March 2, 1988

Docket Nos. 50-445
and 50-446

NOTE TO: File

THRU: James H. Wilson, Assistant Director for Projects
Comanche Peak Project Division
Office of Special Projects

FROM: Melinda Malloy, Project Manager
Comanche Peak Project Division
Office of Special Projects

SUBJECT: PUBLIC MEETING BETWEEN TU ELECTRIC AND CASE AND MARK WALSH ON FEBRUARY 18, 1988

On February 18, 1988, Texas Utilities Electric Company (TU Electric), lead applicant for the Comanche Peak Steam Electric Station, Units 1 and 2, met with representatives of the Citizens Association for Sound Energy (CASE) to discuss TU Electric's corrective action program as it relates to cable tray hangers and conduit and conduit supports. Representatives from NRC's Comanche Peak Project Division, Office of Special Projects and the Office of General Counsel attended this meeting as observers.

Enclosed for the record is a copy of the TU Electric meeting notice (Enclosure 1) and the transcript of this meeting and associated presentation materials (Enclosure 2). Since the NRC staff did not participate in this meeting, it is the staff's position that any determination as to whether the Atomic Safety and Licensing Board should be informed of this meeting should be made by the applicant or intervenor. The enclosures to this note are being placed in the NRC Public Document Room and the Local Public Document Room.

(original signed by)
Melinda Malloy, Project Manager
Comanche Peak Project Division
Office of Special Projects

Enclosures:
1. TU Electric Meeting Notice
2. Transcript and Presentation Materials

cc: (w/o enclosures) see next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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cc: (w/o enclosures) see next page

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Comanche Peak Steam Electric Station
Units 1 and 2

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ENCLOSURE 1

TU ELECTRIC

Log # TXX-88166
File # 10005
10068

February 4, 1988

William G. Counsil
Executive Vice President

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
MEETING NOTICE

Gentlemen:

Attached is a notice of a forthcoming meeting between Citizens Association for Sound Energy (CASE) and TU Electric. The purpose of the meeting is to discuss the Corrective Action Program (Cable Tray Hangers, and Conduit and Conduit Supports).

Very truly yours,

W. G. Counsil

By: John W. Beck
John W. Beck
Vice President,
Nuclear Engineering

JDS/grr

c - Mr. R. D. Martin, Region IV
Resident Inspectors, CPSES (3)

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MEETING NOTICE

SUBJECT: FORTHCOMING MEETING BETWEEN CASE AND TU ELECTRIC

DATES & TIME	LOCATION	PURPOSE
*Thursday, February 18, 1988 8:30 a.m.	Sheraton Hotel Houston/Austin Room 400 N. Olive Street Dallas, Texas	Discuss Corrective Action Program (Cable Tray Hangers and Conduit and Conduit Supports
Friday, February 19, 1988 8:00 a.m.	Comanche Peak Steam Electric Station (CPSES) Site (Visitors Center)	CPSES Plant Tour

* The session on Thursday will be transcribed.

ENCLOSURE 2

PUBLIC MEETING BETWEEN
TU ELECTRIC AND CASE AND MARK WALSH
FEBRUARY 18, 1988

Meeting Transcript
and Presentation Materials

TU ELECTRIC PUBLIC MEETING

WITH CASE AND MARK WALSH

Taken by: Carmen Gooden, CSR, RPR February 18, 1988

PROCEEDINGS

MR. COUNSIL: The meeting will come to order. Mrs. Ellis and Jerry, welcome once again. We always look forward to seeing you. I'd like a special welcome to Mark Walsh, I've looked forward to meeting him for about three years now.

Earlier this morning I said I hoped his trip was comfortable and blessed with nice weather. Thinking about that driving in this morning we couldn't have picked a better day to be inside than on a plant tour. I hope tomorrow will be better.

With that, I'd like to turn it over to Mrs. Ellis for any statements she might like to make.

MRS. ELLIS: We're very glad for this opportunity to meet with you again, and as I've said at previous meetings, we're still reading and reviewing things, so we may have some additional comments or questions after we have had a chance to read the transcripts and documents --

THE COURT REPORTER: I can't hear you.

MRS. ELLIS: I think we've already mentioned that Jerry, my husband, is here and Mark Walsh. And I want to say again that I think that these meetings of this type have been very helpful to all of us and help to clarify what the issues are and what you are doing and the amount of work you're doing. And I want to say again that it's obvious that you are trying to address the issues, and we appreciate the

opportunity to come and help clarify what our concerns are even further.

MR. COUNSIL: Now I'll turn it over to Larry Nace and we will begin.

MR. NACE: I, too, would like to welcome Mark Walsh to the Comanche Peak project, and I look forward to the site tour tomorrow.

Before we start, since the last meeting, Mrs. Ellis, we've received two requests from you wanting to show the videotape on the ANCO shake table tests again for Mark's benefit, and the second request was to discuss questions relative to the temperature effects on structural steel.

We'd like to open the meeting this morning with the replay of the videotape on the ANCO shake table tests. Because of the weather, we have had a problem with some of our slides, so we'll talk about the temperature effects on structural steel as soon as our material gets here. We had hoped to do that as a second issue.

Before we start, I would like for Mark's benefit to introduce the panel again. Then I'll turn the presentation over to Jim Muffett.

Jim is TU Electric's manager of civil engineering.

MR. MUFFETT: Good morning. Let me introduce the panel before we play the videotape.

We have Kevin Warapius of IMPELL, Greg Ashley of

IMPELL, Pat Harrison of EBASCO, and Gavin Winship of EBASCO. These people represent people that have had a significant part in the efforts in these areas.

Before we get on into picking up where we left off on the cable tray issues, we'd like to show the videotape.

MRS. ELLIS: I just might mention that Mark has seen the tape and he has, I think, a question or two about it.

(Videotape shown.)

MR. NACE: That completes the showing. Will the panel make sure that when you're talking [illegible] close to the microphone for the reporter?

Mrs. Ellis, do you have questions now on the showing of the ANCO tests?

MR. WALSH: I have a few. On the cable trays what was tested or shown on the film does not appear to me to be the maximum tray width or tray lengths between supports. Is that correct? Or did ANCO do tests that would indicate the maximum tray weights completely filled with [illegible]?

MR. MUFFETT: Before I answer that question, let me talk about the purpose of the tests and then we can lead into the question. These were not qualification tests of cable trays per the typical component qualification test scheme. These were tests to demonstrate the appropriateness of the analytical method so that these tests were performed and also models were made so that the analytical methods did, in fact,

conservatively predict what was happening.

As far as fill, a range of fill was used in the tests, a low filled tray, a moderately filled tray and a completely filled tray, to judge whether analytical methods did, in fact, conservatively predict the range. The tray was a 24-inch tray.

MR. ASHLEY: Essentially, the parameters that were tested, we tested two tray widths that consisted of multi-tiered systems. On one tier we may have a 12-inch tray on the bottom tier or the top tier, or vice versa we may have a 24-inch tray. The span widths or span lengths that were tested were nine feet. This was tested as a system that was representctive of most of the systems as installed in the plant. And as Jim said, the intent wasn't to run these tests and say these configurations are qualified. The intent was to gather information such that we could have assurance that our analytical methods were conservative in predicting these system responses.

MR. WALSH: What were the parameters that you had used in design and that this test verified was correct? For example, displacements.

MR. ASHLEY: What we measured in this test, they were extensively instrumented to measure displacement, acceleration. We did instrument in some instances restraint. There were numerous locations of these measurements. For

example, we measured displacement and acceleration at several heights along the posts of the trapeze-type supports. We measured recorded response along the tray, we recorded response at the shaking frame attachment of the ANCO shaking frame such that we knew at each attachment location what the input motion to the system was. You recall from the videotape we talked about fragility level inputs as high as two times the expected earthquake at Comanche Peak.

(A short break was taken.)

MR. ASHLEY: As I was saying, that two times the maximum earthquake was determined on the basis of the measurement at the attachment of the hangers to the shaking frame. In other words, we knew what the input was of those systems.

MR. WALSH: When you were measuring displacement, predicted displacement, how much did that deviate?

MR. ASHLEY: We supplied the correlation study report to you. You will note in there that on average the overpredictions in ratios in the analytical model to the actual testing configurations were a factor of two. There was some overprediction in ratios which was as much as seven to eight hundred percent over predicted in terms of displacement.

MR. MUFFETT: Obviously, this is a very complex test with a lot of data. In general, we're seeing overpredictions

on the order of two.

MRS. ELLIS: From time to time, if you will bear with me, there may be some things that I want to clarify that probably Mark can tell me later, but if you would, I'm not an engineer and I'm just trying to understand some of these things just so it's clear in my mind as much as possible.

I think it mentioned at the beginning of the tape that the tests began in 1985. But I think on the tape were both tests for the conduit supports and the cable trays done in May of '86? I think it said at the beginning of the cable tray tests that it was May of '86, and I don't think it really said on the conduit. That would be the same time frame, I assume, wouldn't it?

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MR. MUFFETT: Well, we can get those exact dates when it started, but obviously tests like this extend over a period of time, and there were some tests even taking place in '87 that we had NRC come witness.

MRS. ELLIS: Right. One of the things that I wanted to be sure of is that -- and I'm assuming that I know the answer to this already, but I just want to make sure -- is that these tests weren't done on what was in place really in 1985, but are more representative of what's actually in place out there right now.

MR. MUFFETT: Exactly. And we touched on that last time. One thing, these represent the designs as they exist in

the plant now, and in some instances we built certain things into these trays to see their exact -- see the actual size of bolt holes in the plant. We even did some tests on a bed member just to see what the effect was. So, yes, these trays are a very accurate depiction of what exists in the plant.

MRS. ELLIS: I assumed that that's what it was. I would have had some problem if those were the ones in place in '85.

MR. WALSH: I still have an additional question regarding this cable tray test and the tray and the wire that was used. It seemed like the wire was not held down with ties. When I worked out there I remember seeing some ties to hold the wiring to the trays.

MR. ASHLEY: In fact, the cable was installed in these trays the same as it is installed in the plant with the cable ties.

MR. NACE: Excuse me. I think one of the items that could be confusing, some of the cable looked like it was hanging unsupported, that was test instrumentation; instrumentation for the tests, not the cable installed in the tray.

MR. MUFFETT: It was installed using exactly the same procedures that would be in the plant. Cable trays were built using exactly the same procedures and exactly the same material. We made those as close as was humanly possible for

conditions in the plant.

MR. WALSH: But I think you have already stated that this is not the maximum weight that could be used out at the plant.

MR. MUFFETT: We had three fills. We had a light fill and a moderate fill and a full tray.

MR. WALSH: But the systems that go out there I can see heavier trays; is that correct?

MR. MUFFETT: You mean larger?

MR. WALSH: Larger trays, maybe larger spans for each hanger?

MR. ASHLEY: That's correct. There are larger trays in the plant and there are some 36-inch wide trays in the plant. As far as fill level, we tested the maximum fill level. We tested 35 pounds per square foot, which in your 24-inch trays would be 70 pounds.

Now, as far as -- as Jim mentioned earlier, these were tests to give us additional confidence in our engineering methods. We were applying standard engineering methods. These tests weren't used to develop the criterion method used for design validation.

Now, we have a separate set of tests which are component tests. Those tests were run at CC&L. Now, the purpose of those was to develop past these components for design purposes. For example, we tested the tray there. In

those tests we tested enough trays such that we had an allowable for every tray size that's used in the plant. Additionally, we tested clamps such that we had an allowable that could be used for every tray clamp in the plant.

MR. WALSH: I guess what's bothering me about this test is the method of the conclusions and the large margin that exists, but that there's only -- it's -- this test did not demonstrate the worst possible condition at the plant using the test up to two times SSE or --

MR. MUFFETT: Each tray tested to a peak of twice the SSE, which is probably a multiple of five per the ZPA. But the important thing to remember is these are not qualification tests of the trays. They're a demonstration of the analytical method. And we did a wide parameter, wide range of parameters, as far as the design, and then performed the analytical studies that showed that our studies always are conservative in the design of these trays.

The purpose of the test. You are right. If you were going to do a classic component qualification, our trays are qualified by analysis. This was an additional backup and a confirmation of the conservatism of the method.

MR. WALSH: And this test was to demonstrate the hanger or the tray? Or both?

MR. ASHLEY: These being system tests, these were to test the behavior of the cable tray systems, meaning the trays

and the hangers.

MRS. ELLIS: Again, just so I'm sure I understand, these particular tests that we saw weren't really designed or intended to test for an absolute worst case condition, right?

MR. MUFFETT: No. Let me rephrase what Greg said. We took all the components that existed in these trays and tested them statically to get allowables, so we had an allowable for each type of tray, fitting, component. That gives a number. It takes so much. Now, due to the way the cable tray systems are in the plant with the wide variation in configurations, we could not actually test all those configurations. But we wanted to do a confirmation of our analytical method that it was, in fact, conservatism. We took a wide range of configurations and tested them on a shake table and made a conclusive demonstration that the analytical methods were conservative. Those analytical methods are used in conjunction with those allowables for the other tests.

MR. WALSH: Somewhere I read in literature that we received there was a comment or a statement made that a test was performed on a member with a cable of more than 300, and that it was intentionally bent. Did that occur during these tests?

MR. MUFFETT: Yes.

MR. WALSH: I'm curious. How can one draw a conclusion that if this is not the maximum load that you can

still exceed Kl/R, go to Kl/300, if you don't have the maximum load on that member?

MR. MUFFETT: As you are well aware, the Kl/R was eliminated regardless of the load, per AISC.

MR. WALSH: I don't have that information right in front of me at this time, but a conclusion is drawn that it's an acceptable item, but it's -- this test, if it's not maximumly loaded, you can't really get a large buckling stress, axial loading of that member.

MR. ASHLEY: The intent of that test, once again, was a test to provide additional confidence. That configuration was specifically designed to ensure that there were large axial loads in the bolts of that hanger member. But as I said, it was not used as the basis to develop part of the design criteria. It was simply as a demonstration that these hangers with these long slender members under these seismic loads, these transient compressive loads, are not susceptible to instability.

MR. WALSH: Even -- you see, that's where I have a problem. They are not maximum -- they do not contain a large axial stress or a maximum that -- you know, what would be the maximum axial stress you could put in that member with the large lengths.

MR. MUFFETT: First, I think that we may have misled you. We want you to realize that any compression member

complies with the guidance that we have from AISC in regard to these compression members. We don't use this test as the basis for any design of our members. They all comply with AISC. And one could draw the conclusion that the loads we put on those are probably overpredicted by about two based on what we saw from the test. The reason we did that is since we had the shake table and the time, and this has been a question that's come up on numerous dockets -- the Byron docket, the LaSalle docket -- exactly the behavior of these long slender members during a one-time transient short-term compression, and we had a shake table and a structural review and decided to see what would happen.

MR. WALSH: When you increased your load to two times SSE, there was no yielding on the steel; is that correct? Of the hangers?

MR. ASHLEY: That's correct. There was no noticeable gross deformation of hanger members. During one of the tests after it had seen many, many cycles of earthquake, over an hour of earthquake, there was some small deformation in one of the clamp members; however, that did not result in any loss of function of that hanger or that clamp.

To directly address your question, there was no noticeable deformation, no deformation in the hanger members themselves.

MR. NACE: I would like to clarify, Mark. Are we

confusing you or confusing ourselves? The systems themselves are all qualified by analyses. These tests do not qualify the system. The tests were confirmation of the adequacy of the analytical techniques used on all those systems. Are we communicating on that?

MR. WALSH: I believe so. You know, I received a lot of information, and I am concerned that someone would take this test and say, "Well, we did it on this test. Now we don't have to follow specific guideslines. We did it on this one test."

MR. MUFFETT: No, absolutely not. We are in very strict compliance with the applicable code.

MR. ASHLEY: In fact, I'd like to point out that the test demonstrated much higher levels of damping than Comanche Peak has committed to in the FSAR; however, we have used the damping levels as committed to.

MR. WALSH: That's another point. The lengths between hangers. Someone mentioned that the maximum was nine feet. Were there shorter spans tested?

MR. ASHLEY: Yes, there were shorter spans tested. Those shorter spans tested were in the region of, for example, near the horizontal bend.

MR. WALSH: I believe if you decrease the length between supports your damping would go down. If you increase it, it would go up. I read somewhere this damping was noticed

that it was higher than TU indicated that they were using. But if you tested a shorter span you might be closer to what is in the FSAR or whatever.

MR. MUFFETT: All the damping from all the tests, with fittings, with bends, with all the configurations, were equal to or higher than what we used.

MR. WALSH: That's what I'm getting at. If we shorten the span, wouldn't the damping go down?

MR. MUFFETT: You'll find that structural damping is a fairly complex phenomenon, and there's a lot of aspects to it. And shortening the span probably would reduce the stress level which would reduce the structural damping.

The test obviously is a very complex subject. The test report that you have bears what we are telling you.

MR. WALSH: And it would indicate that the shorter spans the damping is closer to what TU is using.

MR. MUFFETT: I think another interesting thing is the damping, from my reading the report, tends to vary more with fill than with span. And if you think about it, that's logical, because what happens is the cables actually rubbing against each over use up a lot of energy. And really these events are energy based. Although typically analyzed with forces and components, energy is a big concern, and when you have something take place like friction that uses up the energy, it tends to magnify the damping.

MRS. ELLIS: When you're talking about the reports, you're still talking about the ANCO report?

MR. MUFFETT: Yes. And the correlation section.

MR. COUNSIL: Are there any other questions on the cable tests?

MR. WALSH: No.

MR. NACE: Let's continue with the presentation of cable tray hanger issues from the project status report, and as soon as we're ready on the temperature effects, we'll make that presentation.

MR. NACE: We would like to ask you one clarifying question from the last discussion to make sure --

MR. ASHLEY: -- that we were talking about the same thing. What we were talking about is that what the ANCO tests have shown is that the damping, in particular for the higher fill levels, is much higher than what TU has committed to. In other words, we're using conservative levels of damping. Your understanding is that as the spans get shorter, the damping may more closely approach or come down to the level TU has committed to.

MR. MUFFETT: Before we get started with where we left off last time, we have a new panel member here today. I'd like to introduce him. His name is Gavin Winship.

MR. WINSHIP: Good morning. My name is Gavin Winship, and I've been working in England on nuclear power

plants for about two years. I came to the United States to work on nuclear plants. I worked on the pressurized water reactors and one boiling water reactor.

I've been with EBASCO for five years now as project engineer at Comanche Peak. I've worked on the quality engineering side and structural engineering side.

MR. MUFFETT: The first handout that we have is basically an update and it shows the [illegible] 1 [illegible] the December meeting [illegible] didn't get to because of the time constraint.

What we'd like to do, if you look on the second page, is pick up with item 24.

MRS. ELLIS: What we'd like [illegible] to let you go ahead and finish with the things that you had planned on cable trays and cable tray support issues, and then by that time it may be time for lunch, or a break anyway, and let Mark take a look at some of the things that were covered in the December meeting [illegible] some of those that he would like [illegible] some questions [illegible] and finish up with cable trays first before we go [illegible] conduits and conduit supports.

MR. NACE: Fine.

MR. MUFFETT: With that, we'll go to issue 24, which Pat Harrison is going to present.

MR. HARRISON: Issue 24 is [illegible]

members.

Issues A and B: In the original design of cable tray support flexural members, moments (bending and torsion) induced by cable tray eccentricities to tier centroidal axes have not been considered.

The resolution to this issue follows: Design Validation Procedures, SAG.CP11, SAG.CP34, PI-02, PI-03, and M-12 require that moments (bending and torsion) resulting from tray/hanger connection eccentricities be considered.

MR. MUFFETT: Any time you'd like to ask a question, feel free.

MR. HARRISON: Issue 24C. In the original design of cable tray support flexural members, reductions in beam section properties due to bolts holes and weld undercuts are inconsistently considered.

The resolution to this issue is in two parts.

Reductions in section properties resulting from bolt holes were developed per engineering studies in Volume I, Book 25 and M-65, which are in accordance with the AISC specification. The size of the bolt hole was determined to be three quarters of an inch, based on a statistical evaluation of a bolt hole sample. Design Validation Procedures SAG.CP34 and PI-11 require the use of these reduced properties in the design validation of cable tray tiers to account for the presence of both used and unused bolt holes.

The second part of the issue: The cable tray hanger [illegible] as specified in Procedure NQ1-3.09-M-001. All unacceptable weld undercuts have been repaired. An engineering study in Volume I, Book 20, of the base metal defects (identified by these QC inspections) has been performed and concluded that the effects of weld undercut on cable tray capacity need not be explicitly considered.

[illegible] I would interject [illegible] a moment. I [illegible]

[illegible] you say [illegible] to assume that you have them. To the best of our knowledge, you have these.

[illegible] the bolt [illegible] diameter [illegible] utilized in that? Is [illegible]

MR. HARRISON: The hole size was three quarters of an inch.

