Hanger 41, the sampled so-called more-highly-stressed cable pan hanger, the basis for

identifying as more highly stressed -- that is, that it had an interaction coefficient of greater than .8 -- no longer would qualify that item as a more-highly-stressed item, since, for Byron purposes, the current interaction coefficient was calculated to be .53?

A (WITNESS KOSTAL) That's correct.

Maybe if I can clarify --

Q Well, let me just round this out and then I'd be happy to have you explain.

And yet for Braidwood, if you used the current Braidwood interaction coefficient for that particular cable pan hanger, it's .98?

A (WITNESS KOSTAL) That's correct.

Q All right, sir.

Do you want to add something?

A (WITNESS KOSTAL) What I wanted to add was the fact that the process in time is a fluid process for the analysis of these hangers.

There are many analyses on a given hanger, based on changes in conditions on the hanger, which could be as a result of as-builting the hanger. It could be as a result of a field problem that was determined to exist on the hanger. It could be as a result of additional loads applied to the hanger. So the hangers in the analysis are updated and kept track of over time.

So at any point in time, the list of highly-stressed hangers or the state of stress that exists in any given hanger is fluid; it will change, depending on the loads that exist on that hanger today versus the conditions that exist on the hanger.

If we look back at the time of Byron when we created this list, it was based on conditions that existed in the 1984 time frame. We now have a set of conditions that exist in the current interaction coefficients based on the 1986 time frame, almost two and a half years later. Things have occurred to these hangers over that two and a half years.

Our responsibility is to keep track of those and make sure that those calculations are updated and stay condition code allowables or else repair the given hanger such that we stay within the code allowables.

Q And looking at just the first page of Intervenors' Exhibit 169, I count 19 items on that page. These again are 19 items that became more-highly-stressed sample items out of BCAP.

Would you agree with me, sir, that looking at the last column, the current Braidwood interaction coefficients, that only 10 of those 19 still even meet your screening threshold of .80 or higher interaction coefficient to be qualified as a more-highly-stressed

sample item?

A (WITNESS KOSTAL) At this point in time, if we were creating a list of hangers to inspect and using the same threshold of .8, we would have only 10 hangers that now meet that threshold.

Q And would you expect that that relationship would remain generally the same: that a smaller number, fewer than originally identified through the rest of the population, would still qualify as more-highly-stressed after you iterated through the current interaction coefficient calculation?

A (WITNESS KOSTAL) What we would have is a different list of hangers because as the hangers change over time and loads are applied to them, different hangers will replace these as being more-highly-stressed.

Q But those different ones are not on the list, and they weren't part of the BCAP sample?

A (WITNESS KOSTAL) That's correct.

Q My question is: Would you expect that the relationship would remain the same through the rest of the population?

A (WITNESS KOSTAL) The relationship of this population?

Q 10 of 19 on Page 1 would still meet the screening criteria.

Would you expect that that would represent t'e

relationship if we went through the rest of the cable pan hanger population and counted them up?

A (WITNESS KOSTAL) Well, it's 13 on the next page, and it's 13 on the next page, and it's 7 out of 11 on the last page.

Q All right, sir.

I take it that -- well, strike that. Let's look at one other item, Mr. Kostal.

JUDGE GROSSMAN: Are we going off this exhibit now?

MR. GUILD: No, sir, no, sir. One other example I'm going to look at, if I might.

BY MR. GUILD:

Q Let's look at your Intervenors' Exhibit 168, the BCAP result; again, the R value and the safety margin calculation. Let's look at it for Cable Pan Hanger 123, please.

I show at that point, for Cable Pan Hanger 123, that the R value, the capacity reduction, is .63, and the design margin was 1.5; correct?

A (WITNESS KOSTAL) That's correct. That's based on any given joint within that particular hanger.

Q All right.

The same principle applies to that item as it did to the last one that you've described?

A (WITNESS KOSTAL) That's correct.
Q Okay.
Now, looking at Intervenors' Exhibit 169 for that same item, that item, using the Byron highly-stressed interaction coefficient screening, had an interaction coefficient of 2.13; correct?
A (WITNESS KOSTAL) Yes, sir.
Q All right.
It has a current Braidwood interaction coefficient of 1.0?
A (WITNESS KOSTAL) Yes, sir.
Q Now, would you expect that the same principles apply to all the items in the population; the more-highly-stressed selection is based on the weakest link, if you will, the most highly-stressed connection at the time that evaluation is made?
A (WITNESS KOSTAL) At the time that sample was chosen, yes.
Q At the time the evaluation was made, given the methodology and assumptions made at the time of the evaluation; loadings, et cetera?
A (WITNESS KOSTAL) Yes, sir.
Q All right.
And the BCAP CSR discrepancy that's evaluated for design significance, capacity reduction, is only by

coincidence the same connection that got the item, the hanger, into the more-highly-stressed sample in the first instance?

A (WITNESS KOSTAL) It's not by coincidence. It's by choice.

Q By chance?

They're not necessarily the same connections at all?

A (WITNESS KOSTAL) What it represents is the fact that when we do the analysis on the connections and if there are discrepancies on it, the discrepancy then determines what becomes the more-highly-stressed connection.

Q All right, sir.

The fact remains, though, that the BCAP discrepancies don't occur at the same connection that was the basis for the sample item being identified as more-highly-stressed?

A (WITNESS KOSTAL) They may not.

Q They may?

A (WITNESS KOSTAL) They may.

Q Now, does that same principle apply to the other populations for which you supplied lists of more-highly-stressed items?

We've talked about cable pan hangers.

Now, if we move to the other populations --

A (WITNESS KOSTAL) The principle isn't the same in the others because of the fact that the number of connections that could exist are fewer.

For example, in the cable pan population, there are only two locations where connections occur, and that's where the pan is tied down to the horizontal member.

In a conduit hanger, the number of connections is limited because normally conduit hangers are cantilever members supported off walls or floors where you have single welds, single connections.

Q The principle doesn't apply at all, so let's just talk about this other population.

A (WITNESS KOSTAL) Sure.

Q You don't analyze it on the basis of the weakest connection for conduit hangers; you use another approach altogether. That's the approach you described the other day:

You compare the actual weight load on the hanger with the maximum allowable, and the relationship between the two is used to derive a ratio which is the screening factor?

A (WITNESS KOSTAL) That's correct, sir.

Q All right, sir.

JUDGE GROSSMAN: Excuse me.

Are you off 169 now?

MR. GUILD: Yes, sir.

JUDGE GROSSMAN: Were these original values for Byron based on the as-built condition of those items including the discrepant condition?

WITNESS KOSTAL: Some of them are. I can't speak to each item, but what it represented at that point in time was those hangers that we knew required additional analysis to reconcile whatever had occurred on that hanger.

A number of them were due to as-built conditions and could in some way have been due to increased loads because they attached more things to the hangers.

JUDGE GROSSMAN: Well, weren't all of these items subject to rework?

WITNESS KOSTAL: No, sir. They're subject to at least re-analysis to determine what the interaction value is.

In some cases, rework could have been recommended. In other cases, the re-analysis, refined analysis, resulted in the interaction coefficients being less than .1.

So it could be either one.

JUDGE GROSSMAN: Okay.

But the analysis depended upon the discrepant condition?

WITNESS KOSTAL: Yes, sir.

JUDGE GROSSMAN: Okay.

Now, I notice that --

MR. GUILD: Mr. Chairman, excuse me. I don't think that's correct.

BY MR. GUILD:

Q The Byron analysis is simply a design evaluation of these hangers.

I don't believe it includes any discrepant conditions, does it?

A (WITNESS KOSTAL) It included -- if there were discrepant conditions, it included those as being the reason for the interaction values to be at this level.

Q For Byron?

A (WITNESS KOSTAL) Sure.

The whole basis for this was we had a population of hangers that we were reconciling for various reasons: either they had outstanding nonconformances associated with them that we had to do an analysis for, meaning they had some type of field problem, or they had an as-built drawing associated with them that we had to still reconcile, or they may have had an additional load.

That's what --

MR. GUILD: I apologize for interrupting, Mr.

Chairman. I really didn't understand that to be the case at all. Excuse me.

JUDGE GROSSMAN: Well, now, it seems to me, from looking at this list, that a great number must have been subject to rework.

Is that your understanding, too?

Let me point out to you that except for one instance -- and that is, with regard to Item 141 -- every single item here, unless I missed some, had considerably lower values for the current than for the initial determination. In that one exception, there was a very slight increase from .59 to .60.

It would seem to me that a repair or rework of a discrepant condition could very well account for all or almost all of that because the magnitude of change was so great in almost every single instance that I would jump to that conclusion.

Is that unfounded, Mr. Kostal?

WITNESS KOSTAL: I believe, sir, that a majority -- that a large -- I'd have to validate it, but many of these were dispositioned through analysis. Whether or not repairs were required on these particular hangers, I do not know that at this moment.

But given the margins that are in our hanger designs, I believe that many of these would have been

dispositioned by a further refined analysis.

It, in essence, would show that -- the refined analysis would show that there are substantial margins in the refined analysis technique.

JUDGE GROSSMAN: I see.

But if you were to eliminate the discrepant condition existing in all of these items here, you would expect, wouldn't you, that every single one of these items would reflect a much lower value than the original value shown here for Byron?

Is that so?

WITNESS KOSTAL: Yes, sir.

JUDGE GROSSMAN: Okay.

BY MR. GUILD:

Q So, Mr. Kostal, the screening basis for more-highly-stressed items was not simply whether the item as designed, because of its design, was closer to the margin, closer to the design allowable.

The screening device was given the chance of a defect occurring in that item as built at Byron, how close that item with that defect came to the design allowable?

A (WITNESS KOSTAL) I didn't say that.

I said that some of these could have had that as a reason for being in this population, amongst many of the

other reasons.

Q All right, sir.

But these represented the as-built conditions for the Byron hangers, with all of the flaws that may or may not have existed in those hangers?

A (WITNESS KOSTAL) No. They represented the interaction values at a point in time at which a particular analysis existed, and that additional further analysis was still required.

Q But it would have included the as-built condition of some of those hangers?

A (WITNESS KOSTAL) It may have.

You asked me what could have been the reason for these existing in this fashion, and I gave you a multitude of reasons why I thought that could exist for these values.

One of those was NCR's that were being dispositioned, one of those was additional loads, and a variety of other reasons.

Q All right, sir.

Well, don't you recognize, Mr. Kostal, that by injecting the element of defective construction into your screen for more-highly-stressed components, you insert yet another multiple or joint probability -- that is, the likelihood that there was defective construction

at Byron -- to determine whether or not a sample item, in turn, got picked to be reviewed at Braidwood?

A (WITNESS KOSTAL) I didn't characterize it as "defective construction." I characterized it as a condition that could exist at Byron. It could just be a different as-built condition.

Q It could be also a defect in welding, for example?

A (WITNESS KOSTAL) It could possibly be.

Q All right, sir.

JUDGE GROSSMAN: Excuse me, but I think we could make a further generalization than that.

Each one of these items was re-evaluated, Mr. Kostal; isn't that so?

WITNESS KOSTAL: Yes, sir.

Part of our commitment is to review each hanger and to assure that each hanger, when construction is complete and prior to fuel load -- that the interaction coefficient is within code.

So we have to do an additional analysis to complete the cycle to show that all connections on all hangers meet the code requirements.

JUDGE GROSSMAN: Even those hangers in which no discrepancies have been observed?

WITNESS KOSTAL: If no discrepancies are observed, there would have been a calculation already in

existence that would have dispositioned that hanger at some previous point in time.

JUDGE GROSSMAN: And so you wouldn't have an initial calculation and then a recalculation, would you?

WITNESS KOSTAL: These hangers have all gone through more than one cycle of -- I believe that these hangers have all gone through more than one cycle of analysis primarily because the original calculations for these hangers were performed in the late '70s.

We were constructing the plant over a period of years, and various conditions occurred to the hangers over a period of years. So there are subsequent analyses that exist on these hangers.

JUDGE GROSSMAN: Well, when you have your initial value for the initial Byron value here, you're not talking about a 1970s figure, are you?

You're talking about a figure that you used at the time you ran the Braidwood CSR review; isn't that so?

WITNESS KOSTAL: These were the calculations that existed at Byron. Some of those calculations could have been calculations that were, let's say, made much earlier in the time frame. We may have received them just recently, meaning "recently" in the time frame of '84, that needed to have an additional calculation made on them.

JUDGE GROSSMAN: Okay, but the point is: You were using the 1984 values, whether or not they were originally calculated in the 1970s?

WITNESS KOSTAL: That's correct.

JUDGE GROSSMAN: And that's shown on that first column, "HS IC"; isn't that so?

WITNESS KOSTAL: That's correct.

JUDGE GROSSMAN: Now, to the extent that you had an item that did not have some discrepant condition that required a recalculation, you wouldn't have made a recalculation on that item, would you?

WITNESS KOSTAL: We could have made a recalculation on the item because additional loads were being added.

One of the ongoing processes is the addition, for example, of cables into cable pans. That report I mentioned earlier, the CIS-4, which is the Cable Information System report, tracks the routing of cables and pans and the change in load at node points along the cable.

That tracking is updated on a regular basis, and we assess the impact of changes in loads at given points in the cable pans as they associate with hangers.

So if we had routed, let's say, a hanger that was previously analyzed and found to have an interaction

value less than .1 and now we route in a given cable pan an additional amount of load or we attach to that hanger, let's say, a piece of lighting -- maybe we want to attach lighting -- we would go back and, at that point in time, assess those changes in load on that particular hanger and perform another analysis.

JUDGE GROSSMAN: So it's possible that you covered some subsequent occurrence which would require you to recalculate; is that what you're telling me?

WITNESS KOSTAL: Yes, sir.

JUDGE GROSSMAN: But assuming that the item was not changed at all or the loads were not changed on an item or there was no discrepant condition, there would ordinarily not be the obligation to re-evaluate?

WITNESS KOSTAL: That's correct.

JUDGE GROSSMAN: So what we're talking about here are basically anomalous situations or -- I'm not sure "anomalous" is a correct word, but not the norm.

These are situations in which there was some condition that required re-analysis, a change or a discrepant condition; is that so?

WITNESS KOSTAL: It could be it required a change because either additional loads occurred or any of those other factors.

What it did represent, at that point in time, was a

known population of hangers that were indeed highly-stressed at Byron.

Given that as being a known large quantity of hangers that were highly-stressed, that was the basis for the choice for the sampling at Braidwood, because we hadn't been that far along in the Braidwood cycle.

We hadn't finished routing, let's say, all the unique cables at Braidwood. We hadn't finished adding additional loads for a variety of -- whatever could be added to it.

So we didn't necessarily have a set of highly-stressed which reflected an almost as-completed plant.

JUDGE GROSSMAN: Mr. Guild?

MR. GUILD: Thank you, Mr. Chairman.

BY MR. GUILD:

Q Let's talk about conduit hangers. Let's approach that subject, Mr. Kostal. All right, sir.

This is a list again prepared by you in response to a request I made, identified "Conduit Hangers More Highly Stressed.

(Indicating.)

MR. GUILD: Mr. Chairman, I ask this be marked as Intervenors' Exhibit 170.

(The document was thereupon marked Intervenors' Exhibit No. 170 for

identification as of October 16, 1986.)

BY MR. GUILD:

Q Now, indeed, as you've testified, the conduit hanger more-highly-stressed items were selected in a fashion that is different from the way you selected cable pan hangers.

These items were selected on the basis of the comparison of the allowable weight loading on the hanger compared to the then-projected actual weight.

A percentage was computed, and you used that percentage to screen for more-highly-stressed conduit hangers; correct?

A (WITNESS KOSTAL) Yes, sir.

Q And what was the threshold for identification of a conduit hanger as more-highly-stressed for this purpose?

A (WITNESS KOSTAL) 70 percent.

Q All right. Now, the percent figure is shown in the second column from the right.

It is a comparison of the actual weight, as then projected at the time you made this selection, to the maximum allowable weight, correct, the first two columns?

A (WITNESS KOSTAL) Yes, sir.

Q But there may be further evaluations performed with regard to the particular conduit hanger.

I take it the projected loading may change, and that may be the basis for a changed value in the far right column, "Current Weight"?

A (WITNESS KOSTAL) That's correct.

Q And in the instances where the percent of maximum allowable exceeds 100, I note by your asterisk that you had to perform unique calculations?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

Now, if you turn to Intervenors' Exhibit 168, the first page is the BCAP results, the notable discrepancies that were subject to Sargent & Lundy's evaluation in the conduit hanger population.

At the bottom of the page, you note "average design margin 9.90; say, 900 percent of design margin remaining."

And I take it, from the notes appearing in the remarks above, that you derived that average figure of 9.90 by eliminating the extreme item -- that is, the 38.50 for Conduit Hanger 026 -- and summing the rest, dividing by the number?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

Now, if you'd look at Intervenors' 170, the more-highly-stressed conduit hangers, can we agree that none

of the CSR sample results, sample items, for which a design margin exceeded your average value of 9.90 -- that none of those items represented more-highly-stressed conduit hangers from your more-highly-stressed conduit hanger list?

Let's go down the list. The first is 30.30 for Conduit Hanger 24.

Can we agree that 24 is not on your list --

A (WITNESS KOSTAL) Yes, sir.

Q -- of more-highly-stressed conduit hangers?

The same is true for 26, the 38.5 value; it's not a more-highly-stressed item, is it?

A (WITNESS KOSTAL) No, sir.

Q Let's see. Let's give you the benefit of rounding down to be conservative.

For Conduit Hanger 050, you've got a design margin of 9.06, slightly below average.

But it's not on the more-highly-stressed list, either, is it?

A (WITNESS KOSTAL) No, sir.

Q 062, the 18.70 value.

It's not more-highly-stressed, is it?

A (WITNESS KOSTAL) No, sir.

Q For 112 you get a value of 14.10 for the design margin.

It's not on the list?

A (WITNESS KOSTAL) That's correct.
Q 121, a value of 29.50 design margin.
It's not on the list of more-highly-stressed items?
A (WITNESS KOSTAL) Correct.
Q Nor is 121, the second observation, also 29.50, listed here?
A (WITNESS KOSTAL) Which number?
Q There are two Conduit Hanger 121 sample items shown on your list --
A (WITNESS KOSTAL) Oh, I'm sorry.
Q -- with the same result.
Neither are on your more-highly-stressed list?
A (WITNESS KOSTAL) That's correct.
Q Finally, again rounding down for conservatism, 127, design margin of 9.50.
It's not on your more-highly-stressed list?
A (WITNESS KOSTAL) That's correct.
Q Do you know what your average design margin remaining would be if you averaged the results only of the more-highly-stressed conduit hangers?
A (WITNESS KOSTAL) I would have to perform that calculation.
Q Would it be significantly lower than the value of 900 percent that you calculated?
A (WITNESS KOSTAL) It may be.

Q All right.

MR. GUILD: Mr. Chairman, I'm not sure how many dangling exhibits I have, but I would ask that 168 and 170 be admitted. I intended to offer --

JUDGE GROSSMAN: 168 already was. 169 and 170 were not. We'll receive them now.

MR. GUILD: Okay.

(The documents were thereupon received into evidence as Intervenors' Exhibits Nos. 169 and 170.)

JUDGE GROSSMAN: There are still some dangling exhibits from yesterday --

MR. GUILD: All right, sir.

MR. STEPTOE: Can we have all the sketches returned?

JUDGE GROSSMAN: -- because most of them are sketches, and I'm looking to see if any are other than sketches.

MR. BERRY: Mr. Chairman, my notes reflect that Intervenors' Exhibit 155-B --

JUDGE GROSSMAN: I'm sorry? Pardon?

MR. BERRY: My notes reflect that Intervenors' Exhibit 155-B has not yet been received in evidence.

MR. GUILD: That would be the calculation

package, Mr. Chairman.

I certainly intended to offer it.

MR. BERRY: 155-A as well.

JUDGE GROSSMAN: Intervenors' 155 -- they were all admitted. 155, 155-A and 155-B I have as being admitted already.

MR. BERRY: Do you have a date on that, Mr. Chairman?

JUDGE GROSSMAN: I don't want to mess up the transcript.

If they weren't -- we'll just assume they are. There's no reason why they wouldn't be, and I'm not going to receive them again and cause the Reporters any problem.

Now, I take it we're not prepared to admit those sketches because we don't have them yet; is that correct?

MR. STEPTOE: We have all but a few, but I don't think Mr. Guild and I have had a chance to discuss them.