[illegible] But if you use a three-quarter-inch bolt the hole's got to be a sixteenth inch larger.

MR. HARRISON: I misunderstood your question. The bolt was a five-eighths-inch bolt and the hole size was three quarters of an inch.

Issue 29D: In the original design of cable tray flexural members, design calculations did not consider shear stress effects due to direct shear, St. Venant shear, or the combination of the two.

Resolution to the issue is as follows: Stresses due to direct shear and St. Venant shear are considered in design validation as specified in SAG.CP34 and PI-03.

MR. WALSH: Is warping torsion taken into account for these members also?

MR. HARRISON: Yes. Warping is added on to these members.

Issue 24E: In the original design of cable tray support flexural members, capacity reduction due to unsupported length of compression flange, per AISC equation 1.5-7, was not properly considered.

Resolution to this issue is as follows: Design Validation Procedures SAG.CP34, PI-03 and PI-11 require the use of AISC equation 1.5-7 for the validation of cable tray hanger channel members and provide direction for its proper application.

Issue 24F: In the original design of cable tray support flexural members, the practice of considering torsional warping normal stress was not specified in the Design Validation Procedure.

Resolution to the issue is as follows: Torsional warping normal stresses are considered in design validation as specified in SAG.CP11, SAG.CP34 and PI-03.

MR. MUFFETT: The next one we'd like to present is Issue 25, and Greg Ashely is going to present this.

MR. [illegible]: This issue is related to cable tray [illegible]. It has several parts. The first part: In the original cable tray qualification, dynamic amplification factor was not used.

This issue has been resolved since the design validation of cable trays by the equivalent static method considered peak seismic accelerations or seismic accelerations at the system frequency and used an amplification factor [illegible] of [illegible]

[illegible] amplification factor is [illegible] by detailed engineering studies contained in Volume [illegible] Book 15.

Certain configurations may require a higher [illegible]. Design Validation Procedures SAG.CP28 and [illegible] were developed to properly analyze these cable tray system configurations.

MR. WALSH: These are the results -- here it's titled [illegible] qualification. Did you use a spectra on the [illegible] also?

MR. [illegible]: Yes.

MR. [illegible]: Yes

MR. ASHLEY: The second part to this issue: In the original cable tray qualification, the interaction equation was improperly based on total load for spans greater than [illegible] feet.

This issue has been resolved since design validation

of cable tray spans greater than eight feet is based on comparison of tray bending moments with bending moment capacities obtained from testing." They refer you to Calculations M-03, M-34, M-35 and Volume I, Book 1.

MR. WALSH: What testing?

MR. MUFFETT: This is the CCL testing. This is not the testing that you saw in the tape. This is the static testing to determine allowables, determine moment capacities.

MR. WALSH: Okay. And those tests they did fill trays to the maximum possible?

MR. ASHLEY: That's correct. In those tests, being component tests, the components were loaded to failure.

MR. ASHLEY: The next part to this issue: In the original cable tray qualification, several incidences of modifications of vendor-supplied hardware for cable trays were found without adequate justification or documentation.

This issue has been resolved since the effects of modifications to vendor-supplied hardware are being evaluated using as-built data as design input for validation as part of the Post Construction Hardware Validation Program.

MR. WALSH: May I go back to a previous question?

MR. MUFFETT: You can go back anywhere you like.

MR. WALSH: On the channels -- or excuse me -- the section member properties, you commented that you used three-quarter-inch diameter holes. How does that relate to

what's out in the field, out in the plant?

MR. HARRISON: That was the maximum hole size that was found.

MR. WALSH: That was found or that was allowed?

MR. HARRISON: That was found.

MRS. ELLIS: Here comes another possibly dumb question. Am I right in assuming that basically you redid the as-built drawings yourselves, what was out in the field, rather than relying on what was shown on the original drawings? Is that correct?

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MR. MUFFETT: Exactly. These programs, the basis of all these analyses that we talked about today, are the actual configurations of the trays as they exist with no dependence on other drawings or configurations. These have been walked down and that's the foundation of the analysis.

Now, we will go back and look at some other variables in the Post Construction Hardware Validation Program, which is presently ongoing, but the foundation of these analyses is the actually physical configuration as the trays and hangers are now. So that if they fail we modify them. If it passes the stress allowables, then we have an as-built of exactly how it is now.

MRS. ELLIS: I know that there had been quite a problem in the past with drawings matching what was out in the field, so you basically have avoided that problem by doing

your own as-built drawings so that there's not a problem with --

MR. MUFFETT: Exactly. And I believe you have those procedures.

MR. WALSH: And those drawings would indicate if they had a three-quarter-inch hole or a five-eighths-inch hole, correct?

MR. HARRISON: Yes.

MR. ASHLEY: The last part of this issue: In the original cable tray qualification, cable tray moment of inertial calculations do not consider shear deformation under transverse loading of ladder-type trays.

This issue has been resolved. Design Validation Procedures SAG.CP18 and PI-02 consider cable trays as flexural members. An engineering study, Calculation M-66, has shown that this procedure is appropriate and that shear behavior does not need to be explicity considered.

MRS. ELLIS: Is this one of the ones that would be in all the stack of stuff that we have gotten on this particular calculation?

MR. NACE: I believe it is. After the last meeting we went through the presentation of the material in the December meeting, including that which we didn't get to, and sent you a truck load of three copies of each.

MRS. ELLIS: Right. I remember.

MR. NACE: I don't know where you put it all.
MRS. ELLIS: I'm certainly not saying that we don't have it. I'll look.
MR. NACE: If there are no questions at this moment, I'd like to take a short break, and we'll reconvene in 10 minutes.
(A break was taken.)
MR. NACE: The meeting will come back to order. I would like to set the record straight with respect to my last statement. It turns out there are 12 more documents that are referenced in the slides today that are not in that which we provided you after the December meeting. There are three copies of each available here in Dallas, and as soon as this meeting is over we will hire another truck and transfer those.
MRS. ELLIS: I'll try to make another spot on my kitchen floor.
MR. MUFFETT: Before we go on, I'd like to clarify something, because I think the way we stated something was a little misleading in regard to bolt holes. Just to make that issue crystal clear, I'd like Pat to explain exactly what's done.
MR. HARRISON: What I said was that the bolt hole was measured on the as-built drawing. In reality, it is the bolt hole size that is measured on the as-built drawing. The bolt -- I'm sorry -- is measured on the as-built drawing. The

size of the hole was determined by a sample that was done of hangers, which is in Volume I, Book 25.

MR. WALSH: So the holes could be larger than was shown in the calculations; is that correct?

MR. HARRISON: What the sample showed was out of the maximum size hole found in that sample.

MR. NACE: What he's trying to say is that that's not an average based upon a sample. That's the maximum diameter hole found in the plant.

MR. WALSH: For that particular size bolt?

MR. HARRISON: For the bolts that were measured. For every bolt that was disassembled and the hole measured, the maximum size that was found was three quarters of an inch.

MRS. ELLIS: That is done on a sampling basis, right?

MR. HARRISON: Yes.

MR. MUFFETT: All the details are in the study for that.

Now, getting back to an issue which is not on your matrix there, which is one you asked us about, I'd like to pick up with that one.

Now, we paraphrased the question, our understanding of it, and we believe that the question is: How is the effect of high temperature due to LOCA on steel yield strength taken into account in the design validation of the cable tray, conduit and HVAC supports?

The analyses are conducted in strict accordance with AISC requirements. This code is appropriate for the LOCA conditions since the maximum steel temperature resulting from the extreme accident event is less than 280 degrees, and this is for less than actually that peak of around 280 that existed for a number of hours.

The code recognizes that the ultiamte strength is not affected by this temperature.

MR. WALSH: The loading combinations that are annotated in the FSAR is based on the yield strength criteria. I believe that is what's been commonly used out there at Comanche Peak. And the effect of the temperature does affect the yield strength of the material. And from the documents that I have seen, it appears that they're still utilizing the yield strength of 36 KSI versus the 280-degree temperature, which would be 31.2.

MR. MUFFETT: If you will allow me to put up a supplemental slide, I can relate to that issue. Unfortunately, I'm going to have to apologize because there is one typo on here.

In regard to this question of what we use and the reduction in yield strength, you will see that what we're using at Comanche Peak is .9 of Fy. Now, the NUREG 0800, which is the standard review plan, would allow you to go to .96 Fy, 1.6 times .6. We don't take advantage of that. So

what you see here is that the allowable of non-temperature-adjusted allowables in compliance with the NUREG would be 34.6. If the yield is adjusted for the allowable, a change due to temperature, you see that you have 1.6 times .6 times the reduced yield, which is .95 of what it is at room temperature, which would give you now an F allowable of 32.8, which is still higher than what we used.

Now, not to get into a complex issue, but one thing we wanted to check was, let's look at another code that does something similar. Obviously, there's a lot of complexities and a lot of differences between ASME and AISC, which I'm sure you're aware of.

So what we did as a benchmark, as a crude benchmark, is look at what ASME would do. That's the last two equations here. ASME would derate the allowable, but they would also use an increase, because it's a one-time faulted event, of approximately 1.8. That would give an allowable of 40.6 for that faulted event at room temperature. If you adjusted the ASME allowable for temperature as it does in the code and then used the factor, the increase for the faulted condition, you would get 36 KSI. All those numbers are higher than what we used. In effect, we used the lower allowable to remove the necessity to derate allowable for temperature on these types of components. That offers us a very positive benefit in that rather than different people performing all these different

calculations, we take a uniform allowable that addressed these effects.

MR. WALSH: Is that -- I don't have my notes with me on this, but I think there was one load combination where you have, I think it's 1.7 times the strength of the material, and it's equal to the SSE condition plus the LOCA. Then there's another load case where it's 1.6 times the strength of the material. And that was with the LOCA and the OBE condition. How do those equations relate back to the 1.6 times the yield strength of the material? Or is this with the SSE condition?

MR. MUFFETT: This is for the faulted condition. These loads are all manipulated in accordance with the guidance given in the standard review plan, NUREG 0800.

MR. WALSH: Now, how about the case with the OBE condition and the LOCA temperatures?

MR. ASHLEY: What we've provided here as the limit on yield is .9 Fy as the load combination and the limit we used for the SSE condition. In fact, we limit the OBE condition for .6 Fy, or in effect we don't use the 1.6 multiplier. If you note in the SRP 1.7 is applied to the SSE condition, so we've, in fact, for this comparison taken the lower factor applicable for the OBE and compared it to the SSE allowable that we used in design.

MR. WALSH: But wasn't that all based on an Fy of 36, not 31.2?

MR. ASHLEY: That's correct. What I'm saying is, what you would find for the OBE validation is that we're using a .6 Fy, or roughly 21.6, rather than the faulted condition allowed by the SRP which would be 1.6 times .6. So, in fact, we were more conservative for the OBE case than the faulted load combination.

MR. WALSH: I guess I'll have to look at this a little bit more closely.

MR. MUFFETT: This is the slide with the typo. Let me point that out. It's the second asterisk, the one with the two stars by it, and I believe -- timing is everything.

As you see, now you have the corrected one up there. It's .7 times Su over Ft. This comes from Appendix F of Section III of ASME.

I guess the real point is, Mark, one thing we're going to make, we're aware that ASME derates this, but if you see that when they use this factor of 1.8, 1.88, to increase the load, because it's a one-time faulted condition, it actually comes up to a higher number than we're using.

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MR. WALSH: I guess the problem I have with this is that when Gibbs and Hill did their original analysis, they neglected LOCA because it was -- the material was ductile. When they did their comparison they did not include the decrease in yield strength, and that was the basis of it. And the way I was looking at it -- I've drawn a few numbers -- is

it's not necessarily the case if you stick with the original criteria that they had used in comparing the strength of the material, the 1.6 versus the 1.7 times the strength. The yield strength goes down. They hadn't considered it.

MR. MUFFETT: Right. And I believe, if I understand correctly, if you were using .96 as your allowable, you should derate it with temperature. But since we used something lower all the time, those temperature effects don't really impact this allowable. I guess that was the point of this slide.

MR. WALSH: So that 34.6 KSI is based on a yield strength of 36; is that correct?

MR. MUFFETT: 34.6 is the non-temperature adjusted allowable.

MR. WALSH: So if you adjusted for temperature --

MR. MUFFETT: That would be the next one down.

MR. WALSH: Okay.

MR. MUFFETT: You see that that's 32.8, which is again a higher allowable than what we used.

MRS. ELLIS: So what you're using all the time is 32.4; is that right?

MR. MUFFETT: Right. And that saves us the necessity of having to make a critical calculation for temperature. This way we use a uniform allowable. We don't have to worry about that or address it.

MR. WALSH: And that is for bending?

MR. MUFFETT: Yes. Now, there's a lot -- obviously there's a lot more complexity to this and there's a lot of different types of things going on here. We couldn't really address that in simple charts or in the contents of this meeting.

MR. WALSH: Okay. So you're trying to say that you're utilizing this 32.4 just for the .9 Fy simplicity here. Now, if you were to take a channel, which has long and various lengths, how would that be reflected here? Where the point -- it won't be .9. It's going to be dramatically less because of the various lengths. How is that reflected here?

MR. ASHLEY: Essentially what we're doing, this .9 Fy is set as the limit on stress, on normal stress. In other words, for this load combination, this being the SSE combination, we do not have any normal stress in design validation greater than .9 Fy. When we do the individual component designs, the components of stress, we, of course, are reducing those components based on the AISC code; in other words, whatever the major axis bending allowable is for the channel, whatever it happens to be for the compressive stress allowable for the particular channel member. Now, when you combine all those interaction-type equations, the total combined normal stress cannot be greater than .9 Fy.

Now, the other point that this does bring out is the .9 Fy, as I said before, is the limit set for the load

from them.

MRS. ELLIS: Unless something else would come up -- Thank you.

MR. MUFFETT: The next issue we have is 26, and Greg Ashley is going to present that.

MR. ASHLEY: This issue is related to the design of base angles. It has several parts.

The first part: In the original design, original base angle design, base angles were modeled as simply supported beams, ignoring the stiffening effects of concrete bearing at angle ends.

This issue has been resolved. Design validation procedures use the same assumption when checking base angle stresses since consideration of the stiffening effects due to concrete bearing at angle ends would produce lower base angle stresses. This assumption is conservative for evaluation of base angle stresses. However, concrete stiffness is included in calculations of the base angle flexibility used in the determination of support stiffness.

The second part of this issue: In the original base angle design, principal axes were not considered in the analysis of base angles.

Design Validation Procedures SAG.CP34 and PI-07 require the base angle principal axes be considered in the evaluation of base angles.

where extremely similar hangers were grouped, the grouping was performed with consideration of support geometries, connection details and other relevant attributes in accordance with Design Validation Grouping Procedures in Volume I, Books 4 and 8.

MR. NACE: I might comment the references, Volume I, Books 4 and 8 are, in fact, two of the documents you have not received yet, but you will shortly.

MR. MUFFETT: The next issue is issue 28, which is again going to be presented by Pat.

MR. HARRISON: Issue 28, critical support configuration and loadings. The original issue was that the original design calculations for trapeze-type cable tray hangers considered symmetric load patterns and a limited number of hanger aspect ratios which may not have represented the bounding as-built configurations.

Resolution to this issue is as follows: Design validation was performed using as-built information which adequately accounts for the significant number of attributes, including actual tray locations. The majority of the hangers have been design validated individually. In the limited number of instances where extremely similar hangers were grouped, the grouping was performed with consideration of support geometries, connection details, and other relevant attributes in accordance with Design Validation Grouping

Procedures in Volume I, Books 4 and 8.

MR. WALSH: What was the percentage that was in this group?

MR. HARRISON: It's less than 10 percent.

MR. MUFFETT: The next issue is issue 29, which Greg Ashley is going to present.

MR. ASHLEY: This issue is related to the cumulative effect of all of the review issues. The actual issue was that small unconservatisms resu[illegible] significant cumulative eff[illegible] for cable tray hanger[illegible] by more than one issue.

This issue has been resolved since there's no cumulative unconservative effect on the [illegible].

In the current program th[illegible] Corrective Action Program overall design validation approach has addressed each issue, both individually and collectively.

The design validation has been based on as-built data.

The Design Validation Procedures SAG.CP3, 4, 9, 1[illegible], 18, 19, 28, 34, PI-02, [illegible] and 11 provide control of the design process.

All the final designs are in conformance with the applicable codes.

An extensive test program provided data demonstrating the design validation approach as conservative.

MR. WALSH: I have another question regarding the temperature effects on structural steel. You referenced a NUREG 800.

MR. MUFFETT: Yes.

MR. WALSH: Is that included in the FSAR for the justification of not decreasing the yield strength?

MR. MUFFETT: That doesn't speak to that, and we did not reference it in regard to that. What we referenced in the NUREG was the 1.6 increase on the .6.

MR. WALSH: And that would be referenced in the FSAR.

MR. MUFFETT: The NUREG?

MR. WALSH: Yes.

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MR. MUFFETT: Our load combinations come right out of Standard Review Plan. I don't know if it referenced the NUREG. It was just written the same on the FSAR, and I don't want to mislead you, but I believe that those are -- I think they are exactly transposed from the Standard Review Plan to the FSAR.

MRS. ELLIS: I'd like to just mention that when Mark talks about the FSAR he's thinking primarily of the way it used to be, because he hasn't seen all of the stack of changes that we received recently on this. So it may very well be some of the things that he's talking about are different from what -- are now different in the new revision from what he is

[illegible] I think [illegible]'s question is: Is the [illegible] verbiage identified in the FSAR? I think that's your question as opposed to is the NUREG 0800 referenced?

MR. WALSH: The NUREG.

MR. MUFFETT: I don't believe the NUREG is. I believe that what we've done is taken those recommendations [illegible] composed them and [illegible] them down [illegible]

[illegible] reason is from the FSAR, [illegible] in the past, they did not indicate .6 Fy in the FSAR.

MR. ASHLEY: What we've -- we've used .6 Fy in that slide [illegible] using [illegible] [illegible] As I mentioned, we [illegible] components per the AISC specification. What we did [illegible] slide is we took .6 Fy and ran a comparison through using [illegible] We are doing our designs per the AISC specification, which means if you get a reduced allowable [illegible] compressive stress from the AISC, that's what's used in the design. If we get a reduced allowable from major axis bending and stress on a channel section, that's what we used in design.

MRS. ELLIS: So you're not really relying on the verbal[illegible]

MR. MUFFETT: The NUREG gives a list of recommended

load combinations, and that's what we've taken out into the design procedures. That's the way we combined loads for typical designs. I don't believe we have referenced what we've done, is plagiarized those combinations out and put them in the FSAR. There's a recommended combination from the Staff.

MRS. ELLIS: There's one thing I want to clarify. I'm sure I know the answer to this, but just for the record, in what you have done it was not part of your job to really look at the root cause of the problems that had come up in the past; is that right? You were looking at the corrective action aspect of it and addressing it from that aspect rather than what had happened before and the reason things had happened before; is that right?

MR. COUNSIL: Mrs. Ellis, somehow somebody has a misconception that we are not going to do a root cause analysis. That is not true. In the last approval of our Corrective Action Program and CPRT Program Plan the NRC in Item 1 specifically asked us to do so. With any degree of luck, that will be issued next week.

MRS. ELLIS: I just wanted to establish that these gentlemen are not really the ones.

MR. COUNSIL: Yes, they are. They are part of the team that is helping us do the root cause analyses.

MRS. ELLIS: That's what I was trying to clarify.

MR. NACE: The basic mechanism will be described in the submittal once we finish our activities. All the contractors, having gone through the validation process and having cataloged Appendix A and Appendix B issues to the PSR, then participate in the development of a root cause report which will be submitted.

MRS. ELLIS: Thank you.

MR. MUFFETT: The next two issues numerically are 30 and 31. We addressed those last time in our last meeting. We would propose to go on to 32 and let you ask questions later about anything in the prior meeting.

Issue 32 is conduits attached to cable trays or supports.

The external source issue is: Questions regarding conduits attached to cable trays or cable tray hangers have been identified. These questions are as follows:

How are conduit loads considered in cable tray hanger validation?

How are conduit loads considered in cable tray design validation?

How is hanger frequency at conduit attachment locations determined in the equivalent static analysis?

The resolution to the issue is as follows: Design Validation Procedures SAG.CP18 and SAG.CP34 and PI-02 for cable trays and cable tray hangers require that the effects of

attached conduit be included in the evaluation of cable trays and cable tray hangers.

For the equivolent static analysis the system frequency was evoluated based on appropriate mass participation as specified in SAG.CP34.

MR. MUFFETT: The next issue is issue 53, which is going to be presented by Gavin Winship.

MR. [illegible]: This issue is on as-built walkdown [illegible]

[illegible] is the question that in [illegible] walkdown procedure, what is the justification for tolerances used for as-built measurements?

The issue resolution was that [illegible] Report [illegible] M-[illegible] [illegible] demonstrated that the measurement tolerances used for gathering as-built cable tray and cable tray hangers [illegible] were acceptable.