JUDGE GROSSMAN: Oh, okay. We're not pushing on that. I just want to remind you that you have them outstanding now, and I'm just looking through my notes to see if there are any nonsketches that --

MR. STEPTOE: There's a drawing and a --

JUDGE GROSSMAN: Now, there's Intervenors' Exhibit 162, which is a BCAP evaluation summary of discrepancies, which I don't believe was offered.

MR. MILLER: 162?

JUDGE GROSSMAN: You have it received? It's on Cable 130.

MR. MILLER: Our records show that it was received.

JUDGE GROSSMAN: It was received? Okay. I stand corrected on that.

All I have missing now are sketches and Applicant's Exhibits 151 and 152; that is, the proposal of technical data for that 600-volt -- there was one large item and one small one.

You have to reproduce that along with the sketches, so we won't take any action on that now.

MR. MILLER: Your Honor, I believe that we've deferred on Intervenors' Exhibit 141 as well.

MR. GUILD: What's that?

MR. MILLER: That is the Sargent & Lundy print-out of inspection points and discrepancy points.

MR. BERRY: My records reflect that that was received on October the 9th.

JUDGE GROSSMAN: I have that as admitted.

MR. MILLER: Thank you.

MR. BERRY: Your Honor, my records also reflect that Intervenors still owe us Exhibit 163.

MR. GUILD: And what's that?

MR. BERRY: The Bojan letter.

MR. GUILD: Yes.

JUDGE GROSSMAN: Plus we do need a copy of Intervenors' Exhibit 163, which is that Bojan letter to Bartolucci of May 13, 1985.

But you'll have a chance to review this transcript over the weekend, and you can supply us with everything on Monday.

MR. GUILD: May I continue, Mr. Chairman?

JUDGE GROSSMAN: Yes, please.

BY MR. GUILD:

Q Now, with respect to Intervenors' 170, Mr. Kostal, the conduit hanger population, do I understand that the values that were used for screening were Braidwood-specific values?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

And did those values include as-built conditions of the conduit hangers?

A (WITNESS KOSTAL) They included the loads of the conduit.

Q Well, did they --

A (WITNESS KOSTAL) That's the weight of the conduit attached to the hanger.

Q Right.

They included the weight as it was projected at the time you did the screening?

A (WITNESS KOSTAL) That's correct.

Q All right.

You didn't go out to the field and actually look at the loading of the conduits and base your screening of conduit hangers on the as-built condition, did you?

A (WITNESS KOSTAL) No, sir.

Q And, therefore, the conduit hangers by definition wouldn't include such things as as-built discrepant conditions, weld defects, workmanship problems?

A (WITNESS KOSTAL) They may have.

The reason they may have is at that point in time there may have been adjacent hangers, let's say, on a given hanger that had been moved.

We would have calculated the appropriate weight associated with the hanger in question, which could have then accounted for an as-built condition.

I just can't say effectually whether or not it did or didn't include as-built conditions.

Q For conduit hangers?

A (WITNESS KOSTAL) For conduit hangers.

Q All right, sir.

Can you say categorically that it did not include weld discrepancies?

A (WITNESS KOSTAL) This is purely a weight calculation, so it had nothing to do with weld discrepancies.

Q I see.

Let's round out this discussion, if we might, and talk about electrical equipment, the last --

JUDGE GROSSMAN: Wait.

Before we get to that, I'm not sure whether you used what you took to be the actual weight or whether you used a set figure like that 45 pounds per square foot kind of figure.

Which was it?

WITNESS KOSTAL: What we would have used, Judge Grossman, is -- we would have used either one of two things:

We would have used the cable pan -- the conduit hanger drawing, which shows the various locations of the drawing, which then would define the tributary length of conduit that would be attached to a given hanger.

We would have also have used the number of conduits that were attached to that hanger.

The unit load is the load associated with the diameter of the conduit that's being attached. So we

would multiply the unit load for that particular conduit and its tributary length; and that would be then the weight that we would calculate, that we would review for the load table.

JUDGE GROSSMAN: And there was no --

WITNESS THORSELL: Could I --

JUDGE GROSSMAN: -- factor included with regard to cable that goes through that conduit?

WITNESS KOSTAL: It includes the weight of the cable.

WITNESS THORSELL: Could I make a clarification, Judge Grossman?

JUDGE GROSSMAN: Yes.

WITNESS THORSELL: The weights are based on a full conduit whether that conduit is full of cable or not. It's just a standard weight for the conduit, assuming that the conduit is full of cable.

Many conduits are not full of cable, so it's a conservative weight in that regard.

JUDGE GROSSMAN: Okay.

So when it comes to actual calculations later on for design margin, you would then have whatever factor would be implicit in having less than a fully loaded conduit?

WITNESS THORSELL: Depending on the level of

refinement to which that calculation was performed.

JUDGE GROSSMAN: Okay.

BY MR. GUILD:

Q Let's turn to electrical equipment, if I could ask Applicant's assistance if they have a copy.

MR. STEPTOE: (Indicating.)

MR. GUILD: We're not threatening to burden the record with this stack, but we want to dissect some documents here.

Mr. Chairman, I've distributed to the Board and parties a document entitled "Highly Stressed Electrical Equipment."

Mr. Kostal, do you have your own copy?

I'm short one.

WITNESS KOSTAL: (Indicating.)

MR. GUILD: Great.

I request we mark this, please, as Intervenors' Exhibit 171.

(The document was thereupon marked Intervenors' Exhibit No. 171 for identification as of October 16, 1986.)

BY MR. GUILD:

Q Now, the document that I extracted this two-page exhibit from, Mr. Kostal, is a list.

I take it that it's a list that was used to derive

the selection of more-highly-stressed pieces of electrical equipment for submission to the BCAP Task Force?

(Indicating.)

A (WITNESS KOSTAL) The document you're holding, yes, sir.

Q Yes.

The list is entitled "Equipment Loads for Floor Slab Foundation Design Status Report," and it lists a number of pieces of equipment.

Now, can you tell me how the item got from that rather voluminous listing to the listing of the items that appear on the two-page exhibit of more-highly-stressed electrical equipment, please?

(Indicating.)

A (WITNESS KOSTAL) If I could have the document, the explanation is in that cover sheet --

Q Sure.

(Indicating.)

A (WITNESS FIRST) -- so I don't misquote it.

What this document is is it's a component -- this is a document of the equipment that we have information on at a point in time. This particular run was made on 1/10/1985. This document reflects all the equipment that we had data on within Sargent & Lundy.

This equipment includes both safety-related and nonsafety-related equipment. It also includes equipment that is nonsafety-related yet seismically qualified.

This list was the list that existed at the point in time of all equipment when BCAP asked for a list of more-highly-stressed.

What was done with this list is we reviewed the list; and the first thing we did was, since we were only evaluating safety-related equipment, we struck out all equipment that was not safety-related.

The next thing that we struck out is those items where no calculations existed; and that you would find under the heading "Item No.," which is the sixth heading in the column. There would be an "NC" listing, which represented the fact that there was no calculation.

(Indicating.)

The next thing that we did was we took the remainder of the pieces of equipment that were screened by these two criterias, and we've reviewed the calculations that we had in-house on the remainder of the equipment.

From that remainder of equipment, reviewing those calculations, we used a screening of .8 interaction value or an allowable stress equal to 80 percent -- the actual stress equal to 80 percent of the allowable

stress. As a result of that screening process, we obtained a list of 38 pieces of equipment that met that criteria.

This list then was submitted to Braidwood in the form of two lists: one which was Unit 1, representing 20 pieces of equipment; and one which was Unit 2, representing 18 pieces of equipment. So there was a total of 38 pieces of equipment.

What Exhibit 171 has is a listing of all that equipment and whether or not BCAP chose those in the sample and whether or not the interaction coefficient was at the point in time at the time we selected the component as well as the elevation at which the equipment is located.

Q All right, sir.

Were the 38 that appear on Intervenors' 171 all of the items of electrical equipment that met the screening criteria that you've just described?

A (WITNESS KOSTAL) To my knowledge, they are.

Q Now, are there items of equipment with an interaction coefficient of .8 or greater for which you did not have a calculation at the time the list of equipment items was prepared in January of '85?

A (WITNESS KOSTAL) These represented all the calculations we had with interaction values greater than

.8 at that point in time.

Q That's not exactly my question, Mr. Kostal.

The question is: Are there others for which you didn't have calculations which had interaction coefficient values of .8 or greater?

A (WITNESS KOSTAL) I don't know. We only had what we had, and what we had is what we evaluated.

Q All right, sir.

A (WITNESS KOSTAL) Speculating on things that we didn't have -- I can't.

Q I don't want you to do that, sir.

Now, again, these are items that are stressed -- these are items of equipment that are analyzed for stress on the basis of their attachment connections?

A (WITNESS KOSTAL) That's correct.

Q Now, does the listing that was the basis for the more-highly-stressed electrical equipment, the screening, contain items of equipment that are not electrical?

A (WITNESS KOSTAL) Yes, sir.

Q Does it contain all equipment items that were identified at the time: electrical, mechanical, other?

A (WITNESS KOSTAL) Yes, sir. They're the complete population that existed on equipment at the 1/10/85 date.

Q It includes tanks, for example?
A (WITNESS KOSTAL) I don't know. I did not review this complete list to determine whether or not tanks is noted or not.
Q Well, I saw diesel fuel tank, boron injection tank.
A (WITNESS KOSTAL) Okay. The description of the equipment is provided. If we we were to read through it, there would be a variety of equipment, both electrical and mechanical.
Q And who decided what was electrical and what was not electrical, for purposes of making the more-highly-stressed evaluation?
A (WITNESS KOSTAL) The list that was created for -- I don't have the name of the individual in front of me. There is a memorandum that was authored by an individual who created this particular list of 38.
Q And the memo does what; it describes how that choice was made?
A (WITNESS KOSTAL) No.

It lists the electrical equipment that met this screening criteria; and that memo was created and authored by an individual, listing all those pieces of electrical equipment.

You asked me who did that, and I don't at this moment know the name of that individual.

Q All right, sir.

A (WITNESS KOSTAL) But it was an individual within Sargent & Lundy.

Q All right, sir.

And someone made a judgment about which items met the criterion of being electrical equipment?

Mr. Thorsell, can you add to that?