The second issue: The following questions regarding as-built walkdown procedures were identified:

What is the justification for using [illegible] as part of the weld acceptance criteria?

How do the walkdown procedures evaluate weld penetration?

How do the walkdown procedures evaluate unknown [illegible]?

Do the walkdown procedures evaluate items attached to cable tray supports?

The resolutions were as follows: TU Electric has received NRC approval to use visual weld acceptance criteria (VWAC).

The effective throat of welds was assumed 40 percent of the beveled member's thickness based on ultrasonic tests and engineering studies, Volume I, Book 20.

When expansion anchor type and embedment length could not be identified, the anchors were design validated assuming minimum capacity for the anchor type. Example here, A307 bolts with Richmond inserts, or Hilti-Kwik bolts as opposed to a Hilti-Super-Kwik bolt.

Design validated assuming minimum embedment for the particular anchor size.

And inspected using ultrasonic tests to determine as-built anchor embedment for validation.

Finally, items attached to cable trays and cable tray hangers and methods used to attach those items were then identified by walkdown procedures FVM-CS-002, 003, 019 and 048.

The third and final issue: The following questions regarding as-built walkdown procedures were identified.

What are the specific items evaluated as part of the cable tray span walkdown procedure?

The resolution was: Tray covers, side rail extensions and modified splice plates are identified as per walkdown procedures FVM-CS-001, 003, 019 and 048. These attributes are being validated in accordance with Procedures SAG.CP3, SAG.CP4, SAG.CP18 and SAG.CP34, PI-02, PI-06 and Calculation M-39.

MRS. ELLIS: I don't think we have any questions right now. We may have some at some point later.

MR. MUFFETT: The next issue that we'd like to talk about is 34, which is the system analysis methodologies, which Greg Ashley is going to present.

MR. ASHLEY: This issue is related to the system analysis methodologies. The external source issue is: The following questions were raised regarding cable tray system analysis methodologies.

Superpipe error SP-004 involved the incorrect assignment of lumped directional masses for static load cases. A method to adjust the results to account for the error was incorporated in the cable tray validation procedures. The error was subsequently corrected in a later version of superpipe, and this method was no longer required. System analysis 176-063-02 incorrectly applied this method for error SP-004 to a version of superpipe in which the error had been corrected. The question is: What is the impact of applying the method to adjust for the error to a corrected version of

superpipe?

The resolution of this question was: This issue was identified and documented in an internal technical quality review which was conducted in accordance with IMPELL Quality Assurance Procedures prior to identification by external source. There was no impact of incorrectly applying this method of adjustment to systems analysis 176-063-02. This is documented in the TQR response. In response to the TQR, the corrective action required that generic implications also be identified. No other occurrences of this issue were identified.

The second part to this issue: The following questions were raised regarding cable tray system analysis methodologies:

The question was: What is the justification for the use of a 1.1 load factor for cable tray and cable tray hangers located near analysis boundaries in the overlap regions of response spectrum analyses?

This issue was resolved by: A detailed engineering study (Calculation M-13) which developed the overlap criteria using the results of partial models with overlap regions compared to the results of full models of the same system. Results of this study showed that no load increase factor was required; however, a load increase factor of 1.1 was applied in the overlap region to assure conservative analysis results.

This factor was established from a review of other structural overlap criteria. One of those criteria, in particular, was "Overlap Criteria in Piping" by Brookhaven National Laboratory.

MR. MUFFETT: The next issue we'd like to proceed with is A35. The issue was that in the original design and inspection of cable tray hangers, QC inspectors failed to identify and document conditions where the installation was not in accordance with the design document.

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The resolution is that under the Corrective Action Program the reinspection of cable tray hangers has been performed and documented in accordance with the following procedures: QI-QP-11.10-2A, QI-QP-11-10-9, FVM-CS-001, FVM-CS-003, and FVM-CS-036.

This as-built information is independently reviewed by TU Electric QC personnel.

This as-built information performed is considered as design input for the design evaluations that we're talking about today. And I think we touched on this point earlier.

Now we'd like to shift gears slightly and move into Subappendix B items. These are items that we have identified ourselves while conducting a CAP that have been reportable issues under 50-55E. We'd like to talk about what we found and how we corrected these issues.

The first one is B1, which is SDAR-CP-83-15. It's

going to be presented by Greg Ashley.

MR. ASHLEY: This internal source issue is related to the bolting material for cable tray hanger clamps.

Specifically, the original design of heavy duty cable tray clamps for longitudinal-type hangers required the installation of high strength A-325 bolting materials to attach the cable tray clamp to the cable tray hanger. Field walkdown of the installed conditions revealed the use of lower strength A-307 bolting material.

This issue is being resolved in the Post Construction Hardware Validation Program which for cable tray hangers identifies the installed bolt material used for the connection of cable tray clamps to structural members. Existing bolting material is being evaluated in accordance with the appropriate allowables in the Design Validation Procedures SAG.CP19 and VI-06. Bolts which do not comply with design requirements are being replaced.

MR. MUFFETT: The next issue is B2, which has to do with cable tray hanger design, which is going to be presented by Pat Harrison.

MR. HARRISON: This issue is SDAR-CP-85-35 and is now cable tray hanger design.

The original design criteria may not have appropriately addressed certain design requirements. Additionally, discrepancies may have existed between as-built

and as-designed cable tray hanger configurations.

The resolution is as follows: TU Electric initiated a cable tray and cable tray hanger Corrective Action Program, CAP. CAP features include the establishment of cable tray and cable tray hanger design criteria which comply with CPSES licensing commitments; development of the Design Basis Document, DBD-CS-082; validation of the installed cable tray and cable tray hanger designs, including the identification and implementation of necessary modifications.

Cable trays and cable tray hangers have been design validated in accordance with the Design Validation Procedures PI-02, PI-03, PI-06, PI-07, PI-11, SAG.CP3, SAG.CP4, SAG.CP9, SAG.CP11, SAG.CP18, SAG.CP19, SAG.CP28 and SAG.CP34. The installed cable tray hanger and cable tray hardware is being validated in accordance with the Post Construction Hardware Validation Program, PCHVP, by Procedures FVM-CS-001, 003, 019, 048, 050, 084, 098 and 100.

MRS. ELLIS: One question on the previous slide. It says -- this was on B1 -- that this was discovered through field walkdown. How was the information for B2 obtained? How was that issue identified?

MR. ASHLEY: B2 -- you'll note on page B2-1 as opposed to B1 -- B1 we call the internal source issue, B2 we call an external/internal source issue. Really, B2 reported to the Commission the findings of the external source issues.

For example, the CYGNA review and all other issues, external source issues, those were recorded under 10CFR.50.55E using SDAR-CP-85-35 as the vehicle.

MRS. ELLIS: Okay. I may have a little more to say about that later, too.

MR. MUFFETT: The next issue is B3, which is SDAR-CP-85-50, which is going to be presented by Gavin Winship.

MR. WINSHIP: Cable tray tee fittings. The issue was as follows: Some as-built welds on vendor-supplied tray tee fittings were not in accordance with the welds specified in the vendor drawings.

The resolution was that tee fittings not meeting the minimum vendor weld requirements have been identified as part of the Post Construction Hardware Validation Program, PCHVP, using Procedure FVM-CS-050. Tee fittings with inadequate welds are being modified to meet the design requirements.

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MR. MUFFETT: The next issue is B4, which is SDAR-CP-85-52. In light of what Greg just brought up, I will point you to this. It's also an external/internal issue and that part of this or some of it to some degree was raised by outside parties. We reported it on this SDAR under the requirements of 50.55E.

The issue was that discrepancies were identified in the as-built documentation developed during the early phases

of the as-built inspection program.

Resolution is that cable tray and cable tray hanger systems which have been as-built inspected during this phase were validated and reinspected by personnel trained in the TU Electric field verification methods.

The next issue is B5, which is SDAR-CP-86-52, which is going to be presented by Gavin Winship.

MR. WINSHIP: Cable tray splices and connections. The issue was as follows: Cable tray splices were not installed in accordance with approved splice configurations as summarized below.

The cable tray splice configurations may have used splice plates that were not approved designs or may have incorrectly used approved splice plates.

Improper installation of splice plates may have resulted in unused bolt holes in cable trays and splice plates.

The original calculations did not consider the effects of unused bolt holes in cable trays and splice plates.

Special splice plates may have been installed in place of reducer fittings. The original calculations did not consider the use of splice plates in place of reducer fittings.

The resolution was as follows: Unacceptable field-fabricated splices, which do not comply with design

criteria, are being identified in the Post Construction Hardware Validation Program, PCHVP, in accordance with Procedures FVM-CS-019 and FVM-CS-048. Splice plates that do not comply with the design criteria are being replaced with design-validated splice plates.

Unused holes in cable trays and splice plates which do not comply with design criteria are being identified during the Post Construction Hardware Validation Program, PCHVP, using Procedures FVM-CS-019 and FVM-CS-048. Trays and splice plates with unused holes that do not comply with design criteria are being repaired or replaced with validated designs.

Special splice plates used in place of reducer fittings are being identified during the Post Construction Hardware Validation Program, PCHVP, using Procedures FVM-CS-019 and FVM-CS-048. These splice plates are being replaced with design-validated splice plates.

MR. MUFFETT: The next issue will be B6, which is SDAR-CP-86-82, which is going to be presented by Greg Ashley.

MR. ASHLEY: This issue is related to cable tray hanger splice welds. The original cable tray hanger installation specification required the use of full penetration weld joints when channel sections were spliced end to end. Non-destructive tests performed on a sample of these end-to-end splice welds revealed in certain instances less

than complete weld penetration.

This issue has been resolved since the Post Construction Hardware Validation Program has identified the location of all channel end-to-end splice welds. Non-destructive examination was performed, and welds that did not achieve full penetration were modified to conform with design requirements.

MRS. ELLIS: Just one question on this. The method used to locate this initially was a sampling, but the resolution of it was not on a sampling basis. It was 100 percent.

MR. ASHLEY: Right. The sample identified the problem and the need to look at every splice weld.

MR. WALSH: In the original criteria was there a quality assurance program set up that they would go out and use non-destructive testing on the original splices? How were they originally approved, the splices?

MR. ASHLEY: The original design required a full penetration weld. I could not speak to the original program with regard to what quality assurance was provided if full penetration was achieved, but the original design was for full penetration. We identified if it was lack of full penetration then the need to repair.

MR. MUFFETT: The next issue is B7, which is SDAR-CP-87-48. Pat Harrison will present this issue.

This issue is cable tray transverse clamps. The original installation of particular combinations of transverse cable tray clamp types provided inadequate restraint of the cable tray when subjected to transverse movement.

Resolution is as follows: The Post Construction Hardware Validation Program, PCHVP, is identifying cable tray clamp combinations using Procedure FVM-CS-001, 003 and 100. Clamp combinations not in compliance with the design requirements are being replaced with an acceptable clamp combination.

MR. MUFFETT: The next issue is B8, which is SDAR-CP-87-59, which will be presented by Gavin Winship.

MR. WINSHIP: This issue concerns the improper application of construction aids.

Certain adjustable cable tray fittings, intended only to aid in the alignment of tray segments during installation, were installed in permanent components without evaluation of their structural adequacy.

The resolution: That adjustable cable tray fittings installed as permanent components are being identified during PCHVP in accordance with Procedures FVM-CS-019, 048 and 084. Fittings which do not comply with design requirements will be modified or replaced.

MR. MUFFETT: The next issue is B9, which is SDAR-CP-87-76, which will also be presented by Gavin Winship.

MR. WINSHIP: This issue is field-drilled cable tray holes. The issue was that field-drilled holes used to install splice plates resulted in unused holes in cable trays and splice plates. The issue was that these unused holes were not considered in tray and splice plate design.

The resolution was as follows: Unused holes in cable trays and splice plates are being identified during the Post Construction Hardware Validation Program, PCHVP, using Procedures FVM-CS-048 and FVM-CS-019. Unused holes that do not comply with design criteria will be repaired.

MR. MUFFETT: That covers Appendix A and Appendix B issues that we had.

MR. NACE: I think at this time, Mrs. Ellis, consistent with your earlier remarks, if you desire we can break for lunch and Mark can collect his thoughts. If that's your desire, then I might ask you what time you suggest we reconvene.

MRS. ELLIS: How about 12:30?

MR. NACE: The meeting is recessed until 1:00 p.m.

(A lunch break was taken.)

MR. NACE: The meeting will come back to order. At this time we'll proceed directly into the conduit and conduit support project status reports and subjects.

Jim?

MR. MUFFETT: Before we get into the individual

issues, I'd like to put up a few slides that talk about the program in general. We've put these up before for piping and the cable trays at the inception of that meeting, but, Mark, I don't think you've seen us walk through the overall program. So I think it would be a good chance to talk about that for conduits.

The first thing I'd look to go into in talking about this program is the scope of the Corrective Action Program in this area. It deals with Unit 1 and common Seismic Category 1 Trains A, B conduits and conduit supports and Seismic Category 2 conduits and conduit supports for Train C which are larger than two inch in diameter. These have all been design validated. We'll talk about the Train C less than two inch in diameter at the conclusion of this presentation -- at the conclusion of these conduit issues.

The primary features of the Corrective Action Program are the establishment of conduit and conduit support design criteria which comply with the CPSES licensing commitments, resolution of design and hardware-related issues for the CPSES conduits and conduit supports, development of the design basis document, implementation of design and hardware validation, including identification and implementation of necessary modifications, and compilation of validated design documentation to form the basis for configuration control.

To expand a little bit on some of the topics I

touched on briefly, all the licensing commitments were identified. These were found in the FSAR, the NRC Reg Guide, I&E Bulletins and the applicable codes and standards.

Design validation criteria and procedures were established. Engineering studies were performed, and component testing was performed. Unistrut material was tested. Static, cyclic and dynamic clamp tests were performed, and static conduit threaded fitting tests.

Another feature of the program was to provide assurance that all external source concerns have been resolved. There's been extensive review by the CPRT Third Party, which is being performed by TENERA, and this is documented in the DAP Results Report, Civil/Structural Train A and B conduit supports which is DAP Results Report C/S-002.

Design validation was performed. This dealt with the collection of as-built data for each conduit and conduit support.

Design validation of each as-built conduit and conduit support, and the above includes the junction boxes and the junction box supports.

Implementing necessary hardware modifications.

And the final step is complete final reconciliation process. That has the implementation of the Post Construction Hardware Validation Program, the incorporation of the results, the closure of all open items from all of the reviewers, and a

compilation of the Design Validation Packages.

The next slide is a flow chart talking about the design validation process. And this outlines the steps that I have just spoken about before in a logical fashion.

Do you have any questions?

MR. WALSH: No.

MR. MUFFETT: In the morning we were moving along rather quickly, and I may have forgotten to ask you if you had any questions. Just feel free to break in any time.

16 The first issue we have in conduits is Issue 1, and this is going to be presented by Frank Hettinger. As you see, I have two new gentlemen here with me, Frank Hettinger and Enver Odar from EBASCO, who have been dealing in the conduit program. So we have changed teams except for me.

MR. HETTINGER: Good afternoon, everyone. I would very briefly like to introduce myself. My name is Frank Hettinger. I'm a structural civil engineer with 19 years experience. Fourteen of those years have been with EBASCO Services, during which I've participated in design and analysis for structures for 10 nuclear power plants. I've been working on Comanche Peak for three years now, and I'm currently supervising engineer responsible for engineering activities on Comanche Peak. I'm a member of the Society of Civil Engineers and I am a registerea professional engineer.

The first issue is related to the governing load case

for design. The issue is that the original design may not have properly considered both OBE and SSE load combinations by assuming that a 60-percent increase in allowables for SSE was applicable to all conduits, conduit supports and their components.

This issue was resolved as follows: Conduits, conduit supports and their components are design validated for the OBE and SSE load combinations separately utilizing OBE and SSE allowables respectively. The criteria used for each component is described in Design Validation Procedures SAG.CP10 for conduits and their supports, and SAG.CP17 for junction boxes.

MR. WALSH: This covers the structural steel members as well as the anchor bolts and catalog items?

MR. HETTINGER: Yes. It covers all components.

MR. MUFFETT: The next issue is A2, which Frank is also going to present.

MR. HETTINGER: This issue is related to dynamic amplification factors. The FSAR allows use of a dynamic amplification factor less than 1.5 only if justification is provided.

The particular issue is that in the original design a dynamic amplification factor of 1.0 times the response spectra peak accelerations was used without proper justification.

This issue was resolved as follows: Design

Validation Procedures SAG.CP10, CP17, CP20 and CP25 specify use of any of the following methods to account for dynamic amplification effects in conduit system design validation. All these methods comply with FSAR commitments.

One method is the equivalent static in which 1.5 times response spectra peak accelerations are used independent of conduit system frequency.

Second: In the equivalent static method when determination of conduit system frequency is made, design accelerations justified by dynamic response spectra analysis are used. Dynamic amplification factors are inherently included in these design accelerations.

Third: When dynamic response spectra analysis of specific conduit systems is used, dynamic amplification factors are inherently included in the analysis.

MR. WALSH: Just for my own clarification, I guess. When you analyzed the conduit system, are you referring to the conduit as one item and the supports as a different item, or did you model support stiffness in?

MR. HETTINGER: No. The terminology, conduit system, is the system of the conduit and the supports which support that conduit.

MR. WALSH: Did you perform the analysis where you did not model in the support but just modeled a conduit or --

MR. HETTINGER: In the second method, which is the

equivalent static method, the system effect is considered by the nature of the design accelerations. The loads imposed on the conduit support are imposed independent of modeling the conduit itself in that model, but the system effect is considered.

MR. MUFFETT: Any more questions?

MR. WALSH: No.

MR. HETTINGER: The next one is A3.

The issue was that in the original design the load due to deadweight was incorrectly combined with the seismic loads using the SRSS method. SRSS means square root sum of the squares.

Issue resolution: Deadweight is not included within the SRSS of seismic loads but is added separately to the resultant seismic loads in the load combinations specified in the Design Validation Procedures SAG.CP10 and SAG.CP17.

MR. MUFFETT: The next one we'd like to present is issue 4, and Enver Odar is going to present this.

MR. ODAR: Good afternoon. I introduced myself during our December meeting; however, my name is Enver Odar. I'm the project engineering manager for EBASCO on Comanche Peak and I'm located at the site. I've been with EBASCO since 1965; the only difference, last time it was 22 years and this time it is 23. And I have worked on 17 nuclear plants that EBASCO had A&E responsibility for, both here and

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abroad, including plants in high seismic areas such as Japan, Mexico and Taiwan. I'm a member of the American Society of Civil Engineers, Seismological Society of America, and I am a registered professional engineer in three states.

The issue is measurement of embedment from top of concrete floor topping.

Note 5A on the original Drawing Number 2323-S-0910 SH. G-4A allowed the two-inch thick concrete floor topping to be considered in determining embedment length of anchors at building elevations 832 feet 6 inches and below.

Since the topping integrity cannot be assured, the effect of reduced embedment must be considered.

This issue was resolved as follows: The floor where supports with Hilti-Kwik bolts are mounted were reviewed against the list of floors which have architectural topping during the design validation effort. Design validation for such supports on floors with topping considered a two-inch reduction of bolt embedment length as specified in Design Validation Procedure SAG.CP10. Anchor bolts embedded only in concrete topping and those that do not meet the anchor bolt acceptance criteria are being replaced. In addition, we've revised Note 5A accordingly.

The next issue is bolt hole tolerances and edge distances, which we discussed to some extent in cable trays earlier. This was an issue on bolt hole tolerances and edge

distances.

The external source issue on this was in two parts. The first part of the issue was that on the original Drawing Number 2323-S-0910, on Sheet G-1B, Note 15 allowed bolt hole tolerances which vary with the bolt size and are larger than the AISC one-sixteenth inch tolerance. This tolerance may have resulted in oversized bolt holes.

This issue was resolved as follows: For steel to concrete connections, AISC bolt hole requirements are not applicable. This was covered in an AISC letter to Mr. Nace dated August 29, '86. The effects of bolt hole sizes allowed by the original Drawing Number 2323-S-0910 package were evaluated through analytical studies. These are shown in EBASCO Position Paper, "Effect of Bolt Hole Oversize in CTH System and Conduit System Adequacy". It was concluded that the steel to concrete connections with the existing bolt holes are adequate.

For clamp connections which include cold-formed components, the AISI code is applicable. Clamp capacities were determined from tests as recommended by the AISI code, and the tests were performed in the CCL facilities. Those procedures and test results are documented in CCL Report Number A-699-85 and A-702-86.

For connections between structural steel members, the AISC code governed, and to ensure compliance with AISC code

appropriate corrective action is being taken in our Post Construction Hardware Validation Program.

MRS. ELLIS: These may very well be in one of our stacks. If they are, just let me know. The AISC letter dated August 29, '86, and the EBASCO position paper which --

MR. NACE: I believe that you do have a copy of the AISC letter to me. I believe that was sent last time, as well as the position paper. However, the same thing we talked about in the cable tray hanger meeting. We are checking to make sure you have the latest references in there, and if there is one or more, they will be provided at the progress meeting, the second truck.

MR. MUFFETT: Just for completeness, that is the same letter that we referenced last time on the cable tray hangers that we brought up with Jack.

MR. ODAR: The second part of the issue was that some original designs may not have provided the minimum edge distance as stated in the AISC code. For example, CA-5A and CSM-42 type supports have three-quarter-inch edge distance in concrete to steel connection members versus 25/32 inch based on the code, i.e., 1/32 inch difference.

This issue was resolved as follows: Edge distances in structural steel to structural steel connections contained in the revised Drawing Number 2323-S-0910 have been design validated in accordance with AISC requirements.

Baseplate edge distances in steel to concrete anchorages were design validated in conformance with AISC code. Cases where edge distance values were outside of the AISC manual table values were validated based on acceptable bearing stress calculations.

For clamp connections which include cold-formed components, the AISI code is applicable. Clamps with reduced edge distance due to hole size were tested as recommended by AISI code to determine clamp capacities used in the design validation. The results of these tests are summarized in CCL Report Number A-699-85 and A-702-86.

18 The next issue was on the FSAR load combinations. The external source issue on this was that all applicable loads as defined in CPSES FSAR Section 3.8.4.3.3 may not have been explicitly considered in the original design. Specifically, loads due to pipe whip and jet impingement were not addressed. Also, seismic response spectra which envelope the containment building shell and internal structure response spectra should have been used for conduit and conduit supports which are supported by both the containment building shell and the internal structure.

This issue was resolved as follows: Design Validation Procedures SAG.CP10 and SAG.CP17 specify all applicable loads and load combinations to be considered in the design validation, and these are based on FSAR Section

3.8.4.3.3.

Safety-related conduits and conduit supports have either been relocated or shielded from pipe whip, jet impingement and internally generated missile effect.

Safety related conduits located outdoors have been shown to require no protection from tornado effects.

Thermal effects were considered as specified in Design Validation Procedures SAG.CP21 and SAG.CP25.

Seismic response spectra which envelope the containment building shell and internal structure response spectra were used for validation of conduits and conduit supports which are supported by both the containment building shell and the internal structure. And this is specified in Design Validation Procedure SAG.CP25.

MR. WALSH: For the conduits that are on the outside, are they protected from missiles, tornadoes or --

MR. ODAR: No, they are not required to be protected from tornado-related effects which is missiles as well as high winds, because these safetey-related conduits are required to remain functional for a specific LOCA event, and I believe they are associated with feed water isolation valve operation. Since tornado and LOCA are not postulated simultaneously, they would perform their function for LOCA, but they don't have to remain functional under tornado effects.

MR. MUFFETT: The next issue is issue 7. The issue

was that the self-weight of the support was not uniformly considered in the original design for conduit supports.

The resolution is that the Design Validation Procedures SAG.CP10 and 17 specified that self-weight be explicitly and consistently included in design validation of all conduit supports.

The next issue is issue 8, which Enver Odar is going to present.

MR. ODAR: This issue is on torsion of unistrut members, and it has two parts.

The first external source issue was that torsional loading on unistrut members was not considered in the support design.

This issue was resolved by the fact that the torsional effects have been considered in design validation. Tests, as summarized in CCL Report Number A-678-85, were performed by CCL, which included the torsional load effect on unistrut members and the support.

The results of the test were used to establish allowable capacities for supports which do utilize unistrut members.

The second part of the issue was on the tests that were performed, and they included: The following additional issues resulted from CYGNA's review of the CCL test procedures and test results.

The conduit support types selected for testing may not represent all support types installed at CPSES. Also, test results for some conduit supports may have been affected by improper test set-up.

In addition, only one conduit clamp type, which was C-708-S, for large conduit sizes was included in most of these tests.

The second part of this issue was resolved as follows: The conduit support test set-up and results reported in CCL Report A-678-85 were reviewed and conduit clamp and support capacities were developed as follows:

Only unistrut configurations which were unaffected by the test set-up are employed at CPSES. Configurations which were not tested or were unsatisfactory were replaced. The allowable load capacitiess for the unistrut supports at CPSES were determined utilizing the test results. These allowable load capacities are shown on the Revised Drawing 2323-S-0910 package.

In addition, conduit clamp capacities for all clamp types used in CPSES conduit supports were established by tests. These results are reported in CCL Report Numbers A-699-85 and A-702-86, and they are incorporated in Design Validation Procedure SAG.CP10.

To illustrate the type of supports that were tested, we have added a graphic sketch of a test set-up with conduit,

unistruts and unistrut components that were tested.

MR. WALSH: The new allowables or the allowables that
are currently used, did it take into account the flexibility
of the connections and connect with the displacements, the
19 flexibility of the stiffness of the unistrut also utilized?

MR. ODAR: Yes. The test -- whatever a test came up with formed the basis for the allowables that were used. That includes flexibility, interaction of components, everything. We have tests for that specific hanger as utilized at CPSES. As I mentioned, those that were not covered by acceptance testing or those that were not the usual results were actually replaced. We were only left with specific ones for which we had specific tests.

The next issue is on the use of catalog components. The external source issue on this was that the original design was based on the application of AISC to unistrut catalog components which may not be conservative. AISI should have been used.

And also that the following components were used in ways not recommended by the vendor: These included unistrut components; clamps, both unistrut and superstrut; and anchorages, which includes Hilti-Kwik bolt and Richmond inserts; as well as Nelson studs.

The above issues were resolved by the fact that all components employed in the conduit supports are either in

compliance with the vendor allowables or allowables have been determined by tests as recommended by the AISI code.

MR. MUFFETT: Any questions?

MR. WALSH: No.

MR. MUFFETT: The next issue is A10, and Frank will present this issue.

MR. HETTINGER: This issue is related to anchor bolts and has four subissues.

The first subissue is that prying action effects on anchor bolt tension may not have been uniformly considered in the original design.

This issue was resolved as follows: Prying action effects are included in design validation for all base member anchorages. Requirements are specified in Design Validation Procedures SAG.CP10, CP17 and CP29.

The second subissue related to anchor bolts is that for conduit support CST-17, Type 17, the original design does not consider moments induced in the anchor bolt due to shear forces applied above the concrete surface.

This issue was resolved as follows: Moments induced in the anchor bolts due to shear forces applied above the concrete surface are considered in design validation of all multidirectional supports, as specified in SAG.CP10 and CP29. The CST-17 type supports in this particular issue are transverse-type supports, all of which are either being

eliminated or replaced by multidirectional type supports.

The third subissue is that outrigger Hilti-Kwik bolts for the original CA-2A supports were assumed not to take any load. However, some load may be imposed due to conduit loads and prestressing of the support. The outrigger Hilti-Kwik bolts may not be adequa in resisting these loads since the design drawing waives separation violations between Hilti-Kwik bolts and the outriggers and any other bolts.

This issue was resolved as follows: The CA-2A type unistrut support was tested without Hilti-Kwik bolts on the outriggers. These tests are documented in CCL Test Report Number A-678-85. Therefore, these Hilti-Kwik bolts are not required in order to achieve the support capacity. Validation of other supports which do not comply with separation criteria will be performed as part of the Post Construction Hardware Validation Program.

The next slide simply illustrates a typical CA-2A type support and the arrangement of the conduit, clamps and outrigger.

The fourth subissue related to anchor bolts is that the original Drawing Number 2323-S-0910, Sheet G-4A, allowed substitution of Richmond inserts for Hilti-Kwik bolts. This substitution may have resulted in lower bolt/insert capacities than the original design because Richmond inserts in cluster arrangements may have lower capacities.

This issue was resolved as follows: Revised Drawing Number 2323-S-0910, Sheet G-4A, no longer permits this substitution of Richmond inserts for Hilti-Kwik bolts. As part of the engineering walkdown performed in accordance with CPE-EB-FVM-CS-033, all supports have been individually as-built including concrete anchorage type and arrangement. And the as-built configurations have been design validated in accordance with Design Validation Procedures SAG.CP10 and CP29.

MR. MUFFETT: Are there any questions?

MR. WALSH: No.

MR. MUFFETT: The next issue is issue 11.

The external source issue was that longitudinal loads may not have been considered in the original design of some transverse supports.

The resolution is that all loading directions are evaluated in design validation of conduit supports. All previous transverse-only supports have either been converted to multidirectional supports or replaced.

Any questions?

MR. WALSH: No.

MR. MUFFETT: The next issue is 12, and Frank will present this.

MR. HETTINGER: This issue is related to Hilti-Kwik bolt substitutions.

20 The issue is that Note 4 on Sheet G-4A of original Drawing Number 2323-S-0910 allowed substitution of Hilti-Kwik bolts with larger size Hilti-Kwik bolts. A situation may occur where the substituted bolts have a lower capacity than the bolts in the original design.

This issue was resolved as follows: Drawing Number 2323-S-0910, Sheet G-4A, was revised to delete Note 4. These bolt substitutions are no longer allowed.

The size and type of anchorage bolts were identified as part of an engineering walkdown performed in accordance with Procedure CP-EB-FVM-CS-033. As-built configurations, including bolt substitutions, were evaluated on a case-by-case basis utilizing Design Validation Procedure SAG.CP10.

MR. WALSH: I certainly have a generic question that goes with some of these other ones. In this particular one they specify a particular drawing, a particular note. Have the other drawings gone back to see if they had that similar note?

MR. MUFFETT: That's a really good question. I'm glad you asked that because we should clarify that. When they say Drawing Number 2323-S-0910 that's kind of a misnomer, because it is actually a package of a lot of drawings that has drawings of conduit supports and conduit runs. And there was only one note like this in that package. And it really does not look like a drawing, what you think of a drawing. It's

actually a stack of drawings, 20,000 drawings or something like that. That's what -- oftentimes when they mention it, you will see it says Drawing 2323-S-0910 package, that was the note that was like in this regard in that package.

MR. WALSH: That would cover all conduit supports..

MR. MUFFETT: Yes.

MR. NACE: We'll take a 10-minute recess.

(A break was taken.)

MR. NACE: The meeting will come back to order.

Jim?

MR. MUFFETT: This morning we had some questions about the NUREG, and just as a matter of clarification I'd like to go over this again for your clarification and for the record. The requirements for the design of other Category 1 structures which are requirements which govern the design of cable trays, conduits and HVAC supports, are presented in Section 3.8.4 of the FSAR. These requirements are consistent with those found in U.S. NRC Standard Review Plan, NUREG 0800.

This section of the Comanche Peak FSAR was revised in 1978. This revision provided complete consistency with the Standard Review Plan. In response to questions from the NRC, TU Electric has formally confirmed consistency of design covered by this section of the FSAR which includes the Standard Review Plan design guidelines. The NUREG 0800 is not explicity referenced in the FSAR, but we have done a check and

they are totally consistent in this area with them.

MR. NACE: I think one of the reasons we sounded confused on your question this morning, the NUREG 0800 Standard Review Plan, we don't see that as something that a licensee commits to. We see that as direction to the staff reviewers as to how they should review an application. Therefore, we don't reference it in the FSAR; however, the contents of the FSAR in this case are consistent with what the reviewer is looking for. I hope we're clear on that.

MR. WALSH: Yeah.

MR. MUFFETT: The next issue which we'd like to present is 13, which Frank will present.

MR. HETTINGER: This issue is related to the substitution of small conduits on CA-type supports.

The issue is that CA-type support drawings allowed substitution of smaller conduits for larger conduits. Since CA-type supports were designed using ZPA values for large size conduits and smaller conduit sizes were designed for peak accelerations, this substitution may result in larger loads than reflected in the original calculations.

The issue was resolved as follows: Design Validation Procedure SAG.CP10 specifies that CA-type supports shall be design validated based on design acceleration which bound all conduit sizes.

The next slide pictorially illustrates a conduit

supported by CA-type supports, and goes into a little detail on what the original design considered and what the present design considered. For large size conduits where the conduit span is rigid, the CA-type supports were designed for ZPA in the original design, and smaller size conduits where your conduit span is flexible, the supports were designed for peak accelerations.

In the present design the conduit span is assumed to be flexible for all conduit sizes, and CA-type supports are design validated for design accelerations which bound all conduit sizes.

The next issue is issue 14. This issue is related to the use of CA-type supports in flexible spans.

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The issue is that CA-type supports for conduit with diameter equal to or greater than two inches were designed for ZPA. The original calculations did not consider the fact that seismic accelerations of the CA support may be affected by the flexibility of the conduit span.

This issue was resolved as follows: ZPA is not used for design validation of CA-type supports. The Design Validation Procedure SAG.CP10 specifies that all CA-type supports are to be design validated based on design accelerations which include the flexibility effect of the spans.

MR. MUFFETT: Are there any questions?

MR. WALSH: No.

MR. MUFFETT: The next issue is 15, but before we go on, just for the record, ZPA is zero period acceleration. It has to do with the acceleration of a certain place in the response spectra curve.

The issue was that Sheet CSD-16 of Drawing S-0910 package allows conduit to be attached to a cable tray. In the original design, cable tray may have been designed without additional conduit load. In addition, ZPA should not be used to compute conduit load since the cable tray may be flexible.

The resolution: Design Validation Procedure SAG.CP10 specifies that the conduit and its connection to the cable tray are to be design validated for 1.5 times the response spectra peak acceleration. Deadweight for both the rigid and maximum flexible conduit allowed in Sheet CSD-16 of Drawing Number 2323-S-0910 package were included in the design validation of the conduit. In accordance with cable tray walkdown procedure CPE-EB-FVM-048, such configurations are being identified and evaluated in the cable tray Post Construction Hardware Validation Program. See external source issue number 32 for cable tray and cable tray hangers.

The next page is just an illustration of the cable tray with conduit attached.

Are there any questions?

MRS. ELLIS: (Shakes head)

MR. MUFFETT: The next issue is 16. The issue was that allowable conduit lengths were increased in the original calculations based on changes in the response spectra. The effect of this change on conduit stress levels was not appropriately evaluated.

Spans of this type, LA spans, have been deleted from revised Drawing Number 2323-S-0910 package. Design Validation Procedure SAG.CP10, CP20 and CP25 require that conduit stresses be evaluated for actual span lengths.

The next issue we'd like to present is 17, and Enver will present this one.

MR. ODAR: This issue was on substitution of next heavier structural member support.

The issue on this was that Note 5 on Sheet G-1A of the original Drawing 2323-S-0910 package allowed the substitution of the next heavier structural member. Documentation of this substitution in the original design was inadequate and self-weight of the support was not properly considered.

This issue was resolved as follows: Note 5 which allowed substitution of the next heavier structural member was deleted from Sheet G-1A of the revised Drawing 2323-S0910 package.

Member sizes were identified during engineering walkdown per Procedure CPE-EB-FVM-CS-033. For open section

members the actual section thickness was recorded for the design validation. For single cantilever type and L-shaped cantilever type supports which utilized tube steel members, an engineering study, which was reported in EBASCO Calculation Book Number SUPT-0247 and SPAN-1189, was performed to evaluate the effect of substitution of the next heavier member on the support capacities.

The results of this engineering study are being incorporated into the Design Validation Procedure SAG.CP25 for the design validation of such supports.

Other supports utilizing tube steel sections were conservatively evaluated in accordance with the Design Validation Procedure SAG.CP25 utilizing the weight of the next heavier member and the smaller section of properties of the as-designed member shown on the drawings.

The next issue is A18 and it's on clamp usage. The external source issue is that the original design allowed alteration of clamp assembly components. These alterations may have created a minimum edge distance violation and distortion during installation. Justification is required for omission, alteration or distortion of washers, reaming of clamp holes and cutting off a portion of the clamp ears.

This issue was resolved by the fact that the clamp test program performed by CCL and reported in CCL Report Numbers A-699-85 and A-702-86 utilized three directional

loading and considered reaming of the clamp holes; clamp edge distances; bolt type and size; omission, alteration or distortion of washers; clamp distortion; and clamp modification which was resolved by cutting off a portion of the clamp ear.

The clamp allowables are based on the above tests, and these are incorporated in the Design Validation Procedure SAG.CP10.

In addition, we reviewed and identified revisions required to the installation specs, construction procedures and quality control inspection procedures to preclude unauthorized modification to clamp and clamp assembly components.

MR. WALSH: I have a question. On this test for the allowables, what did you utilize as a factor of safety for the load on the test?

MR. ODAR: Perhaps I will come back a little bit and explain that we had two sets of tests. One set was a static test, conventional. The second very punishing test was piston driven, typical for the load; goes with the conduit itself, in other words. Very, very punishing, I guess, is a good word for conduit clamps.

The results of the tests were then reduced to establish allowable capacities. The exact number of factor of safety I will have to give you during the break or confer with

my associates on this. It is consistent or higher than normal factor of safety.

MR. WALSH: I'm just curious. Did the allowables go down or up after the test?

MR. ODAR: From where?

MR. WALSH: For the clamps. Based on what was originally there.

MR. ODAR: Originally -- how far originally?

MR. WALSH: Gibbs and Hill.

MR. ODAR: Conventional way of testing clamps is applying one load in one direction and the other load in the other direction, and not too many people really worry about the actual direction. In our case we established both for each of the three directions, statically as well as dynamically. The loads -- again, I'll confirm. Numerical values I don't have.

MR. WALSH: I was just wondering about the factor of safety that you're utilizing.

MR. ODAR: That the allowable loads are extremely conservative in my opinion. The actual numerical values we'll get for you.

The next issue is issue 19, and it deals with documentation deviations between inspection reports, CMCs and IN-FP drawings.

The external source issue was that differencers were

identified between some final conduit line inspection reports and the corresponding component modification cards, CMCs, and/or individually engineered fire protected conduit system, IN-FP, drawings. Additionally, differences were identified between the final IRs and the installed conduit configurations.

This issue was resolved as follows: An engineering walkdown in accordance with CPE-EB-FVM-CS-033 of conduits and conduit supports was performed to determine the as-built configurations. Design validation of the conduit and conduit supports was performed in accordance with Design Validation Procedure SAG.C[illegible], CP17, CP25 and CP29, and revised Drawing Number 2323-S-0[illegible]0 package utilizing the as-built data.

Each of the documentation and conduit configuration discrepancies identified under this issue were individually evaluated. A determination was made that there is no safety significance with any of the identified deviations.

The next issue is A20. The external source issue on this was that the original calculations to qualify Nelson studs used in conduit connections details may not account for the flexibility of clamp and shim plate, relaxation of preload and additional moment on the stud. Also, an analysis of the shim plate subjected to pretension loads in the Nelson studs may not be adequate.

This issue was resolved as follows: The allowable

capacities for clamps using Nelson studs have been established based on CCL tests, reported in CCL Report Number A-699-85 and A-702-86. These tests took into account the flexibility of the clamp and shim plates, relaxation and additional moment on the stud. There also was some detail covered in issue 18 when we were talking about the test.

These allowable clamp capacities were incorporated in the Design Validation Procedure SAG.CP10.

In addition, the adequacy of shim plate configurations subjected to pretension loads in the Nelson studs was confirmed by engineering studies, and these are reported in EBASCO Calculation Book Numbers 44 and SPAN-1191.

MR. MUFFETT: Any questions?

MR. WALSH: No.

MR. ODAR: The next issue is A21, and it's on conduit fire protection calculations.

The external source issue on this was that the original design considered a round configuration of thermolag material around conduits. A square configuration of thermolag material is also used at CPSES. Documentation of the specific configuration installed was not maintained.

And also that the original calculations used support capacities which may not be applicable to the specific configuration.

The resolution of the subissues within this issue

were as follows: The thermolag conduit systems were as-built and the actual thermolag configurations were documented. Design validation of thermolag systems was performed using support capacities contained in the revised 2323-S-0910 drawing package and the as-designed support configurations. The as-designed support configurations are being confirmed as part of the Post Construction Hardware Validation Program.

In addition, this particular issue may be inapplicable due to the fact that the thermolag, all thermolag, on the plant is being removed because of other considerations. And when placed back obviously will be properly controlled and design validated accordingly.

MR. WALSH: I have no questions.

MR. MUFFETT: The next issue is issue 22. The issue was that the original design used the conduit yield stress data from the vendor's tests in which the yield stress value varies with conduit nominal size. This is not considered to be appropriate. In addition, the original design used a dynamic amplification factor of 1.0 in the calculations.

Resolution: Design Validation Procedure SAG.CP10 specified that the conduit yield stress shall be 25,000 pounds per square inch for all conduit sizes, which is the lowest yield stress for any conduit used at CPSES.

In addition, the fire protected conduit systems were design validated utilizing the response spectra analysis

method which inherently incorporates dynamic amplification effects.

Any questions?

MR. WALSH: No.

MR. MUFFETT: The next issue is issue 23, which Frank will present.