A (WITNESS THORSELL) You can tell by the equipment number whether it's an electrical piece of equipment or not.

Q How can you tell that?

A (WITNESS THORSELL) In this particular case, the first piece of equipment on the list is 1CX13J. J is a designation for an electrical panel.

If you go down the list, you'll see --

Q I just didn't see the one you have.

I see; it's the first on Intervenors' 171?

A (WITNESS THORSELL) Yes, the first piece of equipment on Intervenors' 171.

Q All right, sir. Understood.

A (WITNESS THORSELL) If you go to the second item on that list, the 1JB008A, JB is a designation for a junction box.

Q Yes, sir. Well, that's helpful; and there's also, on the longer list, a narrative description.

But someone has to decide that a tank is not a piece of electrical equipment, unless you included tanks as pieces of electrical equipment.

Is there a judgment that a piece is or a piece isn't electrical equipment?

A (WITNESS THORSELL) To the degree that judgment is required, I think most electrical engineers are familiar with what pieces of equipment are electrical and what --

Q Well, how about a pump? How about a pump with a junction box on it? What's that?

JUDGE COLE: You mean a motor with a junction box?

MR. GUILD: That's what I mean: a motor with a junction box, a pump motor with a junction box.

A (WITNESS THORSELL) That is listed as a pump motor -- or as a pump, and the motor is a sublisting associated with the pump. The junction box would be a sublisting associated with the pump motor.

That entire assembly is considered a piece of mechanical equipment.

BY MR. GUILD:

Q So somebody has to make a judgment that that junction box is not a piece of electrical equipment; it's a piece of mechanical equipment?

A (WITNESS THORSELL) Okay.

Q Well, I don't want you to agree with me for the sake of agreement.

Is that a true statement or not?

A (WITNESS THORSELL) That's a judgment.

That judgment is also based on the knowledge of who is responsible for the installation of that piece of equipment. It comes as a single assembly, and one contractor is responsible for the installation of that assembly.

In the example that you gave where you have a pump, a motor with the pump and a junction box or, actually, a motor termination box on the motor, that entire assembly is installed by the mechanical installation contractor.

Q Except, of course, somebody has to hook the wires up, and I guess they don't do that?

A (WITNESS THORSELL) That's true, but this is electrical equipment installation. The connection of the wires is covered under cable.

Q But that connection, that termination, would be an electrical contractor's responsibility?

A (WITNESS THORSELL) Correct, and that's covered in the cable population rather than the electrical equipment population.

Q Well, let me ask you a question more generally:

Was the sample of more-highly-stressed items from

this listing made for use by BCAP more generally than just for the Comstock scope of work?

Did you select more-highly-stressed pieces of equipment that were also sampled in mechanical, for example?

MR. STEPTOE: Can you define "this listing" for me?

MR. GUILD: The listing that was the basis for the electrical equipment.

MR. STEPTOE: The full document that you have not marked?

MR. GUILD: Indeed.

A (WITNESS KOSTAL) There was a list of mechanical equipment prepared and given to BCAP on mechanical equipment.

BY MR. GUILD:

Q From this same source document?

A (WITNESS KOSTAL) Yes.

Q Someone went through and picked more-highly-stressed items, whether they were electrical or mechanical; someone else made the cull of whether they were electrical?

A (WITNESS KOSTAL) No. I didn't say that.

Q Well, that's what I'm asking.

A (WITNESS KOSTAL) I think it was one and the same

individual. I just don't know that individual.

Q All right.

A (WITNESS KOSTAL) I believe it to be one individual, and I believe it to be an individual from the Component Qualification Division.

That division is responsible for qualifying all equipment, both mechanical and electrical; and these engineers are familiar with the differences between mechanical and electrical equipment.

Q I'm sure they are.

MR. GUILD: Mr. Chairman, can I ask that Applicant at a later time provide a copy of this memorandum, the document that apparently will clarify this question?

MR. STEPTOE: Bob, I think you already have it.

Do you want to take a moment to look for it, the one he's referring to?

MR. GUILD: That would be fine, sure.

MR. STEPTOE: He's referring to this and the other one, too.

(Indicating.)

JUDGE GROSSMAN: Do you wish to take your break now, Mr. Guild?

MR. GUILD: It would be a convenient time,

Mr. Chairman.

JUDGE GROSSMAN: Fine. 10 minutes.

(WHEREUPON, a recess was had, after which the proceedings were resumed as follows:)

JUDGE GROSSMAN: Mr. Guild?

MR. GUILD: I think we established off the record that the memo in question was not a memo that's available at this point.

MR. STEPTOE: We're trying to get it.

WITNESS KOSTAL: It's not in the courtroom. It's being brought over.

MR. GUILD: All right, sir.

JUDGE GROSSMAN: By the way, Mr. Kostal, did you ever get that figure on the frequency?

WITNESS KOSTAL: I forgot. I apologize, Judge. No, I didn't get that.

MR. STEPTOE: We've got somebody working on it, Judge Grossman.

JUDGE GROSSMAN: Oh, you do, okay. That's fine.

MR. GUILD: Mr. Chairman, I'd offer 171, the more-highly-stressed equipment.

JUDGE GROSSMAN: Received.

(The document was thereupon received into evidence as Intervenors' Exhibit No.

171.)

BY MR. GUILD:

Q Now, Mr. Kostal, let's shift gears a bit here.

The CSR people derived checklists to conduct their CSR inspections. The sample items to be inspected were identified with Sargent & Lundy's contribution to a certain extent that we've discussed.

After those two steps in the process, Sargent & Lundy thereafter undertook the task of counting inspection points and counting discrepancy points; correct?

A (WITNESS KOSTAL) Yes, sir.

Q Okay.

Now, did Sargent & Lundy participate in the process of reviewing and responding to the NRC's comments on the Braidwood draft program document in the May-June-July, '85, time frame?

A (WITNESS KOSTAL) No, sir.

Q Were you aware, when Sargent & Lundy undertook your role in BCAP, that the NRC had expressed a concern about the use of inspection points to evaluate the results of BCAP and that such a concern was expressed in a letter from Mr. Keppler to Mr. O'Connor?

A (WITNESS KOSTAL) No, sir.

Q Were you aware, when Sargent & Lundy undertook its role

in BCAP, that Commonwealth Edison Company, Mr. O'Connor, responded to that NRC concern from Mr. Keppler and asserted that the BCAP results would not be evaluated on the basis of so-called inspection points but would be evaluated on the basis of items found discrepant?

A (WITNESS KOSTAL) No, sir.

Q Did Commonwealth Edison Company discuss either those NRC comments or Edison's response to those NRC comments when you, Sargent & Lundy, were asked to undertake the counting of inspection points?

A (WITNESS KOSTAL) Not to my recollection.

Q I show you a document on the subject of inspection point counting that you made available to me in discovery, Mr. Kostal, a Sargent & Lundy document.

(Indicating.)

MR. GUILD: Mr. Chairman, I'd ask this be marked as Intervenors' Exhibit 172, please.

(The document was thereupon marked Intervenors' Exhibit No. 172 for identification as of October 16, 1986.)

BY MR. GUILD:

Q Now, Mr. Kostal, do you recall me asking you whether or not there was any written procedure for the counting of inspection points by Sargent & Lundy?

A (WITNESS KOSTAL) Yes, sir, when you came in to our

offices.

Q Yes, and I asked you whether or not there was any written description of any training given to the persons employed by Sargent & Lundy who undertook the counting of inspection points?

A (WITNESS KOSTAL) Yes, sir.

Q And the documents that I've had placed before you, marked as Intervenors' Exhibit 172, represent the only documents that are either Sargent & Lundy procedures or memoranda of training for inspection point counting?

A (WITNESS KOSTAL) It's the only document that I had that I could supply to you.

Q Well, sir, that's one of those answers that leads me to want to ask another one, because it doesn't seem that you responded clearly to my question.

Is this the only written document that either is a description of the inspection point counting procedure or the training given to those who did the inspection point counting for Sargent & Lundy?

Are there any other documents?

A (WITNESS THORSELL) Perhaps I can answer that more directly, Mr. Guild.

Q Yes, if you would, sir.

A (WITNESS THORSELL) I undertook to search our files to determine if any such documents as requested by Mr.

Guild existed, and this is the only such document that I was able to find.

Q All right, sir.

Mr. Kostal, as far as you know, these are the only documents that are responsive to my request?

A (WITNESS KOSTAL) For training, yes, sir.

Q How about written procedures for inspection point counting?

A (WITNESS KOSTAL) There are documents which discuss inspection point counting, various memorandums: the development of the inspection point counting form that was used --

Q The forms I --

A (WITNESS KOSTAL) -- memorandums transmitting those forms, the evolution of the forms. Those types of documents exist.

MR. GUILD: Well, Mr. Chairman, at the risk of missing something with that answer, I would ask that Applicant produce for inspection whatever documents exist above and beyond what was produced in response to my request on the subject of inspection point counting.

MR. STEPTOE: The request was for training.

I have no problem in seeing what documents exist and what Mr. Kostal is talking about producing, but the request was for training and not with respect to

counting.

But we'll see what Mr. Kostal is referring to and get them.

JUDGE GROSSMAN: Okay. You'll attempt to supply --

MR. STEPTOE: Yes.

JUDGE GROSSMAN: -- what Mr. Kostal was referring to?

MR. STEPTOE: Yes.

JUDGE GROSSMAN: That's fine.

BY MR. GUILD:

Q In the document that's before you, Intervenors' 172, the first page is an attendance list.

I take it that documents the training that you were able to find any documentation of?

A (WITNESS KOSTAL) For these particular individuals, yes, sir.

Q Well, was there other training?

At least Mr. Steptoe heard that part of my request.

A (WITNESS KOSTAL) There was other training, informal training, that was conducted on the job; but it wasn't documented in this fashion.

Q Was it documented in any fashion?

A (WITNESS KOSTAL) Per the review that was done by Mr. --

A (WITNESS THORSELL) Well, this is the only documented training that I was able to find in the files. Whether the other training was documented or not, I do not know.

I have been told that there was additional training; there were other individuals trained at various times.

Q You're not aware of any other documentation of that training?

A (WITNESS THORSELL) No, sir, I am not.

Q All right, sir.

Then the second page and the pages following appear to be "Inspection Point Counting Guideline." That's the title on the cover page.

Does this represent the procedures, the Sargent & Lundy written procedures, for inspection point counting?

A (WITNESS THORSELL) No, sir.

That, to my understanding, represents an outline that was used in the training session. There never was a formal documented procedure for inspection counting. What followed from this was an evolution of the inspection point counting checklist.

When you examine the inspection point counting checklist, it carries many of the line items, particularly the line items that aren't self-explanatory, the methodology that could be used in

counting.

For example, if a label has a required location, a required identifier on it and is required to be a certain color and that was going to be counted as three inspection points -- in other words, did you get it in the right place? Does it say the right thing? Is it the right color to indicate the right safety division? -- if that was going to be counted as three inspection points, it would indicate that that should be counted as three inspection points on the inspection point counting form.

So what evolved essentially was that the instructions were contained on the counting forms themselves, and the additional training that was done was merely a clarification of those items for the individuals doing the counting.

Q All right, sir.

The final page of this document -- can you identify it, sir?

A (WITNESS THORSELL) I believe it establishes the inspection point counting form numbers and which population they relate to.

In the electrical area, for example, inspection point counting form E-CND is the form to be used for counting inspection points in the conduit population.

Q How abou' the dates that appear in the columns to the right? What do they represent, sir?

A (WITNESS THORSELL) Well, the column heading is "C-O-M-P-L. MONTH," and there are months listed under that column. I presume that it means "completion month" and that this at one point represented a schedule.

All of that appears to have been crossed out, and a one-time schedule or draft schedule was merely used as a convenient way of generating a list that tabulates the inspection point counting form numbers.

Q Well, to the right it says "fit on one page." It appears to be a markup of what was a schedule.

Was that the schedule?

A (WITNESS THORSELL) I don't know actually whether it was or not.

Q Was there a schedule?

A (WITNESS KOSTAL) Yes, sir.

Q Is this the schedule, Mr. Kostal?

A (WITNESS KOSTAL) It's the beginning of the schedules.

They were evolved as time went on, and the schedules were discussed on a weekly basis at meetings that I held at the site with the key people in each of the disciplines. That included Mr. Thorsell at those same meetings.

Q All right, sir. Well, I see a date in there of April

for the preparation of the conduit checklist.

Did you prepare a conduit checklist in April?

A (WITNESS KOSTAL) We prepared a conduit checklist. Whether or not it was in April, I would have to review the records.

Q Do you know, Mr. Thorsell?

A (WITNESS THORSELL) I do not know.

Q All right, sir.

The third page of the exhibit states under 1.0, the guideline purpose, "This guideline is for the tabulation of construction elements inspected under the Construction Sample Reinspection, CSR, area of the Braidwood Construction Assessment Program, BCAP.

"Its purpose is to generate an inspection result data base which will be used during BCAP's assessment of the quality of construction at Braidwood Station."

Now, was it Sargent & Lundy's idea to accomplish that purpose by counting inspection points, Mr. Kostal?

A (WITNESS KOSTAL) No, sir. That's Edison's idea.

Q Edison, in turn, contacted Sargent & Lundy and asked you to accomplish this; they stated this purpose and asked you to accomplish it?

A (WITNESS KOSTAL) They asked us if we would perform the inspection point counting function.

Q All right.

I take it you agreed to do that?

A (WITNESS KOSTAL) Yes, sir.

Q Now, you also did discrepancy point counting?

A (WITNESS KOSTAL) Yes, sir.

Q Do you have a copy of Intervenors' Exhibit 155-A available to you?

That's the discrepancy type counting forms for Cable Pan Hanger 104.

A (WITNESS KOSTAL) This is -- hold on one second.

Q Sure. 155-A is entitled "Discrepancy Type Counting Forms."

A (WITNESS KOSTAL) The title is "Discrepancy Type Counting Forms"?

Q Yes, for Cable Pan Hanger 104.

A (WITNESS KOSTAL) Okay.

And this is your Exhibit --

Q 155-A is the number.

Now, Sargent & Lundy also undertook to do the discrepancy counting for the BCAP CSR sample items?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

And I take it that for Cable Pan Hanger 104, this package, Intervenors' 155-A, represents the counting of discrepancies for that cable pan hanger?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

Now, can you describe for me, Mr. Kostal or Mr. Thorsell, either gentleman, how the discrepancy counting was performed with regard to Cable Pan Hanger 104 with reference to these documents?

A (WITNESS KOSTAL) You have to work with the discrepancy point counting form. You also work with the observation package, and you also work with the engineering calculations associated with this 104.

Q I see.

So you've already got the engineering calculations at the point where you start counting the discrepancy points?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

You know what the answer is, in terms of what the evaluation has been of the item, before you start counting discrepancy points?

A (WITNESS KOSTAL) Yes, sir.

Q Okay.

Now, Intervenors' 155 is the observation packages for that cable pan hanger, and 155-B is again the Sargent & Lundy calculation package. If you can turn to 155, let's look at Observation 04, the weld discrepancies.

Before we get there, do you have 155, Mr. Kostal?

A (WITNESS KOSTAL) Yes, sir.

Q It's the first series of documents in 155 for Observation 01 for that cable pan hanger, 02, 03 and finally 04.

Do I understand correctly that with regard to the first three observations, which are configuration observations, there was no discrepancy point counting done because discrepancies in the configuration area for cable pan hangers were all declared out of scope?

A (WITNESS KOSTAL) Yes.

Q All right, sir.

So the first time for this item that you got down to counting discrepancies was with Observation Cable Pan Hanger 104-04?

A (WITNESS KOSTAL) Yes, sir.

Q All right. I've got that.

If you would, help me relate that observation to the discrepancy point counting.

A (WITNESS KOSTAL) There are attached to your Exhibit 155-A the individual pages, Pages 245 through 262, which document the discrepancies point counts for various welds.

Q All right, sir. Let's look at the first page. That's 245.

What weld does that refer to?

A (WITNESS KOSTAL) That refers to the undercut welds, and it refers to Page 11 of the calculations -- I'm sorry -- to Item 1 in the calculations found on Page -- this is your Exhibit 155-B.

Q Right.

A (WITNESS KOSTAL) It would be found on Page 1 of those calculations.

Q Page 1 of the calculations?

A (WITNESS KOSTAL) Right, at the bottom of the page, reference to "undercut."

Q Just one second. Excuse me.

All right, sir, Page 1 of the calc package.

And this is undercut?

A (WITNESS KOSTAL) Yes, sir.

Q And where do you derive the counting of 10 discrepant inspection points that appears --

A (WITNESS KOSTAL) You derive it from the -- well, you use this particular page along with the weld maps. You can count item by item what's reflected on the weld maps, which represents a discrepancy in the undercut area.

Q Well, you could do that, but what I'm interested in knowing is: How was it done for this particular item?

A (WITNESS KOSTAL) For example, if you go to the --

let's take Point 1, circled "1."

Q Now, we're on Page 1 of the calculation package, 155-B?

A (WITNESS KOSTAL) Right.

And if you were to go to Page 3 and you look for --

Q Page 3 of what, now?

A (WITNESS KOSTAL) Page 3 of the calculations.

You look for the indication "1," which is U/C, which is the top diagonal on the left -- on the right -- on the right-hand side --

Q All right.

A (WITNESS KOSTAL) -- it shows the point where this undercut is being counted.

If you then go back to the weld map, it points to an undercut on the underside of that connection. This is in the weld map on Page 1, and it shows undercut 3/8 of an inch long, 1/8 inch wide, 1/32 of an inch deep on the north side of the Unistrut.

Q You lost me there.

You're deriving that data from where, sir?

A (WITNESS KOSTAL) I'm deriving it from the weld map, which is your Exhibit Bates Stamp 4667, which is the Page 1 of 3 of the weld map which has formed part of the discrepancy observation.

Q It's an attachment to the observation form.

A (WITNESS KOSTAL) Yes, sir.

MR. MILLER: Intervenors' 155.

MR. GUILD: All right.

BY MR. GUILD:

Q So we've gone from the counting form to the calculation package to the observation form attachment?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

A (WITNESS KOSTAL) That's Point 1. That represents one discrepancy.

Q All right, sir.

Now, what does the parenthetical mean on the discrepancy point counting form for the Item 11, undercut?

It says "one per weld," paren, "(depth end)," paren.

A (WITNESS KOSTAL) You're looking at the depth of the undercut. That's all that's referring to.

An undercut has three dimensions: a horizontal -- two horizontal dimensions, which define the planar section, and there is a depth to the undercut.

Q All right.

So why have we got depth here as a parenthetical in your discrepancy point counting form?

A (WITNESS KOSTAL) That's what represents one undercut, one weld with depth, meaning the depth of the undercut,

which affects -- you take the horizontal dimension and the depth.

That defines the cross sectional area that's cut out of the given member, which then reduces the cross sectional area of the member that you evaluate for, the remaining area.

Q That all sounds helpful, but what's the purpose of noting depth when you're counting discrepancy points for undercut, if any?

A (WITNESS KOSTAL) There is a criteria which defines undercut in terms of a depth.

You have to go back to BCAP and the checklist and look at what is considered acceptable undercut versus unacceptable undercut.

Q What if there is intermittent undercut on the same weld, undercut in more than one place on that weld?

A (WITNESS KOSTAL) It's defined as one discrepancy. If you have on a weld more than one -- one weld, you have more than one undercut, it's defined per the weld as one discrepancy in that weld which is related to undercut.

Q All right, sir.

So this particular discrepancy point counting form counts all of the incidences of undercut reflected in the observation for Cable Pan Hanger 104 with the measure that you only count one instance of undercut,

one discrepancy point, per weld; and you get a value of 10 discrepancies points?

A (WITNESS KOSTAL) Yes. That's the logic of where the 10 is derived, yes, sir.

Q Now, what's the basis for the value that appears to the right-hand margin, .98, and the categorization of this discrepancy as a Y on this discrepancy point counting form?

A (WITNESS KOSTAL) That's the R value associated with this particular -- if you recall, when I went through this example, we didn't individually analyze each of these undercuts.

We took the worst case of undercut; and we accumulated that and performed one calculation found on Page 4, which determined what the R value was for that worst-case condition, that R value being equal to .98.

We assigned then that .98 for conservative method to all those undercuts, and the .98 that you see over on the right-hand side of the discrepancy point counting form reflects that value.

Q I see. You didn't sum up R values or average R values; you took the R value for the case that happened to have been calculated.