MR. HETTINGER: This issue is related to grouted penetrations. The issue is that in the original design all grouted penetrations were considered to be multidirectional supports. The longitudinal load capacity parallel to the conduit for grouted penetrations may not have been completely addressed in the original design calculations.

This issue was resolved as follows: Design Validation Procedure SAG.CP10 provides design criteria and allowable bond stress between the conduit and concrete walls or slabs for conduit penetrations. This criteria is used for determination of the longitudinal load capacity for grouted penetrations.

MR. MUFFETT: Any questions?

MR. WALSH: (Shakes head.)

MR. HETTINGER: The next issue is issue 24. This issue was related to the rigidity of CA-type supports. The issue is that in the original design, CA-type supports were assumed to be rigid, that is, having support frequency equal to or greater than 33 Hz. This assumption was not validated

in the original design calculations.

This issue was resolved as follows: CA-type supports were not assumed to be rigid in the design validation. Frequencies for such supports were calculated in accordance with Design Validation Procedures SAG.CP10, 25 and 29.

MR. WALSH: I have a question. Do you have conduit supports that are attached to the pipe supports?

MR. KLAUSE: My name is Ron Klause. I'm the project manager for the pipe stress/pipe support section.

There have been some pipe supports that have cable tray conduit connected to those. Those have been controlled through interface procedures between the pipe stress group and the cable tray conduit group for inclusion in the validation of its design.

MR. WALSH: What did they use for the dynamic amplification factor when they were attached to the pipe supports? Did they include the pipe support conduit, or did they just -- did you use the 1.5 factor?

MR. ODAR: Let me also add that during the engineering walkdown in 033, one of the requirements was to identify what the conduits are attached to so we know exactly to what other commodities they are attached. The loads are then provided to the owners of that commodity, and that's how we have that close interface.

In cases of attachment to pipe supports, we had used

one and a half times peak G to conservatively cover whatever frequency requirements may have been on the supports.

MR. HETTINGER: The next issue is issue 25. This issue is related to enveloping configurations for design. The issue is that the original generic support design did not consider the most critical support configurations; that is, maximum load eccentricities, installation tolerances, member substitution, bolt substitutions, weight of support member components, and overhang portion of support members.

This issue was resolved as follows: Design validation of generic supports shown in the revised Drawing Number 2323-S-0910 package was performed to establish generic support capacities. This validation included maximum load eccentricities; allowed installation tolerances; member substitutions, as discussed in external source issue number 17; bolt substitutions, as previously discussed in external source issue number 12; weight of support member components; and overhang portion of support members.

MR. HETTINGER: Any questions?

MR. WALSH: No.

MR. MUFFETT: The next issue is issue 26, which will be presented by Enver.

MR. ODAR: This issue was on the original design drawing discrepancies. The external source issue was that certain discrepancies and inconsistencies may exist between

the original design drawings for generic, modified and individually engineered IN supports, and original calculations, including missing information such as base plate size, clamp type and edge distances.

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This issue was resolved as follows: An engineering walkdown in accordance with Procedure CPE-EB-FVM-CS-033 was performed to provide as-built information for conduit support configurations. Drawing Number 2323-S-0910 package which contains generic modified and IN supports was revised to incorporate the as-built data. The as-built support configurations were design validated in accordance with Design Validation Procedures SAG.CP10, CP25 and CP29.

The next issue is on walkdown discrepancies, and these walkdown discrepancies are CYGNA's walkdown as was performed by them.

The external source issue on this consisted of a number of specific issues in that conduit support discrepancies existed between the installed clamps, anchor bolts, structural steel members, and unistrut components and the corresponding original design drawings. In addition, some commodity clearances and anchor bolt spacings were not in accordance with the design criteria.

The issues identified by the external source walkdown were resolved as follows: Conduit and conduit supports were as-built as part of the engineering walkdown utilizing

requirements of the CPE-EB-FVM-CS-033. The as-built configurations were documented in the Drawing 2323-S-0910 package and design validated in accordance with Design Validation Procedures SAG.CP10, SAG.CP17, CP25 and CP29.

Commodity clearances and anchor bolt spacings are being validated as part of the Post Construction Hardware Validation Program.

Any questions?

MR. WALSH: (Shakes head.)

MR. ODAR: The next issue is issue 28, and it deals with systems concept. The external source issue on this was that in the original design of two-bolt concrete surface mounted supports, the acceptability of the support was established by assuming that the moment generated by the eccentrically applied longitudinal load would not be resisted by the support. This moment would be balanced by a load couple consisting of forces generated at the support of interest and the next support. Possible differences in support and conduit stiffnesses were not considered. Applicability of these calculations to other supports was not demonstrated.

This issue was resolved as follows: Design Validation Procedures SAG.CP10 and SAG.CP29 require that load eccentricity effects be included in the design validation of all conduit supports.

Two-bolt concrete surface mounted supports have been design validated by considering that the moments induced by eccentrically applied longitudinal loads are shared between the support and the conduit in accordance with the stiffness of the system components.

We felt that this probably requires a picture to explain further what I am saying. To illustrate this, we made a simple chart. When the load is applied longitudinally on the conduit along the length or access of the conduit, there will be a moment generated due to eccentricities involved.

On the left side is the description of what I tried to verbally explain, which is that the moment equal to E times P will result in a couple by dividing it by distance L between two supports, and then the supports were checked for two loads only. What we're doing is essentially analogous to moment distribution in that we are considering the stiffness of the anchorage as well as stiffness of the conduit and considering that moment acting on the embedment, as well as the couple effect which is relatively or insignificantly small. When you have long L and small eccentricity, the loads are relatively small.

Any questions on system concept?

MR. WALSH: (Shakes head.)

MR. ODAR: Next I will go into the 30 issue, which is on conduit unions in the conduit installation.

MR. MUFFETT: We switched. Everyone is looking puzzled. That was 28. We're going to do 30 next and do 29 as a logical conclusion, which is cumulative effects.

MR. ODAR: The external source issue was that the conduits which are joined together by unions which are loose could result in two ends of conduit becoming free during vibration. The structural continuity of the conduit could then be affected and the cable housed therein may be subject to loads not considered in design.

This issue has been resolved by the specific union tightness verification requirements incorporated into the construction/installation and quality control inspection procedures. This verification is part of our Post Construction Hardware Validation Program.

Any questions on this?

MR. WALSH: No.

MR. MUFFETT: The next issue is issue 29. This issue has to do with the cumulative effect of the review issues. Small unconservatisms resulting from separate issues previously mentioned may have significant cumulative effect on supports impacted by more than one issue.

There is no cumulative unconservative effect with the designs now because the overall design validation approach has addressed each issue, both individually and collectively.

Design validation was based on the as-built data.

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Design Validation Procedures SAG.CP10, 17, 21, 25 and 29 provide control of the design process.

All final designs are in conformance with the applicable codes.

Are there any questions?

MR. WALSH: (Shakes head.)

MR. MUFFETT: Now we will shift gears again here and move over to the B issues, which are the SDAR issues for this discipline.

The first one is B1, which is SDAR CP-85-19. This issue should look familiar. We talked about it a few moments ago.

The issue was the original design used the conduit yield stress data from vendor's tests in which the yield test varied with the conduit nominal size. This is not considered to be appropriate.

Design Validation Procedure SAG.CP10 specifies that the conduit yield stress shall be 25,000 pounds per square inch for all conduit sizes, which is the lowest yield stress for any conduit used at CPSES.

The next issue is B2, which is SDAR CP-85-31, the electrical raceway support system.

The issue was that separation barrier material and radiant energy shield material were installed in Class 1E conduit in order to meet the FSAR and Reg Guide 1.75

electrical separation criteria. However, the original design of conduit and conduit supports constructed prior to the installation of the SBM and RES did not account for the additional weight imposed.

Resolution: Conduit and conduit supports with separation barrier material and radiant energy shield material were design validated in accordance with Design Validation Procedure SAG.CP25, which included the SBM and RES weights.

In addition, the procedure governing design changes, ECE 5.01-I3, requires that when SBM or RES material is added to electrical raceways, the conduit and conduit supports discipline group be notified.

Are there any questions?

MR. WALSH: (Shakes head.)

MR. MUFFETT: The next one is B3, which is SDAR CP-85-34, which Frank will present.

MR. HETTINGER: This issue is an overall umbrella issue related to conduit support design. The issue is that discrepancies may have existed between as-built and as-designed conduit and conduit support configurations. In addition, the original design criteria may not have appropriately addressed certain design requirements. A description of these concerns is provided in subappendices A1 through A20 and A23 through A29 of the PSR.

To resolve this issue TU Electric initiated the

conduit and conduit support Corrective Action Program known as the CAP. Under the CAP, resolution of this issue was accomplished through identification of licensing commitments, establishment of design criteria, and the development of Design Validation Procedures, namely, SAG.CP10, CP17, CP20, CP21, CP25, CP29 and CP35, that include the following:

Use of as-built data as design input for conduit and conduit support validation.

Validation of conduit and conduit supports to design criteria that is in compliance with Comanche Peak licensing commitments and responsive to all Comanche Peak Response Team, CPRT, and external issues.

Testing to establish allowable load capacities and suitable methods for modification of conduit.

Engineering studies implemented to provide additional confidence in the conservatism of the design validation procedures used for conduit and conduit supports.

And lastly, implementation of hardware modifications as necessary to assure that all conduit and conduit supports comply with the validated design.

Resolution to the specific concerns have been discussed in external source issues A2 through A20 and A23 through A29.

Any questions?

MR. WALSH: (Shakes head.)

MR. HETTINGER: The next issue is issue B4 relating to SDAR CP-85-53. This issue is related to the seismic design of conduit. The issue is that a number of free-ended conduit elbows are connected to the remainder of the conduit via a threaded coupling, with no support between the coupling and the free end. The coupling does not provide torsional resistance to motions induced by seismic events.

This issue was resolved as follows: The Engineering Walkdown Procedure CCPE-EB-FVM-CS-033 requires the identification of threaded fittings in the rigid overhanging conduit. Tests as documented in CCL Report Number A-746-87 have shown that wrapping the threaded fitting and adjacent areas with fiberglass cloth impregnated with scotch cast product produces the required torsional resistance. Accordingly, all such instances are being corrected either by fiberglass cloth wrapping or by providing supports in the overhanging portion of the conduit.

MR. WALSH: This wrapping material: Has that been tested for high temperatures?

MR. MUFFETT: It's being reviewed as part of the EQ program for environmental conditions right now.

6 This is a logical breaking point for us because the next thing we're going to go into is the two-inch and less Train C non-safety-related conduits. So I think it may be an appropriate time for a break.

MR. NACE: We'll take a 10-minute recess.

(A break was taken.)

MR. NACE: The meeting will come back to order.

MR. MUFFETT: Before we go on, there is something I wanted to clarify. I didn't state it very clearly on the scotch cast. It's not a formal part of the EQ program, and it isn't going to be environmentally qualified with the environment that it has to be. And there is not any in the plant yet because we're pursuing that last thread.

The other thing that we wanted to come back to is we promised to get back to you those factors of safety.

MR. ODAR: The evaluation of CCL tests and generation of factor of safety are in our Calculation Book SPAN-1200, which we'll make available. The cyclic allowables that were established are at least a factor of safety of three compared to static. As I said, it was a very punishing test, with many, many cycles and distance applied in all three directions simultaneously.

MR. NACE: We will provide that document, three copies, in one of the next trucks.

MRS. ELLIS: Thank you.

MR. MUFFETT: Are there any questions?

With that I'd like to move on to the Train C portion, what we call Train C. This is actually only the Train C that is two inches and less in diameter. The large bore Train C is

covered under the program we just discussed.

The slide here and the issue are a little bit different, and I will get into that as we go along.

The issue was that the installation for non-safety-related conduits with two-inch diameter and less was not adequate for seismic loading. According to Reg Guide 1.29 and the CPSES FSAR, the nonseismic items should be designed in such a way that their failure would not adversely affect the function of seismic Category 1 systems, structures or components, or cause incapacitating injury to occupants of the control room.

Let me paraphrase that in layman's terms. It's not supposeed to fall down and hurt somebody.

Issue resolution: Corrective Action Program for Train C assures compliance with the licensing commitments for the support of Train C conduits and conduit supports. This Corrective Action Program assures that Train C is designed such that its failure would not adversely affect the function of seismic Category 1 systems, structures or components, or cause incapacitating injury to occupants of the control room.

Now, the next slide deals with validation methods. There are three validation methods used for this small bore Train C conduit.

Validation 1: No Interaction Potential. Validated that the Train C conduit supports if they were to collapse,

would not strike any seismic Category 1 system, structure or component. In other words, this was in an area where there was not safety-related equipment.

Validation Method 2: Acceptable Interaction. Validated that the Train C conduit support if they were to collapse, would not reduce the function of any seismic Category 1 system, structure or component.

Validation Method 3: Structural Integrity. Validated that the Train C conduit and conduit supports were evaluated and designed to prevent failure under safe shutdown earthquake conditions.

Design modifications were made when Train C could not be design validated using the three validation methods described. Three design modification methods were used.

One: Modify Support. The Train C conduit support was structurally modified to assure structural integrity, or else additional Train C conduit supports were designed to further support the conduit.

Modification Method 2: Provide Seismic Restraint Cable. Restraint cables were used to restrain the conduit and provide conduit supports if they were postulated to fail.

Modification Method 3: Reroute Conduit. The conduit was rerouted and supported by new conduit supports. The conduit and new supports were evaluated and designed to prevent failure under the safe shutdown earthquake conditions.

The design criteria requiring consideration of the effects of seismic loads on Unit 1 and common Train C and the use of the as-built data for design input have been established and documented in the Train C Design Basis Document, DBD-CS-093. These requirements are included in the Train C two-inch diameter and less conduit supports design validation procedures.

The last thing I was going to conclude with was the flow chart of the program, which was virtually identical to the one I showed you earlier for the large bore conduit.

That concludes our presentation of the Train C program.

It was a massive effort in numbers, but there were not the same type of technical issues involved.

Are there any questions?

MR. WALSH: (Shakes head.)

MR. NACE: I think I would like to point out, emphasize what Jim just said, on the Trains A, B and the Train C greater than two-inch conduit supports in Unit 1 and common areas, something like 30,000 in the plant; whereas in the
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Train C less than two inches, the final issues Jim talked about there, about 108,000 in those same areas of the plant.

That concludes what we had intended to present today on cable tray hangers and conduit supports.

MR. COUNSIL: Just as a general note, a couple of

general notes, then I will make some closing comments and turn it over to Mrs. Ellis and Mark if they would like to make any, and then back to Larry for whatever he might want to say.

I want to let everybody know, especially NRC, that the final Project Status Report was issued today and that's on heating, ventilating and air conditioning. Mrs. Ellis, you'll probably have your copies tomorrow, I hope. That's the third truck.

One other general note, too. I was informed yesterday Rev 4 of CPPP-7 will be out shortly, and I will probably give it to you early next week. There's nothing different. All it does is incorporate the project memoranda so you don't have to chase around and try so hard to look for things. So I wanted you to have that, too.

I would very much like to thank Mark for visiting with us. I know it's an imposition bringing you in from Indiana, but I do appreciate your participation with us today. And also to let you know that for tomorrow your tour at Comanche Peak, as long as you want to make it, I'm sure my people will love that. Really, as long as you want to make it it is absolutely unrestricted. We'll show you conduit, cable tray supports, modifications that are being made in those areas and anything else you may want to see, just ask. There are no limits.

Now, as I usually do at times when I've been talking

to Mrs. Ellis. I have another informal agreement with Mrs. Ellis. What we've agreed to do, because we do at these meetings present so much material in a very concise amount of time and also we do have to provide a few more calculations and books and so forth -- that's the truck Larry is talking about -- our agreement is this: If, in fact, questions are generated as a result of what we talked about today or the material that you get, if it is a small number of questions, just call my office and we will respond in writing, giving the question, our answer and/or appropriate reference back. If it's additional calcs or whatever you need, we'll provide that in addition. And the letter will not be on the service list. It will be a letter between myself and Mrs. Ellis. If it's a large number of questions, we've agreed that she would write the questions to me. I, in turn, will provide the answers to those questions, again, outside the bounds of the service list. If I've said anything wrong, please correct the record, but that is the last comment I have, other than I do hope we all get the feeling that we are trying to either narrow in or close issues. That's the whole purpose of this meeting, as well as the correspondence I just talked about.

Mrs. Ellis?

MRS. ELLIS: I think you summarized it very well. Also, there are some FSAR changes which have come out recently -- I think -- 68, I believe it is -- February 15,

which we haven't had a chance to even open yet, get out of the box. And we do want to take a look at some of those things, too, because they may help to answer some of the questions we might have had on some of these things. And there's no need taking the time now to go over things that might have been answered in some of that. And there is a tremendous amount of information, as you mentioned, in there. We've been plowing through it as best we can. Of course, the main crux of that is on Jack and Mark. I try to read some of it, but I'm not sure I understand all that I'm reading, I have to admit.

Another thing that I wanted to mention is that I still would like to see some sort of recognition officially, I might add, some sort of document at some point in time of the fact that all the cable tray issues virtually probably never would have come to light if it hadn't been for Mark. I said that, I think, at the last meeting, and I want to say it here again. We'll probably embarrass him, but I want to recognize that because it wasn't really until he looked at the CYGNA report of cable tray supports that were involved in their look that really became aware of -- we really became aware of the problems with the cable tray supports.

Another thing that I wanted to be sure to say is that, of course, we may have additional questions, as we said, but I think that again, as I said before, these are so much better circumstances to work under for the detailed technical

engineering type issues, and we really appreciate the opportunity of being able to meet in this more informal setting and have this question and answer session back and forth. We appreciate all your efforts in providing these presentations, and we know they take a lot of effort on your part. We appreciate it.

MR. WALSH: The only comment I have: I appreciate the time to inform me of what you are doing. It's a lot easier than going into the courtroom and finding out that things aren't always as you perceive.

That's about it.

MR. NACE: Just an administrative matter. For the tour tomorrow, the notice says the tour will start in the Visitor's Center for the Nuclear Operations Support Facility. Jim Muffett will give you some directions on how to get there after the meeting. Jim will meet you there and bring you over to the building I'm in, which is right behind that building, and we'll start in there in the conference room. We'll use that as a marshalling point. There will be four people, I believe, going on the tour, plus probably NRC will have -- at least they did last time --a representative, and yourself and, I guess, Doctor Boltz is coming also.

MRS. ELLIS: Yes.

MR. NACE: So Jim will meet you at the Visitor's Center, bring you over to my conference room area, and we'll

go from there on the tour.

If there is no other business, the meeting is adjourned.

(The meeting was adjourned at 3:00 p.m.)

STATE OF TEXAS)
)
COUNTY OF TARRANT)

I, CARMEN GOODEN, Certified Shorthand Reporter of the State of Texas, certify that the foregoing proceedings were reported stenographically by me at the time and place indicated, and that it is a true record of the proceedings had at that time.

Given under my hand and seal of office on this the 22nd day of February 1988.

Carmen Gooden

Carmen Gooden, Notary Public and
Certified Shorthand Reporter in
and for the State of Texas.