In this case, it was the R value for the most significant undercut?

A (WITNESS KOSTAL) For the most -- correct, for the greatest amount of undercut.

Q All right, sir. Let's flip through. You have two weld size discrepancies.

Now, which two weld size discrepancies are reflected on the second page of your discrepancy point count?

A (WITNESS KOSTAL) This is the next discrepancy point count?

Q Yes. It's the second form in the package.

A (WITNESS KOSTAL) This relates to Item -- now, you go back to the weld map. This relates to Item 2, which is the next item in the calculation, which is found on Page -- found on Page 5.

Q Page 4?

A (WITNESS KOSTAL) Well, the calculation is found -- it starts on Page 4, but it proceeds to Page 5. It's actually the connection associated with the diagonal brace.

Q How do you know that's the one they list on this page of the discrepancy point counting form?

A (WITNESS KOSTAL) The way you can determine that is by looking at the R value that's indicated in the lower right-hand margin and also the SM value.

If you turn to the bottom of Page 6, you will see

that R value of .695, and you will see that SM value of 5.18.

Q And that's from your revised calculation?

A (WITNESS KOSTAL) Well, it's the same discrepancy in the original calculation or the revised calculation.

Q Yes, but the R value that's indicated as the revised R value for the revised calculation?

A (WITNESS KOSTAL) Yes, sir.

Q Now, the first page of your discrepancy point count appears to have been completed on September 5, 1985; the second page, October 1, 1985.

I gather that that reflects that a single person didn't sit down and count all the discrepancy points at a single point in time?

A (WITNESS KOSTAL) That's correct.

Q Why did you do it, at least in those two instances, over about a month's period of time?

A (WITNESS KOSTAL) Well, one thing that was happening -- I don't know exactly why in this particular case this counting was done over a period of time. It does date when each of these forms was prepared. Some were prepared in September; some were prepared in October.

The process took a long time in terms of the tabulating of all of the data and filling out all the appropriate discrepancy point forms and inspection point

forms. For some reason, it was done in a two-step stage.

Q Do you know whether or not there was a discrepancy point count made before you revised your calculations?

A (WITNESS KOSTAL) Based on the dates that are indicated in each of these pages, there would have been no discrepancy point counts prior to the date that we had performed the calculations.

I think the earliest date that any of these discrepancy point counts are filled out is 9/5/85. The date of the revised calculation was approved -- it was prepared -- started to be prepared on many sheets as early as 7/25/85, and the approval dates were 9/3/85.

So this would reflect that the calculation was indeed revised for that second run prior to any of these forms being filled out.

Q I see that.

My question really is: Are there any dry runs in the discrepancy point counts for this item that don't appear in the documents that we have before us?

A (WITNESS KOSTAL) Not to my knowledge.

Q Did you do any more than once? Did you do revised discrepancy point counting?

A (WITNESS KOSTAL) In the process of the BCAP validation of observations that were out of scope versus valid

observations in scope, there was an iteration in the counting of changes that occurred.

Q Something was counted as in-scope first; you counted those discrepancy points.

If it became out of scope, you deleted those discrepancy points?

A (WITNESS KOSTAL) That's correct.

Q But for individual items, did you do more than a single stab at counting discrepancy points?

MR. STEPTOE: Excuse me.

Counsel, are you referring to the time period here?

BY MR. GUILD:

Q During any time period, did you count discrepancy points more than once for a single item and come up with different results and revise your discrepancy point counts?

A (WITNESS KOSTAL) At this point in time or at any point in time?

Q At any point in time.

A (WITNESS KOSTAL) Yes, sir.

Q You did?

A (WITNESS KOSTAL) Well, we provided you changes with the -- I don't know. This is the BCAP discrepancy point counting.

Q Right.

A (WITNESS KOSTAL) There were changes in five of those populations.

Q Right.

A (WITNESS KOSTAL) You are aware and we talked to you about the fact that we are and we have just completed a reassessment of the complete cable pan hanger population.

Q I'm going to ask you about that in a moment.

So you did do revised counts, more than one discrepancy point count, for BCAP CSR population items?

A (WITNESS KOSTAL) Yes, sir.

Q All right.

Not this one in particular; this one appears to have been gone through once and all done after the calculations were made and revised?

A (WITNESS KOSTAL) Yes, sir.

Q Now, is there any identification on the discrepancy point counting forms of which particular locations on the component are the subject of the count or are you inferring the association based on the R value number?

A (WITNESS KOSTAL) Well, utilizing the discrepancy point count, utilizing the characterization of that discrepancy, utilizing the R value that's given and the M value that's given, I can correlate each of these pages to the appropriate calculation that was made on a

given connection.

JUDGE GROSSMAN: We'll take five minutes.

(WHEREUPON, a recess was had, after which the proceedings were resumed as follows:)

JUDGE GROSSMAN: Back on the record.

WITNESS KOSTAL: We did bring over that computer run for the frequency. The frequency of that hanger in question, 104, is 6.2 cycles per second.

So it's close to that 10 that we were talking about, which is the flat portion of the spectra.

JUDGE GROSSMAN: Now, could you tell me why, if that is the case, you or whoever made the calculation used the Braidwood-unique response spectra?

WITNESS KOSTAL: The response spectra for the project. In this particular case, it's the location in the enveloped spectra. This particular frequency of the hanger is in an area where the Byron/Braidwood spectra is the same.

JUDGE GROSSMAN: And I take it the calculation confirms that you used a factor of 2; is that so?

WITNESS KOSTAL: Well, the calculation -- I just don't have the spectra in front of me, but it would confirm that if I went up to that --

MR. BERRY: (Indicating.)

WITNESS KOSTAL: -- in this particular example for the north-south direction, we would have used 2. We would have used then on the east-west direction a value of 1.5; and on the vertical direction, we would have used a value somewhere around 3.

JUDGE GROSSMAN: I'm sorry. I was misled by just looking at the north-south, but there is a difference, then -- no. I'm sorry, I'm sorry. There is no difference -- oh, yes, there is on the vertical spectra.

WITNESS KOSTAL: Right.

JUDGE GROSSMAN: There is a difference.

WITNESS KOSTAL: No. The vertical spectra is still in the range of the enveloped Byron/Braidwood.

I said it was 3. I see I was reading slightly off. It's probably more in the range of 2.2, 2.4.

See, that's still the enveloped portion of the spectra with a frequency of over 6.

JUDGE GROSSMAN: I'm sorry. You're looking at the --

MR. GUILD: The vertical, I believe.

JUDGE GROSSMAN: -- at the vertical spectra?

WITNESS KOSTAL: Yes, sir, yes, sir.

(Indicating.)

JUDGE GROSSMAN: Now, I see that there is a

difference at 6.2 cycles per second.

WITNESS KOSTAL: Oh, I apologize. There would be a slight difference, yes, sir. I was reading a little too far over to the left.

But in that case, there would be -- it's close to one another, but there would be a slight difference.

JUDGE GROSSMAN: Okay. That's fine.

BY MR. GUILD:

Q Let's return to Cable Pan Hanger 104 and the discrepancy point counting exercise. If you would, sir, look at Page 252, and that is 252 in the Intervenors' Exhibit 155-A.

Do you have that, sir?

A (WITNESS KOSTAL) Yes, sir.

Q Now, for this particular discrepancy point counting form, this counts one weld size discrepancy and one weld length discrepancy on the same form?

A (WITNESS KOSTAL) That's correct.

Q Why did they aggregate two different attributes on one form in this case when they used the first form to aggregate only the single attribute of undercut?

A (WITNESS KOSTAL) There are two welds that are documented on this particular form. You'll have to go again to -- this is Weld G and Weld 7 that are associated with this form.

Q How do you know that?
A (WITNESS KOSTAL) Because I worked back and forth between the calculations and the discrepancy point forms and the observation and derived that.
Q You matched the R value?
A (WITNESS KOSTAL) Yes, sir. I matched the -- well, I matched the weld size, the weld length and the weld. The R value in this case is indicated as .906, but in reality it's .91.
Q Rounded to .91?
A (WITNESS KOSTAL) Yes, sir.
Q Where does that appear in the calculation? Where did you trace that to in the calculation?
A (WITNESS KOSTAL) Okay. We have to go to Page 12 of the calculations.

Along with Page 12 we look at what's defined as undersize Weld G, as Weld G. The Weld G location -- you have to go back to the figure on Page 3.

Q Let me just slow you down here. At Page 12 we have an R value of .91.

How did you get one more significant decimal place when you listed the R value on the discrepancy point counting form than you did when you did the calculation, if the calculation was the basis for putting the data on the discrepancy point counting form?

A (WITNESS KOSTAL) Well, if you go to Page 17, it was an error in translation.

If you go to Page 17 and if you look under Weld 7, that's the second phase of the reported discrepancy, which relates to weld length.

Now, if you go back to the weld -- if you go back to Page 3 --

Q Page 3 of what?

A (WITNESS KOSTAL) Of the calculations.

I want to show you where Weld Size G and Weld Size 7 appear.

Q All right.

A (WITNESS THORSELL) (Indicating.)

A (WITNESS KOSTAL) Thank you.

Okay. If you look at the bottom of that figure, on the lowest horizontal member on the left-hand side, it reports a length not welded of 1/16 inch.

Q Yes.

A (WITNESS KOSTAL) Okay. That's Weld 7.

If you go back into the calculation, Page 17, it reports that same length undersize of 1/16 on the north side.

If you go back to the --

Q Wait a minute, now. You lost me.

Where does Weld 7 get evaluated on Page 16, then?

A (WITNESS KOSTAL) Well, on Page 17 -- excuse me.
Q Page 17?
A (WITNESS KOSTAL) -- there is a calculation on the length not welded.
Q Right, and an R value of .91 is derived.
A (WITNESS KOSTAL) It also includes in that the undersize weld associated with that same connection, which is Weld G.

You have to look at those --

Q You know that from looking at the diagram on Page 3 of the calculation?
A (WITNESS KOSTAL) The diagram on Page 3 of the calculation shows the fact that there is a weld -- a vertical portion of the -- there is a vertical weld that's undersized.

That's the Weld G, and it's undersized by 1/32 of an inch for its length. You can find that description on your Exhibit 155, Bates Stamp Page 4667, which is the welder's map.

(Indicating.)

Q I've got you.
A (WITNESS KOSTAL) You'll note over on that welder's map in that lower corner, there indicates a note on that horizontal member that the weld size is 1/32 of an inch undersize 7/8 of an inch for 7/8 inch on the south side.

Q I follow all that stuff.

Now, what I'm trying to figure out is: How did you happen to get an R value of .906 on your discrepancy point counting form when you only calculated an R value to two digits in the calculation?

A (WITNESS KOSTAL) Like I said, it was a translational area. It's 9.1, per the calculation.

Q Somebody put "06" down in error?

Where did they get that from?

There's no translation involved. It's a matter, as I understand your testimony, of simply taking data off of the calculation for the discrepancy and transferring that data onto the discrepancy form.

No one made an additional calculation, did they?

A (WITNESS KOSTAL) No. This is the calculation on that given connection, which is represented in this particular discrepancy form.

Q But the numbers ".906" don't appear anywhere in your calculation.

A (WITNESS KOSTAL) That's correct.

Q So somebody made it up?

A (WITNESS KOSTAL) He translated it wrong. It should have been indicated as 9.1. The calculations still define the 9.1 on Page 17.

JUDGE GROSSMAN: You mean .91?

WITNESS KOSTAL: I'm sorry; .91 on Page 17.

BY MR. GUILD:

Q The fact of the matter is the discrepancy point counting form can only be associated with a particular weld or a particular discrepancy by the process of inference that you're making right now.

That is, comparing the character of the discrepancy counted and a numerical value and trying to find that numerical value stated in some other document to help you associate that discrepancy with a particular portion of the observation or observation evaluation?

A (WITNESS KOSTAL) That's correct.

I went through that exercise and was able to determine each of the welds that are represented in these particular discrepancy point counting forms.

Q Well, sir, is there any control for the process of counting discrepancy points that states that one must use the discrepancy point forms in a consistent fashion; let's say, on the one hand, either to aggregate all of the same discrepant attributes on one form or to use one form to count all of the discrepant attributes for a single weld?

Is there any control and requirement for a uniform application of your discrepancy forms?

A (WITNESS KOSTAL) People were trained in reporting the

data on discrepancy point counting forms. Sometimes you'd have to look at a given, let's say, observation package.

This is a fairly detailed and lengthy observation package; so it was felt by the designers who were doing this particular counting to document them on more than one discrepancy point counting form, since there were multiple discrepancies associated with this hanger.

Q I see.

I take it there was no requirement of the Sargent & Lundy program for discrepancy point counting that each form be associated explicitly with a particular discrepancy that the form was intended to count?

In other words, did the form indicate, "We were evaluating the discrepancies contained in Weld No. 1," if Weld No. 1 is a designation used by the CSR inspector or the Sargent & Lundy evaluator of the discrepancy?

A (WITNESS KOSTAL) There was training, for the various people that were involved in this program, to translate the discrepancies that were observed in the observation packages and document to these types of forms.

There was no strict requirement that I'm aware of that said you had to have an individual discrepancy point form for each and every single weld.

In this particular case, this happens to be one

weld; and in general, these represent a corresponding calculation which is on a weld.

Q Except on the first page, in which case there are the evaluation of 10 welds?

A (WITNESS KOSTAL) That's correct, and there it just didn't --

Q There may be some cases where there is also a combination of the two?

A (WITNESS KOSTAL) Sure, sure.

It didn't make any sense to make 10 single forms to document 10 unique individual undercut discrepancies when one form can summarize that same data.

Q So I take it that the process for discrepancy point counting that's reflected in the counting for Cable Pan Hanger 104 is consistent with any discrepancy point counting procedures or instructions given by Sargent & Lundy, as best you can determine?

A (WITNESS KOSTAL) It's supposed to be consistent.

Q Well, is it, from your evaluation?

You've tried to match it up and, I take it, reviewed the counting forms for this cable pan hanger?

A (WITNESS KOSTAL) That's correct.

I think I told you on this particular one that I found some differences that exist that weren't properly reported and that I told you what those differences

were --

Q Well, maybe --

A (WITNESS KOSTAL) -- and that we were going through the exercise as a result of this and recounting all of the discrepancies associated with the cable pan hanger population.

Q I guess I missed that part of what you told me, because I only understood that you were going back and doing the discrepancy point counting all over again for some unstated reason. Perhaps I didn't hear that it was associated with having identified a miscount for Cable Pan Hanger 104.

If that's the case, would you tell me what the miscount was that you identified?

A (WITNESS KOSTAL) Well, let me refresh your memory.

As you recall, when we were in the other chamber, I sat down and gave you an illustration of an item I found that was not counted in this particular population --

Q How about --

A (WITNESS KOSTAL) -- which had to do with the underlength of the weld associated with the Unistrut welded to the plate.

Q I see.

A (WITNESS KOSTAL) Do you recall that?

Q I do recall that, but that was associated with this

particular Cable Pan Hanger 104 item?

A (WITNESS KOSTAL) Yes, sir.

Q And you, Mr. Kostal, identified that in the course of reviewing this discrepancy point counting?

A (WITNESS KOSTAL) Yes, sir, yes, sir. That was a week ago, I think, Tuesday evening.

Q I do recall you telling me about that, and I didn't understand it was associated with Cable Pan Hanger 104. Well, all right, sir.

Now, tell me what you identified, then, or why don't you tell the Board what you identified in the course of doing your discrepancy point counting for Cable Pan Hanger 104.

What was the error you identified?

A (WITNESS KOSTAL) In essence, what I identified -- this particular package of discrepancy point counting forms has a tabulation of 37 discrepancies. That tabulation is found in --

WITNESS KOSTAL: Does this have a number?

(Indicating.)

MR. STEPTOE: Intervenors' 141?

A (WITNESS KOSTAL) (Continuing.) -- Intervenors' 141.

BY MR. GUILD:

Q Your print-out -- is that what you're looking at?

A (WITNESS KOSTAL) Yes. In my print-out we documented,

under the Cable Pan Hanger 104, that there were 37 discrepancies, 31 of which were insignificant and six were notable.

In the process of my reviewing this package in preparation for this testimony, this particular testimony, I reviewed the weld maps, I reviewed each of the discrepancy counting forms, and I reviewed the complete set of calculations to determine whether or not everything was consistent across each of these particular documents.

In the process of that review, I uncovered a difference in the reported discrepancies as compared to my evaluation of the number of discrepancies that exist on this hanger.

Q Okay. I've got you that far.

A (WITNESS KOSTAL) The difference is a total of six discrepancies. We originally had six Z's and 31 Y's.

From my reviewing of these documents, it's been my determination that there are three X's, there are eight Z's and there are 32 Y's, for a total of 43 discrepancies.

Q All right, sir.

Now, how did you find the missing six in the course of your review of this packet?

A (WITNESS KOSTAL) By comparing each joint, by comparing

the discrepancy point counting forms and by comparing the calculations that were performed.

In the process of doing that, I located areas where we reported incorrectly the number of discrepancies.

Q All right, sir.

Where did you identify -- excuse me. Go ahead and finish. I'm sorry.

A (WITNESS KOSTAL) That's all I wanted to say.

Q Where were the discrepancies identified in this package, Mr. Kostal, that were not counted properly in the discrepancy point counts for the package?

A (WITNESS KOSTAL) When you look at the weld map, you can count X number of -- you can count all the discrepancies that exist throughout each connection.

Q You're talking about the diagram associated with the observation itself?

A (WITNESS KOSTAL) Right; in terms of the Bates Stamp, 4667 and 4668.

Q Okay, all right.

A (WITNESS KOSTAL) In the process of doing that and looking at each joint and looking at the number of discrepancies that exist at each joint and also looking at the discrepancy point counting forms on that which define each of the discrepancies, I uncovered differences that were documented.

Q Okay. I'm still waiting for the punch line.

What are the discrepancies that you identified on this weld map or these weld maps that the man who counted discrepancies missed?

A (WITNESS KOSTAL) Okay. There is one undercut.

Q Where is that?

A (WITNESS KOSTAL) Let me go over it.

If you go back to Page -- if you go back to Page 1 of the calculation --

Q All right, sir.

A (WITNESS KOSTAL) -- which is in 155-B --

Q Yes.

A (WITNESS KOSTAL) -- and if you look at each of these, there is a -- let me see. There is -- if you -- there is an Item 3.

If you go back to the weld map and if you go back to Page 3, Page 3 indicates where undercut is defined.

Q Page 3 of what, now, sir?

A (WITNESS KOSTAL) Page 3 of the calculations shows that on the third diagonal on the right-hand side, it indicates undercut.

Q Third diagonal from the bottom?

A (WITNESS KOSTAL) Yes, sir.

Q The right-hand side; I've got you.

A (WITNESS KOSTAL) Okay.

Now, if you go back to the weld map and you look at the information that's reported on the weld map at that location, it says there is undercut "on south side of Unistrut top and side."

I would interpret that to mean that there is a top weld and there is a vertical weld, and there would be undercut associated with the top weld and there would be undercut associated with the side weld.

(Indicating.)

Q Two welds?

A (WITNESS KOSTAL) That would be two welds.

Q And how did the discrepancy point counter count those?

A (WITNESS KOSTAL) The discrepancy point counter, in reading this note -- what I believe he read is it said "top and side," and he read it to mean that it was at the top of the side weld and somewhere further down the side weld.

Q You're assuming that's what he did?

A (WITNESS KOSTAL) Well, he reported -- by looking at the calculations, you can see that he added those two together as one undercut, which is found on Page 1, Item 3.

Q Oh, I see.

So it wasn't just the counter who made the mistake; it was the evaluator as well?

A (WITNESS KOSTAL) No. The evaluator welded all the undercut that was associated at that joint.

Q The guy who did the calculation mischaracterized the two instances of undercut as one?

A (WITNESS KOSTAL) No, he didn't mischaracterize it at all. He correctly added the two together.

You are looking at the effect of the undercut on the Unistrut, and the undercut is in the Unistrut. Therefore, you lose a certain cross section of the Unistrut at that location as a result of those two undercuts.

Q Oh, I see, okay.

So Item 3 on Page 1 of the calculation in reality shows the sum of two welds with one undercut each?

A (WITNESS KOSTAL) Correct.

Q And the discrepancy point counting man simply counted that as one instance of undercut?