Certificate No.: 2353
Expiration Date: 12-31-90
Notary Expires: 08-10-91

CASE MEETING TOPIC MATRIX

ISSUE TITLE	PSR SUB APPENDIX	GIR APPENDIX	DECEMBER 1987 MEETING	FEBRUARY 1988 MEETING
CONTROLLING LOAD CASE FOR DESIGN	A1	1	X	
SEISMIC RESPONSE COMBINATION DESIGN	A2	2	X	
ANCHOR BOLT DESIGN	A3	3	X	
DESIGN OF COMPRESSION MEMBERS	A4	4	X	
VERTICAL AND TRANSVERSE LOADING ON LONGITUDINAL TYPE SUPPORTS	A5	5	X	
SUPPORT FRAME DEAD AND INERTIAL LOAD	A6	6	X	
DESIGN OF ANGLE BRACES NEGLECTING LOADING ECCENTRICITY	A7	7	X	
DYNAMIC AMPLIFICATION FACTORS (DAF) TRIBUTARY TRAY SUPPORT REACTIONS AND MISSING MASS EFFECTS	A8	8	X	
REDUCTION IN CHANNEL SECTION PROPERTIES DUE TO CLAMP BOLT HOLES	A9	9	X	
SYSTEM EFFECTS	A10	10	X	
VALIDITY OF NASTRAN MODELS	A11	11	X	
WORKING POINT DEVIATION STUDY	A12	12	X	
REDUCED SPECTRAL ACCELERATIONS	A13	13	X	
NON-CONFORMANCE WITH AISC SPECIFICATIONS	A14	14	X	
MEMBER SUBSTITUTION	A15	15	X	

CASE MEETING TOPIC MATRIX

ISSUE TITLE	PSR SUB APPENDIX	GIR APPENDIX	DECEMBER 1987 MEETING	FEBRUARY 1988 MEETING
WELD DESIGN AND SPECIFICATIONS	A16	16	X	
EMBEDDED PLATE DESIGN	A17	17	X	
TRAY CLAMP	A18	18	X	
FSAR LOAD COMBINATIONS	A19	19	X	
DIFFERENCES BETWEEN INSTALLATION AND DESIGN/CONSTRUCTION DRAWINGS WITHOUT APPROPRIATE DOCUMENTATION	A20	20	X	
DESIGN CONTROL	A21	21	X	
DESIGN OF SUPPORT NO. 3136, DETAIL "5" DRAWING 2323-S-0905	A22	22	X	
LOADING IN STRESS MODELS	A23	23	X	
DESIGN OF FLEXURAL MEMBERS	A24	24		X
CABLE TRAY QUALIFICATION	A25	25		X
BASE ANGLE DESIGN	A26	26		X
SUPPORT QUALIFICATION BY SIMILARITY	A27	27		X
CRITICAL SUPPORT CONFIGURATION AND LOADINGS	A28	28		X
CUMULATIVE EFFECT OF REVIEW ISSUES	A29	29		X
CABLE TRAY SYSTEM DAMPING VALVES	A30	30	X	
MODELLING OF BOUNDARY CONDITIONS	A31	31	X	

CASE MEETING TOPIC MATRIX

ISSUE TITLE	PSR SUB APPENDIX	GIR APPENDIX	DECEMBER 1987 MEETING	FEBRUARY 1988 MEETING
CONDUITS ATTACHED TO CABLE TRAY OR SUPPORTS	A32	32		X
AS-BUILT WALKDOWN PROCEDURES	A33			X
SYSTEM ANALYSIS METHODOLOGIES	A34			X
FAILURE TO PROPERLY INSPECT CABLE TRAY HANGER NRC NOVEMBER 50-445/8416-V-01	A35			X
BOLTING MATERIAL FOR CABLE TRAY HANGER CLAMPS	B1			X
CABLE TRAY HANGER DESIGN	B2			X
CABLE TRAY TEE FITTINGS	B3			X
CABLE TRAY HANGER REVERIFICATION PROGRAM	B4			X
CABLE TRAY SPLICES/CONNECTIONS	B5			X
CABLE TRAY HANGER SPLICE WELDS	B6			X
CABLE TRAY TRANSVERSE CLAMPS	B7			X
IMPROPER APPLICATION OF CONSTRUCTION AIDS	B8			X
FIELD DRILLED CABLE TRAY HOLES	B9			X

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A24
(GIR APPENDIX 24)
DESIGN OF FLEXURAL MEMBERS

EXTERNAL SOURCE ISSUE:

A, B. IN THE ORIGINAL DESIGN OF CABLE TRAY SUPPORT FLEXURAL MEMBERS, MOMENTS (BENDING AND TORSION) INDUCED BY TRAY ECCENTRICITIES TO TIER CENTROIDAL AXES HAVE NOT BEEN CONSIDERED.

ISSUE RESOLUTION/IMPLEMENTATION:

A, B. DESIGN VALIDATION PROCEDURES SAG.CP11, SAG.CP34, PI-02, PI-03, AND M-12 REQUIRE THAT MOMENTS (BENDING AND TORSION) RESULTING FROM TRAY/HANGER CONNECTION ECCENTRICITIES BE CONSIDERED.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A24
(GIR APPENDIX 24)
DESIGN OF FLEXURAL MEMBERS
(CONTINUED)

EXTERNAL SOURCE ISSUE:

C. IN THE ORIGINAL DESIGN OF CABLE TRAY SUPPORT FLEXURAL MEMBERS, REDUCTIONS IN BEAM SECTION PROPERTIES DUE TO BOLT HOLES AND WELD UNDERCUTS ARE INCONSISTENTLY CONSIDERED.

ISSUE RESOLUTION/IMPLEMENTATION:

C. o REDUCTIONS IN SECTION PROPERTIES RESULTING FROM BOLT HOLES WERE DEVELOPED PER ENGINEERING STUDIES (VOLUME I, BOOK 25 AND M-65) IN ACCORDANCE WITH THE AISC SPECIFICATION. THE SIZE OF THE BOLT HOLES WAS DETERMINED TO BE 3/4 INCH, BASED ON A STATISTICAL EVALUATION OF A BOLT HOLE SAMPLE. THE DESIGN VALIDATION PROCEDURES SAG.CP34 AND PI-11 REQUIRE THE USE OF THESE REDUCED PROPERTIES IN THE DESIGN VALIDATION OF CABLE TRAY HANGER TIERS TO ACCOUNT FOR THE PRESENCE OF BOTH USED AND UNUSED BOLT HOLES.

o THE CABLE TRAY HANGERS HAVE BEEN INSPECTED AS SPECIFIED IN NQI-3.09-M-001. ALL UNACCEPTABLE WELD UNDERCUTS HAVE BEEN REPAIRED. AN ENGINEERING STUDY (VOLUME I BOOK 20) OF THE BASE METAL DEFECTS (IDENTIFIED BY THESE QC INSPECTIONS) HAS BEEN PERFORMED AND CONCLUDED THAT THE EFFECTS OF WELD UNDERCUT ON THE CABLE TRAY HANGER CAPACITY NEED NOT BE EXPLICITLY CONSIDERED.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A24
(GIR APPENDIX 24)
DESIGN OF FLEXURAL MEMBERS
(CONTINUED)

EXTERNAL SOURCE ISSUE:

D. IN THE ORIGINAL DESIGN OF CABLE TRAY SUPPORT FLEXURAL MEMBERS, DESIGN CALCULATIONS DO NOT CONSIDER SHEAR STRESS EFFECTS DUE TO DIRECT SHEAR, ST. VENANT TORSIONAL SHEAR, OR THE COMBINATION OF THE TWO.

ISSUE RESOLUTION/IMPLEMENTATION:

D. STRESSES DUE TO DIRECT SHEAR AND ST. VENANT SHEAR ARE CONSIDERED IN DESIGN VALIDATION AS SPECIFIED IN SAG.CP34 AND PI-03.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A24
(GIR APPENDIX 24)
DESIGN OF FLEXURAL MEMBERS
(CONTINUED)

EXTERNAL SOURCE ISSUE:

E. IN THE ORIGINAL DESIGN OF CABLE TRAY SUPPORT FLEXURAL MEMBERS, CAPACITY REDUCTION DUE TO THE UNSUPPORTED LENGTH OF THE COMPRESSION FLANGE, PER AISC EQUATION 1.5-7, WAS NOT PROPERLY CONSIDERED.

ISSUE RESOLUTION/IMPLEMENTATION:

E. THE DESIGN VALIDATION PROCEDURES SAG.CP34, PI-03 AND PI-11 REQUIRE THE USE OF AISC EQUATION 1.5-7 FOR VALIDATION OF CABLE TRAY HANGER CHANNEL MEMBERS AND PROVIDE DIRECTION FOR ITS PROPER APPLICATION.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A24
(GIR APPENDIX 24)
DESIGN OF FLEXURAL MEMBERS
(CONTINUED)

EXTERNAL SOURCE ISSUE:

F. IN THE ORIGINAL DESIGN OF CABLE TRAY SUPPORT FLEXURAL MEMBERS, THE PRACTICE FOR CONSIDERING TORSIONAL WARPING NORMAL STRESS WAS NOT SPECIFIED IN THE DESIGN VALIDATION PROCEDURE.

ISSUE RESOLUTION/IMPLEMENTATION:

F. TORSIONAL WARPING NORMAL STRESSES ARE CONSIDERED IN DESIGN VALIDATION AS SPECIFIED IN SAG.CP11, SAG.CP34 AND PI-03.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A25
(GIR APPENDIX 25)
CABLE TRAY QUALIFICATION

EXTERNAL SOURCE ISSUE:

A. IN THE ORIGINAL CABLE TRAY QUALIFICATION, DYNAMIC AMPLIFICATION FACTOR (DAF) WAS NOT USED.

ISSUE RESOLUTION/IMPLEMENTATION:

A. DESIGN VALIDATION OF CABLE TRAYS BY THE EQUIVALENT STATIC METHOD CONSIDERED PEAK SEISMIC ACCELERATIONS OR SEISMIC ACCELERATIONS AT THE SYSTEM FREQUENCY AND USED AN AMPLIFICATION FACTOR OF AT LEAST 1.25. (WHEN RESPONSE SPECTRA METHOD IS USED, THIS ISSUE DOES NOT APPLY.) THIS AMPLIFICATION FACTOR IS JUSTIFIED BY DETAILED ENGINEERING STUDIES CONTAINED IN VOLUME I - BOOK 15.

CERTAIN CONFIGURATIONS MAY REQUIRE A HIGHER MRM. DESIGN VALIDATION PROCEDURES SAG.CP28 AND SAG.CP18 WERE DEVELOPED TO PROPERLY ANALYZE THESE CABLE TRAY SYSTEM CONFIGURATIONS

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A25
(GIR APPENDIX 25)
CABLE TRAY QUALIFICATION
(CONTINUED)

EXTERNAL SOURCE ISSUE:

B. IN THE ORIGINAL CABLE TRAY QUALIFICATION, THE INTERACTION EQUATION WAS IMPROPERLY BASED ON TOTAL LOAD FOR SPANS GREATER THAN 8 FEET.

ISSUE RESOLUTION/IMPLEMENTATION:

B. DESIGN VALIDATION OF CABLE TRAY SPANS GREATER THAN 8 FEET IS BASED ON COMPARISON OF TRAY BENDING MOMENTS WITH BENDING MOMENT CAPACITIES OBTAINED FROM TESTING (REFER TO CALCULATIONS M-03, M-34, M-35 AND VOLUME I - BOOK 1).

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A25
(GIR APPENDIX 25)
CABLE TRAY QUALIFICATION
(CONTINUED)

EXTERNAL SOURCE ISSUE:

C. IN THE ORIGINAL CABLE TRAY QUALIFICATION, SEVERAL INSTANCES OF MODIFICATIONS OF VENDOR SUPPLIED HARDWARE FOR CABLE TRAYS WERE FOUND WITHOUT ADEQUATE JUSTIFICATION OR DOCUMENTATION.

ISSUE RESOLUTION/IMPLEMENTATION:

C. THE EFFECTS OF MODIFICATIONS TO VENDOR SUPPLIED HARDWARE ARE BEING EVALUATED USING AS-BUILT DATA AS DESIGN INPUT FOR VALIDATION AS PART OF THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A25
(GIR APPENDIX 25)
CABLE TRAY QUALIFICATION
(CONTINUED)

EXTERNAL SOURCE ISSUE:

D. IN THE ORIGINAL CABLE TRAY QUALIFICATION, CABLE TRAY MOMENT OF INERTIA CALCULATIONS DID NOT CONSIDER SHEAR DEFORMATION UNDER TRANSVERSE LOADING OF LADDER-TYPE TRAYS.

ISSUE RESOLUTION/IMPLEMENTATION:

D. DESIGN VALIDATION PROCEDURES SAG.CP18 AND PI-02 CONSIDER CABLE TRAYS AS FLEXURAL MEMBERS. AN ENGINEERING STUDY, CALCULATION M-66, HAS SHOWN THAT THIS PROCEDURE IS APPROPRIATE AND THAT SHEAR BEHAVIOR DOES NOT NEED TO BE EXPLICITLY CONSIDERED.

TEMPERATURE EFFECTS ON STRUCTURAL STEEL

QUESTION

HOW IS THE EFFECT OF HIGH TEMPERATURE (DUE TO LOCA) ON STEEL YIELD STRENGTH TAKEN INTO ACCOUNT IN THE DESIGN VALIDATION OF THE CABLE TRAY, CONDUIT, AND HVAC SUPPORTS AT CPSES?

TEMPERATURE EFFECTS ON STRUCTURAL STEEL

(CONTINUED)

RESPONSE

- o ANALYSES ARE CONDUCTED IN STRICT ACCORDANCE WITH AISC REQUIREMENTS

- o THIS CODE IS APPROPRIATE FOR LOCA CONDITIONS SINCE

  A. THE MAXIMUM STEEL TEMPERATURE RESULTING FROM THE EXTREME ACCIDENT EVENT (A ONE TIME EVENT) IS LESS THAN 280° FOR ABOUT A DAY.

  B. THE CODE RECOGNIZES THE ULTIMATE STRENGTH IS NOT AFFECTED BY THIS TEMPERATURE.

TEMPERATURE EFFECTS ON STRUCTURAL STEEL

(CONTINUED)

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EXAMPLE

COMPARISON OF CPSES DESIGN CRITERIA VS. ASME LIMITS FOR THE POSTULATED ACCIDENT (FAULTED CONDITION)

LIMITS ON STRESS FOR A36 MATERIAL	(BASIC STRESS LIMIT = $0.6F_Y$)	
CPSES DESIGN AT 267°F	$F_{ALL} \leq 0.9F_Y$	32.4 KSI
NUREG-0800 (SRP)		
NON TEMPERATURE ADJUSTED	$F_{ALL} \leq 1.6^*(0.6F_Y) = 0.96\ F_Y$	34.6 KSI
TEMP. ADJUSTED @ 267°F	$F_{ALL} \leq 1.6^*[0.6(.95F_Y)] = 0.91\ F_Y$	32.8 KSI
ASME NF		
NON TEMPERATURE ADJUSTED	$F_{ALL} \leq 1.8^{**}(0.6F_Y) = 1.13\ F_Y$	40.6 KSI
TEMP. ADJUSTED @ 267°F USING SECTION III APPENDICES	$F_{ALL} \leq 1.88^{**}\ [0.6(0.89F_Y)] = 1.0F_Y$	36.0 KSI

* THIS REPRESENTS THE MINIMUM INCREASE FACTOR FOR THE ACCIDENT LOAD COMBINATION WHICH INCLUDES THE EARTHQUAKE EVENT.

** $\frac{1.17\ S_U}{S_Y}$) APPENDIX F OF SECTION III ASME CODE

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TEMPERATURE EFFECTS ON STRUCTURAL STEEL

(CONTINUED)

EXAMPLE

COMPARISON OF CPSES DESIGN CRITERIA VS. ASME LIMITS FOR THE POSTULATED ACCIDENT (FAULTED CONDITION)

LIMITS ON STRESS FOR A36 MATERIAL	(BASIC STRESS LIMIT = $0.6F_Y$)	
CPSES DESIGN AT 267°F	$F_{ALL} \leq 0.9F_Y$	32.4 KSI
NUREG-0800 (SRP)		
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ASME NF		
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TEMP. ADJUSTED @ 267°F USING SECTION III APPENDICES	$F_{ALL} \leq 1.88^{**}\ [0.6(0.89F_Y)] = 1.0F_Y$	36.0 KSI

* THIS REPRESENTS THE MINIMUM INCREASE FACTOR FOR THE ACCIDENT LOAD COMBINATION WHICH INCLUDES THE EARTHQUAKE EVENT.

** $\frac{0.7\ S_U}{F_T}$ APPENDIX F OF SECTION III ASME CODE

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A26
(GIR APPENDIX 26)
BASE ANGLE DESIGN

EXTERNAL SOURCE ISSUE:

A. IN THE ORIGINAL BASE ANGLE DESIGN, BASE ANGLES WERE MODELED AS SIMPLY SUPPORTED BEAMS, IGNORING THE STIFFENING EFFECTS OF CONCRETE BEARING AT ANGLE ENDS.

ISSUE RESOLUTION/IMPLEMENTATION:

A. DESIGN VALIDATION PROCEDURES USE THE SAME ASSUMPTION WHEN CHECKING BASE ANGLE STRESSES SINCE CONSIDERATION OF THE STIFFENING EFFECTS DUE TO CONCRETE BEARING AT ANGLE ENDS WOULD PRODUCE LOWER BASE ANGLE STRESSES. THIS ASSUMPTION IS CONSERVATIVE FOR EVALUATION OF BASE ANGLE STRESSES. CONCRETE STIFFNESS IS INCLUDED IN CALCULATIONS OF THE BASE ANGLE FLEXIBILITY USED IN THE DETERMINATION OF SUPPORT STIFFNESS.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A26
(GIR APPENDIX 26)
BASE ANGLE DESIGN
(CONTINUED)

EXTERNAL SOURCE ISSUE:

B. IN THE ORIGINAL BASE ANGLE DESIGN, PRINCIPAL AXES WERE NOT CONSIDERED IN THE ANALYSIS OF BASE ANGLES.

ISSUE RESOLUTION/IMPLEMENTATION:

B. DESIGN VALIDATION PROCEDURES SAG.CP34 AND PI-07 REQUIRE THAT BASE ANGLE PRINCIPAL AXES BE CONSIDERED IN THE EVALUATION OF BASE ANGLES.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A26
(GIR APPENDIX 26)
BASE ANGLE DESIGN
(CONTINUED)

EXTERNAL SOURCE ISSUE:

C. IN THE ORIGINAL BASE ANGLE DESIGN, BASE ANGLE LENGTHS CONSIDERED IN THE "WORKING POINT DEVIATION STUDY" DID NOT REFLECT THE MOST CRITICAL SPACING OF RICHMOND INSERTS.

ISSUE RESOLUTION/IMPLEMENTATION:

C. DESIGN VALIDATION PROCEDURES SAG.CP3, SAG.CP4, SAG.CP34 AND PI-07 REQUIRE THAT AS-BUILT INFORMATION WHICH INCLUDES THE SPACING OF RICHMOND INSERTS BE USED AS DESIGN INPUT FOR THE EVALUATION OF BASE ANGLES.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A26
(GIR APPENDIX 26)
BASE ANGLE DESIGN

(CONTINUED)

EXTERNAL SOURCE ISSUE:

D. IN THE ORIGINAL BASE ANGLE DESIGN, NOT ALL BASE ANGLES WERE EVALUATED FOR STANDARD (GENERIC) CABLE TRAY HANGER TYPES.

ISSUE RESOLUTION/IMPLEMENTATION:

D. DESIGN VALIDATION PROCEDURES SAG.CP34 AND PI-07 REQUIRE THAT ALL BASE ANGLES OF EACH CABLE TRAY HANGER BE EVALUATED.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A27
(GIR APPENDIX 27)
SUPPORT QUALIFICATION BY SIMILARITY

EXTERNAL SOURCE ISSUE:

In the original design calculations, some cable tray hangers (i.e. supports) were validated by similarity without proper justification.

ISSUE RESOLUTION/IMPLEMENTATION:

Design validation was performed using as-built information which adequately accounts for significant hanger attributes including brace connection eccentricities. The majority of the hangers have been design validated individually. In the limited number of instances where extremely similar hangers were grouped, the grouping was performed with consideration of support geometries, connection details, and other relevant attributes in accordance with Design Validation Grouping Procedures in Volume I, Books 4 and 8.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A28
(GIR APPENDIX 28)
CRITICAL SUPPORT CONFIGURATION AND LOADINGS

EXTERNAL SOURCE ISSUE:

THE ORIGINAL DESIGN CALCULATIONS FOR TRAPEZE TYPE CABLE TRAY HANGERS (I.E., SUPPORTS) CONSIDERED SYMMETRIC LOAD PATTERNS AND A LIMITED NUMBER OF HANGER ASPECT RATIOS WHICH MAY NOT HAVE REPRESENTED THE BOUNDING AS-BUILT CONFIGURATIONS.

ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION WAS PERFORMED USING AS-BUILT INFORMATION WHICH ADEQUATELY ACCOUNTS FOR SIGNIFICANT HANGER ATTRIBUTES INCLUDING ACTUAL TRAY LOCATIONS. THE MAJORITY OF THE HANGERS HAVE BEEN DESIGN VALIDATED INDIVIDUALLY. IN THE LIMITED NUMBER OF INSTANCES WHERE EXTREMELY SIMILAR HANGERS WERE GROUPED, THE GROUPING WAS PERFORMED WITH CONSIDERATION OF SUPPORT GEOMETRIES, CONNECTION DETAILS, AND OTHER RELEVANT ATTRIBUTES IN ACCORDANCE WITH DESIGN VALIDATION GROUPING PROCEDURES IN VOLUME I, BOOKS 4 AND 8.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A29
(GIR APPENDIX 29)
CUMULATIVE EFFECT OF REVIEW ISSUES

EXTERNAL SOURCE ISSUE:

SMALL UNCONSERVATISMS RESULTING FROM SEPARATE ISSUES MAY HAVE SIGNIFICANT CUMULATIVE EFFECT FOR CABLE TRAY HANGERS IMPACTED BY MORE THAN ONE ISSUE.

ISSUE RESOLUTION/IMPLEMENTATION:

THERE IS NO CUMULATIVE UNCONSERVATIVE EFFECT OF ISSUES BECAUSE:

- OVERALL DESIGN VALIDATION APPROACH HAS ADDRESSED EACH ISSUE BOTH INDIVIDUALLY AND COLLECTIVELY.

- DESIGN VALIDATION WAS BASED ON AS-BUILT DATA.

- DESIGN VALIDATION PROCEDURES SAG.CP3, SAG.CP4, SAG.CP9, SAG.CP11, SAG.CP18, SAG.CP19, SAG.CP28, SAG.CP34, PI-02, PI-03, PI-07, AND PI-11 PROVIDE CONTROL OF THE DESIGN PROCESS.

- ALL FINAL DESIGNS ARE IN CONFORMANCE WITH APPLICABLE CODES.

- AN EXTENSIVE TEST PROGRAM PROVIDED DATA DEMONSTRATING THAT THE DESIGN VALIDATION APPROACH IS CONSERVATIVE.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A32
CONDUITS ATTACHED TO CABLE TRAYS OR SUPPORTS

EXTERNAL SOURCE ISSUE:

QUESTIONS REGARDING CONDUITS ATTACHED TO CABLE TRAYS OR CABLE TRAY HANGERS HAVE BEEN IDENTIFIED:

O HOW ARE CONDUIT LOADS CONSIDERED IN CABLE TRAY HANGER (SUPPORT) VALIDATION?

O HOW ARE CONDUIT LOADS CONSIDERED IN CABLE TRAY DESIGN VALIDATION?

O HOW IS HANGER FREQUENCY AT CONDUIT ATTACHMENT LOCATIONS DETERMINED IN ESM ANALYSIS?

ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION PROCEDURES SAG.CP18, SAG.CP34, AND PI-02 FOR CABLE TRAYS AND CABLE TRAY HANGERS REQUIRE THAT THE EFFECTS OF ATTACHED CONDUIT BE INCLUDED IN THE EVALUATION OF CABLE TRAY AND CABLE TRAY HANGER.

FOR THE EQUIVALENT STATIC ANALYSIS, THE SYSTEM FREQUENCY WAS EVALUATED BASED ON APPROPRIATE MASS PARTICIPATION AS SPECIFIED IN SAG.CP34.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A33
AS-BUILT WALKDOWN PROCEDURES

EXTERNAL SOURCE ISSUE:

A. IN THE AS-BUILT WALKDOWN PROCEDURE, WHAT IS THE JUSTIFICATION FOR TOLERANCES USED FOR AS-BUILT MEASUREMENTS?

ISSUE RESOLUTION/IMPLEMENTATION:

A. ENGINEERING STUDIES (REPORT IM-P-009, M-69, M-15 ATTACHMENT C, M-92 AND M-95) DEMONSTRATED THAT THE MEASUREMENT TOLERANCES USED FOR GATHERING AS-BUILT CABLE TRAY AND CABLE TRAY HANGER INFORMATION WERE ACCEPTABLE.

EXTERNAL SOURCE ISSUE:

B. THE FOLLOWING QUESTIONS REGARDING AS-BUILT WALKDOWN PROCEDURES WERE IDENTIFIED:

- O WHAT IS THE JUSTIFICATION FOR USING VWAC AS PART OF THE WELD ACCEPTANCE CRITERIA?

- O HOW DO THE WALKDOWN PROCEDURES EVALUATE WELD PENETRATION?

- O HOW DO THE WALKDOWN PROCEDURES EVALUATE UNKNOWN BOLT TYPE/EMBEDMENT?

- O DO THE WALKDOWN PROCEDURES EVALUATE ITEMS ATTACHED TO CABLE TRAY SUPPORTS?

ISSUE RESOLUTION/IMPLEMENTATION:

- O TU Electric has received NRC approval to use Visual Weld Acceptance Criteria (VWAC).

- O The effective throat of welds was assumed 40% of the beveled member's thickness based on ultrasonic tests and engineering studies (Volume I-Book 20).

- O When expansion anchor type and embedment length could not be identified, the anchors were:

  - Design validated assuming minimum capacity for the anchor type (e.g. A307 bolts with Richmond Inserts or HKB as opposed to HSKB)

  - Design validated assuming minimum embedment for the particular anchor size

  - Inspected using ultrasonic tests to determine as-built anchor embedment for validation

- O Items attached to cable trays and cable tray hangers and the methods used to attach those items were identified by walkdown Procedures FVM-CS-001, 003, 019 and 048.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A33
AS-BUILT WALKDOWN PROCEDURES
(CONTINUED)

EXTERNAL SOURCE ISSUE:

C. THE FOLLOWING QUESTIONS REGARDING AS-BUILT WALKDOWN PROCEDURES WERE IDENTIFIED:

- O WHAT ARE THE SPECIFIC ITEMS EVALUATED AS PART OF THE CABLE TRAY SPAN WALKDOWN PROCEDURE?

ISSUE RESOLUTION/IMPLEMENTATION:

C. TRAY COVERS, SIDE RAIL EXTENSIONS, AND MODIFIED SPLICE PLATES ARE IDENTIFIED AS PER WALKDOWN PROCEDURES FVM-CS-001, 003, 019 AND 048. THESE ATTRIBUTES ARE BEING VALIDATED IN ACCORDANCE WITH PROCEDURES SAG.CP3, SAG.CP4, SAG.CP18, SAG.CP34, PI-02, PI-06 AND CALCULATION M-39.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A34
SYSTEM ANALYSIS METHODOLOGIES

EXTERNAL SOURCE ISSUE:

A. THE FOLLOWING QUESTIONS WERE RAISED REGARDING CABLE TRAY SYSTEM ANALYSIS METHODOLOGIES:

SUPERPIPE ERROR SP-004 INVOLVED THE INCORRECT ASSIGNMENT OF LUMPED DIRECTIONAL MASSES FOR STATIC LOAD CASES. A METHOD TO ADJUST THE RESULTS TO ACCOUNT FOR THE ERROR WAS INCORPORATED IN THE CABLE TRAY VALIDATION PROCEDURES. THE ERROR WAS SUBSEQUENTLY CORRECTED IN A LATER VERSION OF SUPERPIPE AND THIS METHOD WAS NO LONGER REQUIRED. SYSTEM ANALYSIS 176-063-02 INCORRECTLY APPLIED THIS METHOD FOR ERROR SP-004 TO A VERSION OF SUPERPIPE IN WHICH THE ERROR HAD BEEN CORRECTED. WHAT IS THE IMPACT OF APPLYING THE METHOD TO ADJUST FOR THE ERROR TO A CORRECTED VERSION OF SUPERPIPE?

ISSUE RESOLUTION/IMPLEMENTATION:

A. THIS ISSUE WAS IDENTIFIED AND DOCUMENTED IN AN INTERNAL TECHNICAL QUALITY REVIEW (TQR) CONDUCTED IN ACCORDANCE WITH IMPELL QUALITY ASSURANCE (QA) PROCEDURES PRIOR TO IDENTIFICATION BY EXTERNAL SOURCE. THERE WAS NO IMPACT OF INCORRECTLY APPLYING THIS METHOD OF ADJUSTMENT TO SYSTEM ANALYSIS 176-063-02. THIS IS DOCUMENTED IN THE TQR RESPONSE. IN RESPONSE TO THE TQR, THE CORRECTIVE ACTION REQUIRED THAT GENERIC IMPLICATIONS ALSO BE IDENTIFIED. NO OTHER OCCURRENCES OF THIS ISSUE WERE IDENTIFIED.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A34
SYSTEM ANALYSIS METHODOLOGIES
(CONTINUED)

EXTERNAL SOURCE ISSUE:

B. THE FOLLOWING QUESTIONS WERE RAISED REGARDING CABLE TRAY SYSTEM ANALYSIS METHODOLOGIES:

WHAT IS THE JUSTIFICATION FOR THE USE OF A 1.1 LOAD FACTOR FOR CABLE TRAY AND CABLE TRAY HANGERS LOCATED NEAR ANALYSIS BOUNDARIES IN THE "OVERLAP REGIONS" OF RESPONSE SPECTRUM ANALYSES?

ISSUE RESOLUTION/IMPLEMENTATION:

B. A DETAILED ENGINEERING STUDY (CALCULATION M-13) DEVELOPED THE OVERLAP CRITERIA USING THE RESULTS OF PARTIAL MODELS WITH OVERLAP REGIONS COMPARED TO THE RESULTS OF FULL MODELS OF THE SAME SYSTEM. RESULTS OF THIS STUDY SHOWED THAT NO LOAD INCREASE FACTOR WAS REQUIRED, HOWEVER, A LOAD INCREASE FACTOR OF 1.1 WAS APPLIED IN THE OVERLAP REGION TO ASSURE CONSERVATIVE ANALYSIS RESULTS. THIS FACTOR WAS ESTABLISHED FROM A REVIEW OF OTHER STRUCTURAL OVERLAP CRITERIA ("OVERLAP CRITERIA IN PIPING" BY BROOKHAVEN NATIONAL LABORATORY.)

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX A35
FAILURE TO PROPERLY INSPECT CABLE TRAY HANGERS
NRC NOV 50-445/8416-V-01

EXTERNAL SOURCE ISSUE:

IN THE ORIGINAL DESIGN AND INSPECTION OF CABLE TRAY HANGERS QC INSPECTORS FAILED TO IDENTIFY AND DOCUMENT CONDITIONS WHERE THE INSTALLATION WAS NOT IN ACCORDANCE WITH THE DESIGN DOCUMENT.

ISSUE RESOLUTION/IMPLEMENTATION:

UNDER THE CORRECTIVE ACTION PROGRAM (CAP) THE RE-INSPECTION OF CABLE TRAY HANGERS HAS BEEN PERFORMED AND DOCUMENTED IN ACCORDANCE WITH DETAILED PROCEDURES (QI-QP-11.10-2A, QI-QP-11.10-9, FVM-CS-001, FVM-CS-003, AND FVM-CS-036).

AS-BUILT INFORMATION IS INDEPENDENTLY REVIEWED BY TU ELECTRIC QC PERSONNEL.

AS-BUILT INFORMATION IS CONSIDERED AS DESIGN INPUT FOR DESIGN EVALUATIONS.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX B1
(SDAR-CP-83-15)

BOLTING MATERIAL FOR CABLE TRAY HANGER CLAMPS

INTERNAL SOURCE ISSUE:

THE ORIGINAL DESIGN OF HEAVY DUTY CABLE TRAY CLAMPS FOR LONGITUDINAL TYPE HANGERS REQUIRED THE INSTALLATION OF HIGH STRENGTH A-325 BOLTING MATERIALS TO ATTACH THE CABLE TRAY CLAMP TO THE CABLE TRAY HANGER. FIELD WALKDOWN OF THE INSTALLED CONDITIONS REVEALED THE USE OF LOWER STRENGTH A-307 BOLTING MATERIAL.

ISSUE RESOLUTION/IMPLEMENTATION:

THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP) FOR CABLE TRAY HANGERS IDENTIFIES THE INSTALLED BOLT MATERIAL USED FOR THE CONNECTION OF CABLE TRAY CLAMPS TO STRUCTURAL MEMBERS. EXISTING BOLTING MATERIAL IS BEING EVALUATED IN ACCORDANCE WITH THE APPROPRIATE ALLOWABLES IN THE DESIGN VALIDATION PROCEDURES SAG.CP19 AND PI-06. BOLTS WHICH DO NOT COMPLY WITH THE DESIGN REQUIREMENTS WILL BE REPLACED

CABLE TRAYS AND CABLE TRAY HANGERS

PSR SUBAPPENDIX B2

(SDAR-CP-85-35)

CABLE TRAY HANGER DESIGN

EXTERNAL/INTERNAL SOURCE ISSUE:

THE ORIGINAL DESIGN CRITERIA MAY NOT HAVE APPROPRIATELY ADDRESSED CERTAIN DESIGN REQUIREMENTS. ADDITIONALLY, DISCREPANCIES MAY HAVE EXISTED BETWEEN AS-BUILT AND AS-DESIGNED CABLE TRAY HANGER CONFIGURATIONS.

CABLE TRAYS AND CABLE TRAY HANGERS

PSR SUBAPPENDIX B2

(SDAR-CP-85-35)

CABLE TRAY HANGER DESIGN

(CONTINUED)

ISSUE RESOLUTION/IMPLEMENTATION:

TU ELECTRIC INITIATED THE CABLE TRAY AND CABLE TRAY HANGER CORRECTIVE ACTION PROGRAM (CAP). CAP FEATURES INCLUDED THE:

- ESTABLISHMENT OF CABLE TRAY AND CABLE TRAY HANGER DESIGN CRITERIA WHICH COMPLY WITH CPSES LICENSING COMMITMENTS
- DEVELOPMENT OF THE DESIGN BASIS DOCUMENT (DBD-CS-082)
- VALIDATION OF THE INSTALLED CABLE TRAY AND CABLE TRAY HANGER DESIGNS INCLUDING THE IDENTIFICATION AND IMPLEMENTATION OF NECESSARY MODIFICATIONS.

CABLE TRAYS AND CABLE TRAY HANGERS HAVE BEEN DESIGN VALIDATED IN ACCORDANCE WITH THE DESIGN VALIDATION PROCEDURES PI-02, PI-03, PI-06, PI-07, PI-11, SAG.CP3, SAG.CP4, SAG.CP09, SAG.CP11, SAG.CP18, SAG.CP19, SAG.CP28 AND SAG.CP34. THE INSTALLED CABLE TRAY HANGER AND CABLE TRAY HARDWARE IS BEING VALIDATED IN ACCORDANCE WITH THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP) PROCEDURES FVM-CS-001, 003, 019, 048, 050, 084, 098 AND 100.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX B3
(SDAR-CP-85-50)

CABLE TRAY TEE FITTINGS

INTERNAL SOURCE ISSUE:

SOME AS-BUILT WELDS ON VENDOR SUPPLIED TRAY TEE FITTINGS WERE NOT IN ACCORDANCE WITH THE WELDS SPECIFIED ON THE VENDOR DRAWINGS.

ISSUE RESOLUTION/IMPLEMENTATION:

TEE FITTINGS NOT MEETING THE MINIMUM VENDOR WELD REQUIREMENTS HAVE BEEN IDENTIFIED AS PART OF THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP) USING PROCEDURE FVM-CS-050. TEE FITTINGS WITH INADEQUATE WELDS ARE BEING MODIFIED TO MEET THE DESIGN REQUIREMENTS.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX B4
(SDAR-CP-85-52)

CABLE TRAY HANGER REVERIFICATION PROGRAM

EXTERNAL/INTERNAL SOURCE ISSUE:

DISCREPANCIES WERE IDENTIFIED IN THE AS-BUILT DOCUMENTATION DEVELOPED DURING THE EARLY PHASES OF THE AS-BUILTING AND INSPECTION PROGRAM.

ISSUE RESOLUTION/IMPLEMENTATION:

CABLE TRAY AND CABLE TRAY HANGER SYSTEMS WHICH HAD BEEN AS-BUILT AND INSPECTED DURING THIS PHASE WERE VALIDATED AND REINSPECTED BY PERSONNEL TRAINED IN THE TU ELECTRIC FIELD VERIFICATION METHODS.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX B5
(SDAR-CP-86-52)

CABLE TRAY SPLICES/CONNECTIONS

INTERNAL SOURCE ISSUE:

THIS ISSUE WAS THAT CABLE TRAY SPLICES WERE NOT INSTALLED IN ACCORDANCE WITH APPROVED SPLICE CONFIGURATIONS, AS SUMMARIZED BELOW:

- CABLE TRAY SPLICE CONFIGURATIONS MAY HAVE USED SPLICE PLATES THAT WERE NOT APPROVED DESIGNS OR MAY HAVE INCORRECTLY USED APPROVED SPLICE PLATES.

- IMPROPER INSTALLATION OF SPLICE PLATES MAY HAVE RESULTED IN UNUSED BOLT HOLES IN CABLE TRAYS AND SPLICE PLATES. ORIGINAL CALCULATIONS DID NOT CONSIDER THE EFFECT OF UNUSED BOLT HOLES IN CABLE TRAYS AND SPLICE PLATES.

- SPECIAL SPLICE PLATES MAY HAVE BEEN INSTALLED IN PLACE OF REDUCER FITTINGS. ORIGINAL CALCULATIONS DID NOT CONSIDER THE USE OF SPLICE PLATES IN PLACE OF REDUCER FITTINGS.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX B5
(SDAR-CP-86-52)

CABLE TRAY SPLICES/CONNECTIONS
(CONTINUED)

ISSUE RESOLUTION/IMPLEMENTATION:

- UNACCEPTABLE FIELD FABRICATED SPLICES, WHICH DO NOT COMPLY WITH DESIGN CRITERIA, ARE BEING IDENTIFIED IN THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP) IN ACCORDANCE WITH PROCEDURES FVM-CS-019 AND FVM-CS-048. SPLICE PLATES THAT DO NOT COMPLY WITH THE DESIGN CRITERIA ARE BEING REPLACED WITH DESIGN VALIDATED SPLICE PLATES.

- UNUSED HOLES IN CABLE TRAYS AND SPLICE PLATES WHICH DO NOT COMPLY WITH DESIGN CRITERIA ARE BEING IDENTIFIED DURING THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP) USING PROCEDURES FVM-CS-019 AND FVM-CS-048. TRAYS AND SPLICE PLATES WITH UNUSED HOLES THAT DO NOT COMPLY WITH DESIGN CRITERIA ARE BEING REPAIRED OR REPLACED WITH VALIDATED DESIGNS.

- SPECIAL SPLICE PLATES USED IN PLACE OF REDUCER FITTINGS ARE BEING IDENTIFIED DURING THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP) USING PROCEDURES FVM-CS-019 AND FVM-CS-048. THESE SPLICE PLATES ARE BEING REPLACED WITH DESIGN VALIDATED SPLICE PLATES.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX B6
(SDAR-CP-86-82)
CABLE TRAY HANGER SPLICE WELDS

INTERNAL SOURCE ISSUE:

THE ORIGINAL CABLE TRAY HANGER INSTALLATION SPECIFICATION REQUIRED THE USE OF FULL PENETRATION WELD JOINTS WHEN CHANNEL SECTIONS WERE SPLICED END-TO-END. NON-DESTRUCTIVE TESTS PERFORMED ON A SAMPLE OF THESE END-TO-END SPLICE WELDS REVEALED IN CERTAIN INSTANCES LESS THAN COMPLETE WELD PENETRATION.

ISSUE RESOLUTION/IMPLEMENTATION:

THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP) IDENTIFIED THE LOCATION OF ALL CHANNEL END-TO-END SPLICE WELDS. NON-DESTRUCTIVE EXAMINATION WAS PERFORMED AND WELDS THAT DID NOT ACHIEVE FULL PENETRATION WERE MODIFIED TO CONFORM WITH THE DESIGN REQUIREMENTS.

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX B7
(SDAR-CP-87-48)

CABLE TRAY TRANSVERSE CLAMPS

INTERNAL SOURCE ISSUE:

THE ORIGINAL INSTALLATION OF PARTICULAR COMBINATIONS OF TRANSVERSE CABLE TRAY CLAMP TYPES PROVIDED INADEQUATE RESTRAINT OF THE CABLE TRAY WHEN SUBJECTED TO TRANSVERSE MOVEMENT.

ISSUE RESOLUTION/IMPLEMENTATION:

THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP) IS IDENTIFYING TRAY CLAMP COMBINATIONS USING PROCEDURE FVM-CS-001,003 AND 100. CLAMP COMBINATIONS NOT IN COMPLIANCE WITH THE DESIGN REQUIREMENTS ARE BEING REPLACED WITH AN ACCEPTABLE CLAMP COMBINATION

CABLE TRAYS AND CABLE TRAY HANGERS
PSR SUBAPPENDIX B8
(SDAR-CP-87-59)

IMPROPER APPLICATION OF CONSTRUCTION AIDS

INTERNAL SOURCE ISSUE:

CERTAIN ADJUSTABLE CABLE TRAY FITTINGS, INTENDED ONLY TO AID IN ALIGNMENT OF TRAY SEGMENTS DURING INSTALLATION, WERE INSTALLED AS PERMANENT COMPONENTS WITHOUT EVALUATION OF THEIR STRUCTURAL ADEQUACY.

IMPLEMENTATION/RESOLUTION:

ADJUSTABLE CABLE TRAY FITTINGS INSTALLED AS PERMANENT COMPONENTS ARE BEING IDENTIFIED DURING PCHVP IN ACCORDANCE WITH PROCEDURE FVM-CS-019, 048 AND 084. FITTINGS WHICH DO NOT COMPLY WITH DESIGN REQUIREMENTS WILL BE MODIFIED OR REPLACED.

CABLE TRAYS AND CABLE TRAY HANGERS

PSR SUBAPPENDIX B9

(SDAR-CP-87-76)

FIELD DRILLED CABLE TRAY HOLES

INTERNAL SOURCE ISSUE:

FIELD DRILLED HOLES USED TO INSTALL SPLICE PLATES, RESULTED IN UNUSED HOLES IN CABLE TRAYS AND SPLICE PLATES. THE ISSUE WAS THAT THESE UNUSED HOLES WERE NOT CONSIDERED IN TRAY AND SPLICE PLATE DESIGN.