A (WITNESS KOSTAL) That's correct. Now, that's my --

Q You determined he was in error because you looked at the weld map associated with the observation and read it to indicate two welds?

A (WITNESS KOSTAL) That's the way I read it. This is my understanding of where these two different undercuts are.

In the spirit of documenting undercut associated

with a weld, as I told you before, if undercut was associated -- if more than one place was associated with the weld, we reported it as one undercut.

However, if it's associated with two different welds, we would report it as two undercuts.

Q All right.

In this case somebody exercised some judgment in counting discrepancy points, and they exercised it in error, in your opinion; two welds, not one weld?

A (WITNESS KOSTAL) Yes, sir.

Q I've got you. That's one out of six.

Where are the others?

A (WITNESS KOSTAL) If you look at Item 10 --

Q Undercut?

A (WITNESS KOSTAL) Undercut.

Q Page 1 of the calc?

A (WITNESS KOSTAL) Page 1 of the calc.

Q Okay.

A (WITNESS KOSTAL) Well, we really don't have to go any further.

Q It takes us to Page 4.

A (WITNESS KOSTAL) That is the one that adds to get to the 11. We had 10 noted. This now becomes the 11th one.

Q The one, this undercut?

A (WITNESS KOSTAL) Yes, sir.

Q All right, sir. So that's one additional discrepancy.

Where are the other five discrepancies?

A (WITNESS KOSTAL) That's one additional discrepancy relating to the undercut.

Let's go to 246 of discrepancy point counting form Exhibit 155-A.

Q All right.

A (WITNESS KOSTAL) That would be the second sheet.

Let's also turn, then, tc Page 4 of the calculations, which refers to the check of the undersized weld on the two diagonal -- on the Point A and B of the diagonal brace.

Now, Point A and B -- we have to go back to Page 3 of the calculations, and it defines the plane at which A and B are represented.

If you look at the top of that page, on the right-hand side, you'll see a circled A regarding weld undersize. That is the weld between the diagonal plate and the vertical member.

If you also look at the bottom of that diagonal on the left-hand side, there is a Weld B, which is the weld between the plate and the vertical member, the same weld location.

Now, if we go back to your Exhibit 155 on the weld

map and you read on the top, which is Weld A, it says the weld size is "1/16 inch under throat size 3-1/4 inches of 3-1/4 inches both sides." So that's two welds.

If you read the note on the lower portion of the diagonal, which would represent Weld B, it says, "Weld size 1/16 inch under throat size 3-1/4 inches and 3-1/4 inches south side." That is one weld discrepancy.

So together between those two locations, there are three discrepant welds.

The calculation that was performed was performed on the worst side. That worst side is what's reflected in Page 4 of the calculations, which is the weld which is the connection noted as A.

That calculation was made based on an R value of two discrepant welds. They were discrepant by 1/16 inch undersize, okay.

If you go then to the discrepancy point counting form, which is Page 246 of Exhibit 155-A, it notes there are two weld size discrepancies that are Z. It failed to report -- since the calculation was done at Joint A, it failed to report the fact that that calculation represented also Weld B, and it didn't report that other discrepancy.

So instead of having two weld sizes for this

particular discrepancy point counting form, there should be three. That's one more.

JUDGE GROSSMAN: Excuse me, Mr. Guild.

Is there any reason why we have to go through the other six?

MR. GUILD: Somebody is going to have to decide they counted these discrepancy points correctly for all of the thousands of welds that are evaluated in BCAP, Judge. It's an arduous process, I'll certainly concede.

But it would seem to me that the obscurity and the judgment that's required in order to correctly count these discrepancy points should be a matter of record so that appropriate inferences can be drawn about the likely errors that exist in other instances.

JUDGE GROSSMAN: Well, Mr. Kostal, is there any difference in kind between the other six than from the two that you've discussed?

WITNESS KOSTAL: Well, there are basically those same kind.

However, we did double-count some undercut which shouldn't have been. It was counted twice. It was counted once on one form, and then it was counted again on another form. So, in essence, we had two undercuts reported -- three undercuts reported twice.

So there were some deletions from the --

JUDGE GROSSMAN: But you have a net gain of --

WITNESS KOSTAL: We have a net gain of six.

JUDGE GROSSMAN: Okay.

So that's nine that were reported and three that were reported twice; is that correct?

WITNESS KOSTAL: That's correct.

JUDGE GROSSMAN: I don't really think it's worth our while to go through each of these now.

If you, Mr. Guild, wish to go through these with the witness on your own time and then decide whether there's any significance over and above what we've already heard with regard to the two, we'll entertain that testimony.

But otherwise it just doesn't seem profitable.

MR. GUILD: Perhaps if I could just ask that Applicant supply a description of where the other errors occurred in a documentary form. I don't mean to take the Board's time unduly, but I'm learning about this for the first time as well.

I hesitate only because I don't mean to waive my rights and be in a position where I have to join an argument from Applicant about the degree of accuracy in their discrepancy point counting that I can't completely

meet because I haven't pursued this matter with this witness.

But if Applicant will agree to supply a written description of where the other errors existed for this cable pan hanger -- I'm only using one example now, Mr. Chairman. I'm not going through multiple examples of any of these Sargent & Lundy pieces of work. I simply want to have this as exemplary.

JUDGE GROSSMAN: Okay. I don't think we need to have that by tomorrow.

So, Mr. Steptoe, if you can have Mr. Kostal write out the items or find some way of getting that written out --

MR. STEPTOE: We can generate such a piece of paper I think over the weekend, not tomorrow.

But Mr. Kostal is frowning at me. Maybe I'd better check with him.

JUDGE GROSSMAN: Well, if you were planning on going to Acapulco over the weekend, Mr. Kostal --

(Laughter.)

WITNESS KOSTAL: I'm not going anywhere.

I guess I was trying to, you know -- in the spirit of cooperating with Mr. Guild, I guess I -- would he accept the fact if I just marked up these discrepancy point counting forms with the correct values and

indicate where in the calculation you would find those given joints?

MR. GUILD: That would be fine if you could do that as a starter, Mr. Kostal, and it may make perfect sense and be all that's required.

JUDGE GROSSMAN: And then put a short narrative which you think will explain what was done with each point.

That's out of the way. Let's get on to the next item, Mr. Guild.

MR. GUILD: All right, sir.

Mr. Chairman, the hour is almost 5:00 o'clock. Perhaps if I can collect my notes, I can complete Mr. Kostal promptly first thing in the morning.

I do have one other subject that I'm still awaiting information from Applicant on, and that had to do with the computer model that was used for evaluating the cable pan hanger discrepancy.

MR. STEPTOE: We can take care of that this evening, Judge Grossman.

JUDGE GROSSMAN: Okay.

Well, maybe I have one or two questions, since it's before 5:00.

We have a revision of the BCAP document which has the categories X, Y, Z and D in the document. I think

it's sometime in the middle of 1985.

When was Category D put into the plan, Mr. Kostal?

WITNESS KOSTAL: Category D was put in at the same time X, Y, Z was put in. It represented the concept of design-significant discrepancies, "D" standing for design-significant.

JUDGE GROSSMAN: And that was in there all the time?

WITNESS KOSTAL: Yes, sir.

JUDGE GROSSMAN: Was that similar to the Byron BCAP program?

WITNESS KOSTAL: Yes, sir.

JUDGE GROSSMAN: And that was in all the time in Byron, too?

WITNESS KOSTAL: Yes, sir.

JUDGE GROSSMAN: Okay.

When you made your calculations with regard to stress, either in conduit or cable pan hangers or whatever items we had here in the six categories that required that kind of calculation, did you take into account items that were not subject to your calculation that might have affected stress?

By that I mean items that were right next to the conduit or, let's say, were connected to the conduit.

WITNESS KOSTAL: Yes, sir. Let me give you

an example: a weld.

A weld we would take into account -- a weld represents a definition of a length of weld that, when you make a right-hand turn, you have another weld.

So if you're looking -- you don't analyze just each individual weld; you analyze the welds that are associated with the connection to transfer the load from one element to another element.

JUDGE GROSSMAN: Okay. But you're now discussing welds on the items that you evaluated.

WITNESS KOSTAL: I just wanted to start with that. Then I'll get to the next one.

Let's take, for example, in the weld population we would include all the welds in that connection and all the discrepancies in that connection and analyze all those discrepancies on that weld group simultaneously.

Let's take the conduit hanger population, where conduit is attached by clamps to vertical Unistruts.

In the case where we have an observation package that's reviewing a given hanger and that hanger shows a missing clamp, meaning the conduit is not attached to that hanger, we would look at the two adjacent hangers, which now carry more load. That would be an example where we would look at the two adjacent hangers.

The reciprocal of that would be if we were looking

at the conduit population and we were missing the clamp, we would look at what the new effect is of the conduit for that longer span to make sure that the reaction at the two adjacent hangers are still within, quote, "allowables" for the conduit.

So yes, indeed, we do take into account, when appropriate, adjacent elements.

JUDGE GROSSMAN: Well, how about cable hangers? Is that the way it's characterized?

WITNESS KOSTAL: In the cable pan hanger population, we define every joint as being a calculation. As long as every joint still stays within code, there is no -- it defines each joint. Each joint stays within code. Therefore, the entire hanger is within code.

So rather than looking at the combined effect of all the discrepancies -- which you could, and you could input that into a given analysis -- we look at each individual connection and ensure that the connection satisfies the criteria of meeting the code allowable, rather than relying on at least from the first cut.

We haven't relied upon it in any of these calculations on redistributing the loads by a more detailed hanger analysis, taking into account the revised stiffness characteristics of each of the joints.

We don't have to do that, since each joint still stays within the code.

JUDGE GROSSMAN: Okay, fine. I have no more questions now.

We'll adjourn until 8:00 o'clock tomorrow morning.

(WHEREUPON, at the hour of 5:00 P. M., the hearing of the above-entitled matter was continued to the 17th day of October, 1986, at the hour of 8:00 o'clock A. M.)

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceedings before the UNITED STATES NUCLEAR REGULATORY COMMISSION in the matter of:

NAME OF PROCEEDING: Braidwood Station
Units 1 & 2

DOCKET NO.: 50-456/457-OL

PLACE: Chicago, Illinois

DATE: Thursday, October 16, 1986

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission.

(sigt) Nancy J. Hopp

(TYPED) Nancy J. Hopp

Official Reporter

Reporter's Affiliation