ISSUE RESOLUTION/IMPLEMENTATION:

UNUSED HOLES IN CABLE TRAYS AND SPLICE PLATES ARE BEING IDENTIFIED DURING THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (PCHVP) USING PROCEDURES FVM-CS-048 AND FVM-CS-019. UNUSED HOLES THAT DO NOT COMPLY WITH DESIGN CRITERIA WILL BE REPAIRED.

TU ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION

UNIT 1 AND COMMON

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B AND TRAIN C LARGER THAN 2 INCH DIAMETER

CORRECTIVE ACTION PROGRAM

PRESENTED
TO
CITIZENS ASSOCIATION FOR SOUND ENERGY

FEBRUARY 18, 1988

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

SCOPE OF THE CORRECTIVE ACTION PROGRAM (CAP)

- O UNIT 1 AND COMMON SEISMIC CATEGORY I TRAIN A & B CONDUIT AND CONDUIT SUPPORTS AND SEISMIC CATEGORY II CONDUIT AND CONDUIT SUPPORTS FOR TRAIN C LARGER THAN 2 INCH DIAMETER HAVE BEEN DESIGN VALIDATED.

- O PRIMARY FEATURES OF THE CAP FOR CONDUIT AND CONDUIT SUPPORTS:

  - ESTABLISHMENT OF CONDUIT AND CONDUIT SUPPORT DESIGN CRITERIA WHICH COMPLY WITH CPSES LICENSING COMMITMENTS

  - RESOLUTION OF DESIGN AND HARDWARE-RELATED ISSUES FOR THE CPSES CONDUIT AND CONDUIT SUPPORTS

  - DEVELOPMENT OF THE DESIGN BASIS DOCUMENT (DBD-CS-090)

  - IMPLEMENTATION OF DESIGN AND HARDWARE VALIDATION INCLUDING IDENTIFICATION AND IMPLEMENTATION OF NECESSARY MODIFICATIONS

  - COMPILATION OF VALIDATED DESIGN DOCUMENTATION TO FORM THE BASIS FOR CONFIGURATION CONTROL

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PRIMARY FEATURES OF THE CORRECTIVE ACTION PROGRAM (CAP)

- O IDENTIFY COMMITMENTS
  - FSAR
  - NRC REGULATORY GUIDES AND I&E BULLETINS
  - APPLICABLE CODES AND STANDARDS (E.G., AISC)

- O ESTABLISH DESIGN VALIDATION CRITERIA AND PROCEDURES
  - ENGINEERING STUDIES PERFORMED
  - COMPONENT TESTING PERFORMED
    - UNISTRUT STATIC TESTS
    - STATIC, CYCLIC AND DYNAMIC CLAMP TESTS
    - STATIC CONDUIT THREADED FITTING TESTS

- O PROVIDE ASSURANCE THAT ALL EXTERNAL SOURCE CONCERNS HAVE BEEN RESOLVED
  - EXTENSIVE REVIEW BY CPRT THIRD PARTY (TENERA) DOCUMENTED IN DAP RESULTS REPORT: CIVIL/STRUCTURAL TRAIN A & B CONDUIT SUPPORTS, DAP-RR-C/S-002

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PRIMARY FEATURES OF THE CORRECTIVE ACTION PROGRAM (CAP)

(CONTINUED)

O PERFORM DESIGN VALIDATION

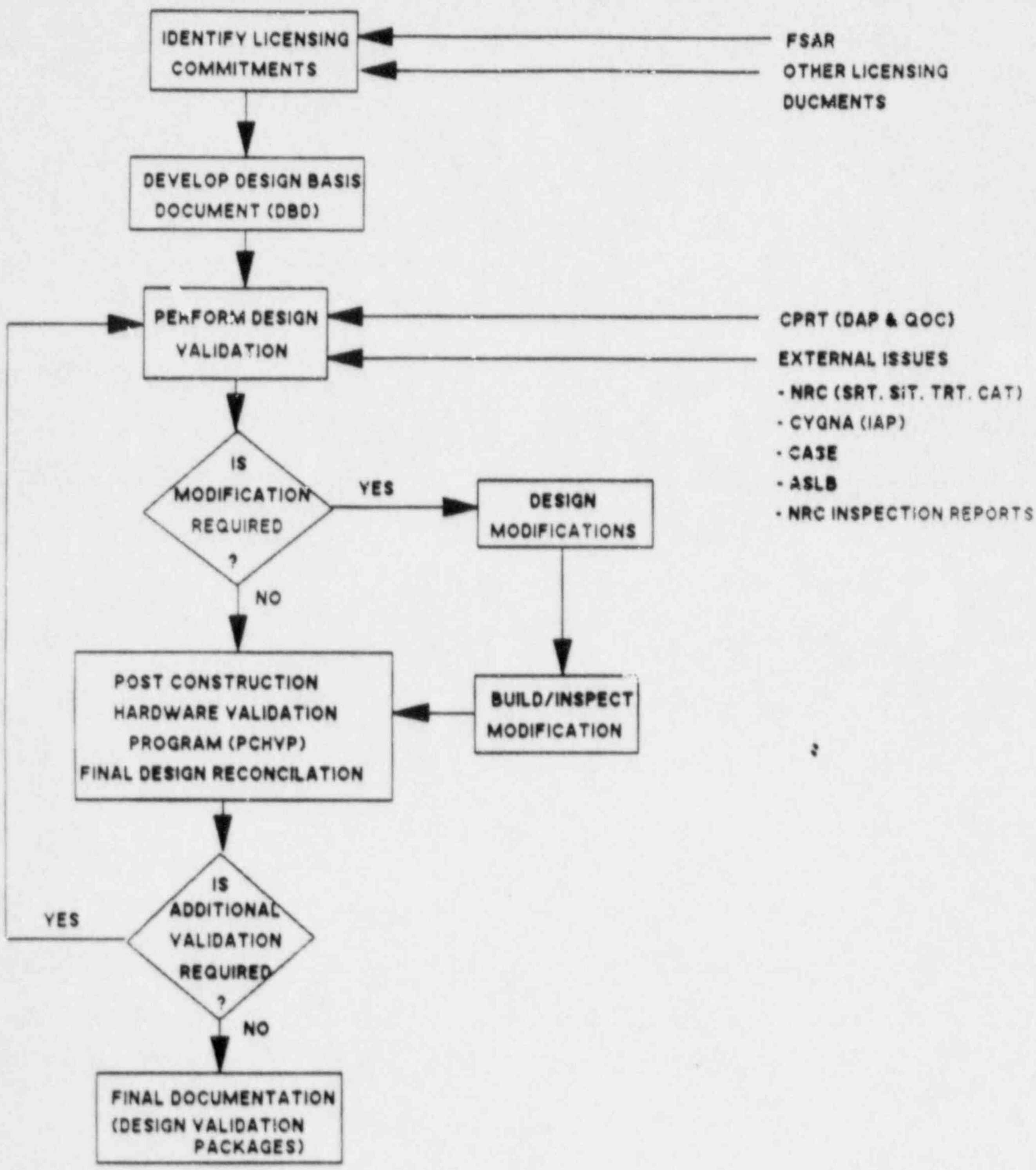
- Collection of as-built data for each conduit and conduit support (Walkdown)
- Design validation of each as-built conduit and conduit support
- The above includes junction box and box supports

O IMPLEMENT NECESSARY HARDWARE MODIFICATIONS

O COMPLETE FINAL RECONCILIATION PROCESS

- Implementation of PCHVP
- Incorporation of PCHVP Results
- Closure of open items
- Compilation of design validation packages

CORRECTIVE ACTION PROGRAM (CAP)
CONDUIT AND CONDUIT SUPPORTS
TRAINS A AND B AND TRAIN C LARGER THAN 2 INCH DIAMETER



CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A1

(GIR APPENDIX 1)

GOVERNING LOAD CASE FOR DESIGN

EXTERNAL SOURCE ISSUE:

THE ORIGINAL DESIGN MAY NOT HAVE PROPERLY CONSIDERED BOTH OBE AND SSE LOAD COMBINATIONS BY ASSUMING THAT A 60 PERCENT INCREASE IN ALLOWABLES FOR SSE WAS APPLICABLE TO ALL CONDUITS, CONDUIT SUPPORTS AND THEIR COMPONENTS.

ISSUE RESOLUTION/IMPLEMENTATION:

CONDUITS, CONDUIT SUPPORTS AND THEIR COMPONENTS ARE DESIGN VALIDATED FOR THE OBE AND SSE LOAD COMBINATIONS SEPARATELY UTILIZING OBE AND SSE ALLOWABLES RESPECTIVELY. CRITERIA USED IS DESCRIBED IN DESIGN VALIDATION PROCEDURES SAG.CP10 FOR CONDUITS AND SUPPORTS AND SAG.CP17 FOR JUNCTION BOXES.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A2

(GIR APPENDIX 2)

DYNAMIC AMPLIFICATION FACTORS (DAF)

EXTERNAL SOURCE ISSUE:

FSAR ALLOWS USE OF A DYNAMIC AMPLIFICATION FACTOR LESS THAN 1.5 ONLY IF JUSTIFICATION IS PROVIDED. IN THE ORIGINAL DESIGN, A DYNAMIC AMPLIFICATION FACTOR OF 1.0 TIMES RESPONSE SPECTRA PEAK ACCELERATIONS WAS USED WITHOUT PROPER JUSTIFICATION.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A2
(GIR APPENDIX 2)

DYNAMIC AMPLIFICATION FACTORS (DAF)
(CONTINUED)

ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION PROCEDURES (SAG.CP10, SAG.CP17, SAG.CP20, SAG.CP25) SPECIFY USE OF ANY OF THE FOLLOWING METHODS TO ACCOUNT FOR DYNAMIC AMPLIFICATION EFFECTS IN CONDUIT SYSTEM DESIGN VALIDATION. ALL THESE METHODS COMPLY WITH FSAR COMMITMENTS.

(I) ONE METHOD IS THE EQUIVALENT STATIC METHOD IN WHICH 1.5 TIMES RESPONSE SPECTRA PEAK ACCELERATIONS ARE USED INDEPENDENT OF CONDUIT SYSTEM FREQUENCY.

(II) IN THE EQUIVALENT STATIC METHOD WHEN DETERMINATION OF CONDUIT SYSTEM FREQUENCY IS MADE, DESIGN ACCELERATIONS JUSTIFIED BY DYNAMIC RESPONSE SPECTRA ANALYSIS ARE USED. DYNAMIC AMPLIFICATION FACTORS ARE INHERENTLY INCLUDED IN THESE DESIGN ACCELERATIONS.

(III) WHEN DYNAMIC RESPONSE SPECTRA ANALYSIS OF SPECIFIC CONDUIT SYSTEMS IS USED, DYNAMIC AMPLIFICATION FACTORS ARE INHERENTLY INCLUDED IN THE ANALYSIS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A3
(GIR APPENDIX 3)

COMBINATION OF DEADWEIGHT AND SEISMIC RESPONSES

EXTERNAL SOURCE ISSUE:

IN THE ORIGINAL DESIGN, THE LOAD DUE TO DEADWEIGHT WAS INCORRECTLY COMBINED WITH THE SEISMIC LOADS USING THE SRSS METHOD.

ISSUE RESOLUTION/IMPLEMENTATION:

DEADWEIGHT IS NOT INCLUDED WITHIN THE SRSS OF SEISMIC LOADS BUT IS ADDED SEPARATELY TO THE RESULTANT SEISMIC LOADS IN THE LOAD COMBINATIONS SPECIFIED IN DESIGN VALIDATION PROCEDURES SAG.CP10 AND SAG.CP17.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A4
(GIR APPENDIX 4)

MEASUREMENT OF EMBEDMENT FROM TOP OF CONCRETE FLOOR TOPPING

EXTERNAL SOURCE ISSUE:

NOTE 5A ON THE ORIGINAL DRAWING NO. 2323-S-0910 SH. G-4A ALLOWED THE 2-INCH THICK CONCRETE FLOOR TOPPING TO BE CONSIDERED IN DETERMINING EMBEDMENT LENGTH OF ANCHORS AT BUILDING ELEVATIONS 832'-6 AND BELOW. SINCE THE TOPPING INTEGRITY CANNOT BE ASSURED, THE EFFECT OF REDUCED EMBEDMENT MUST BE CONSIDERED.

ISSUE RESOLUTION/IMPLEMENTATION:

THE FLOORS WHERE SUPPORTS WITH HILTI-KWIK BOLTS ARE MOUNTED WERE REVIEWED AGAINST THE LIST OF FLOORS WHICH HAVE ARCHITECTURAL TOPPING DURING THE DESIGN VALIDATION EFFORT. DESIGN VALIDATION FOR SUCH SUPPORTS ON FLOORS WITH TOPPING CONSIDERED A 2-INCH REDUCTION OF BOLT EMBEDMENT LENGTH AS SPECIFIED IN DESIGN VALIDATION PROCEDURE SAG.CP10. ANCHOR BOLTS EMBEDDED ONLY IN CONCRETE TOPPING AND THOSE THAT DO NOT MEET THE ANCHOR BOLT ACCEPTANCE CRITERIA ARE BEING REPLACED. NOTE 5A WAS REVISED ACCORDINGLY.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A5
(GIR APPENDIX 5)

BOLT HOLE TOLERANCES AND EDGE DISTANCES

EXTERNAL SOURCE ISSUE:

A. On original drawing no. 2323-S-0910 SH. 6-1B, note 15 allowed bolt hole tolerances which vary with the bolt size and are larger than the AISC 1/16" tolerance. This tolerance may have resulted in oversized bolt holes.

ISSUE RESOLUTION/IMPLEMENTATION - A:

For steel to concrete connections, AISC bolt hole requirements are not applicable (AISC letter to L. D. Nace dated August 29, 1986). The effects of bolt hole sizes allowed by the original drawing no. 2323-S-0910 package were evaluated through analytical studies (Ebasco position paper "Effects of bolt hole oversize in CTH system and conduit system adequacy"). It was concluded that the steel to concrete connections with the existing bolt holes are acceptable.

For clamp connections which include cold-formed components, the AISI code is applicable. Clamp capacities were determined from tests as recommended by AISI code (CCL report nos. A-699-85 and A-702-86).

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A5

(GIR APPENDIX 5)

BOLT HOLE TOLERANCES AND EDGE DISTANCES

(CONTINUED)

FOR CONNECTIONS BETWEEN STRUCTURAL STEEL MEMBERS, TO ENSURE COMPLIANCE WITH AISC CODE, APPROPRIATE CORRECTIVE ACTION IS BEING TAKEN IN THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM.

BOLT HOLE TOLERANCES AND EDGE DISTANCES
(CONTINUED)

EXTERNAL SOURCE ISSUE:

B. Some original designs may not have provided the minimum edge distance stated in the AISC code. For example, CA-5A and CSM-42 supports have 3/4 inch edge distance in concrete to steel connection members versus 25/32 inch based on the code (1/32 inch difference).

ISSUE RESOLUTION/IMPLEMENTATION - B:

Edge distances in structural steel to structural steel connections contained in the revised drawing no. 2323-S-0910 package have been design validated in accordance with AISC code requirements.

Baseplate edge distances in steel to concrete anchorages were design validated in conformance with AISC code. Cases where edge distance values were outside the AISC manual table values were validated based on acceptable bearing stress calculations.

PSR SUBAPPENDIX A5
(GIR APPENDIX 5)

BOLT HOLE TOLERANCES AND EDGE DISTANCES
(CONTINUED)

FOR CLAMP CONNECTIONS WHICH INCLUDE COLD-FORMED COMPONENTS, THE AISI CODE IS APPLICABLE. CLAMPS WITH REDUCED EDGE DISTANCE DUE TO HOLE SIZE WERE TESTED AS RECOMMENDED BY AISI CODE (CCL REPORT NOS. A-699-85 AND A-702-86) TO DETERMINE CLAMP CAPACITIES USED IN DESIGN VALIDATION.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A6

(GIR APPENDIX 6)

FSAR LOAD COMBINATIONS

EXTERNAL SOURCE ISSUE:

ALL APPLICABLE LOADS AS DEFINED IN CPSES FSAR SECTION 3.8.4.3.3 MAY NOT HAVE BEEN EXPLICITLY CONSIDERED IN THE ORIGINAL DESIGN. SPECIFICALLY, LOADS DUE TO PIPE WHIP AND JET IMPINGEMENT WERE NOT ADDRESSED. ALSO, SEISMIC RESPONSE SPECTRA WHICH ENVELOPE THE CONTAINMENT BUILDING SHELL AND INTERNAL STRUCTURE RESPONSE SPECTRA SHOULD HAVE BEEN USED FOR CONDUIT AND CONDUIT SUPPORTS SUPPORTED BY BOTH THE CONTAINMENT BUILDING SHELL AND INTERNAL STRUCTURE.

ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION PROCEDURES SAG.CP10 AND SAG.CP17 SPECIFY ALL APPLICABLE LOADS AND LOAD COMBINATIONS TO BE CONSIDERED, BASED ON FSAR SECTION 3.8.4.3.3.

SAFETY RELATED CONDUIT AND CONDUIT SUPPORTS HAVE EITHER BEEN RELOCATED OR SHIELDED FROM PIPE WHIP, JET IMPINGEMENT AND INTERNALLY GENERATED MISSILES.

SAFETY RELATED CONDUITS LOCATED OUTDOORS HAVE BEEN SHOWN TO REQUIRE NO PROTECTION FROM TORNADO EFFECTS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A6
(GIR APPENDIX 6)

FSAR LOAD COMBINATIONS
(CONTINUED)

THERMAL EFFECTS WERE CONSIDERED AS SPECIFIED IN DESIGN VALIDATION PROCEDURES SAG.CP21 AND SAG.CP25.

SEISMIC RESPONSE SPECTRA WHICH ENVELOPE THE CONTAINMENT BUILDING SHELL AND INTERNAL STRUCTURE RESPONSE SPECTRA WERE USED FOR VALIDATION OF CONDUITS AND CONDUIT SUPPORTS SUPPORTED BY BOTH THE CONTAINMENT BUILDING SHELL AND INTERNAL STRUCTURE AS SPECIFIED IN DESIGN VALIDATION PROCEDURE SAG.CP25.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A7
(GIR APPENDIX 7)

SUPPORT SELF-WEIGHT

EXTERNAL SOURCE ISSUE:

THE SELF-WEIGHT OF THE SUPPORT WAS NOT UNIFORMLY CONSIDERED IN THE ORIGINAL DESIGN.

ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION PROCEDURES SAG.CP10 AND SAG.CP17 SPECIFY THAT THE SELF-WEIGHT BE EXPLICITLY AND CONSISTENTLY INCLUDED IN THE DESIGN VALIDATION.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A8
(GIR APPENDIX 8)

TORSION OF UNISTRUT MEMBER

EXTERNAL SOURCE ISSUE:

A. THE ISSUE WAS THAT TORSIONAL LOADING ON UNISTRUT MEMBERS WAS NOT CONSIDERED IN THE SUPPORT DESIGN.

ISSUE RESOLUTION/IMPLEMENTATION:

TORSIONAL EFFECTS HAVE BEEN CONSIDERED IN DESIGN VALIDATION. TESTS (CCL REPORT NO. A-678-85) WERE PERFORMED BY CORPORATE CONSULTING AND DEVELOPMENT COMPANY, LTD. (CCL) WHICH INCLUDED THE TORSIONAL LOAD EFFECT ON THE UNISTRUT MEMBERS. THE RESULTS OF THE TESTS WERE USED TO ESTABLISH ALLOWABLE CAPACITIES FOR SUPPORTS UTILIZING UNISTRUT MEMBERS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A8
(GIR APPENDIX 8)

TORSION OF UNISTRUT MEMBER
(CONTINUED)

EXTERNAL SOURCE ISSUE:

B. THE FOLLOWING ADDITIONAL ISSUES RESULTED FROM CYGNA'S REVIEW OF THE CCL TEST:

- o THE CONDUIT SUPPORT TYPES SELECTED FOR TESTING MAY NOT REPRESENT ALL SUPPORT TYPES INSTALLED AT CPSES. ALSO, TEST RESULTS FOR SOME CONDUIT SUPPORTS MAY HAVE BEEN AFFECTED BY IMPROPER TEST SET-UP.

- o ONLY ONE CONDUIT CLAMP TYPE (C-708-S) FOR LARGE CONDUIT SIZES WAS INCLUDED IN MOST OF THE TESTS.

TORSION OF UNISTRUT MEMBER

(CONTINUED)

ISSUE RESOLUTION/IMPLEMENTATION - B:

THE CONDUIT SUPPORT TEST SET-UP AND RESULTS (CCL REPORT NO. A-678-85) WERE REVIEWED AND CONDUIT CLAMP AND SUPPORT CAPACITIES WERE DEVELOPED AS FOLLOWS:

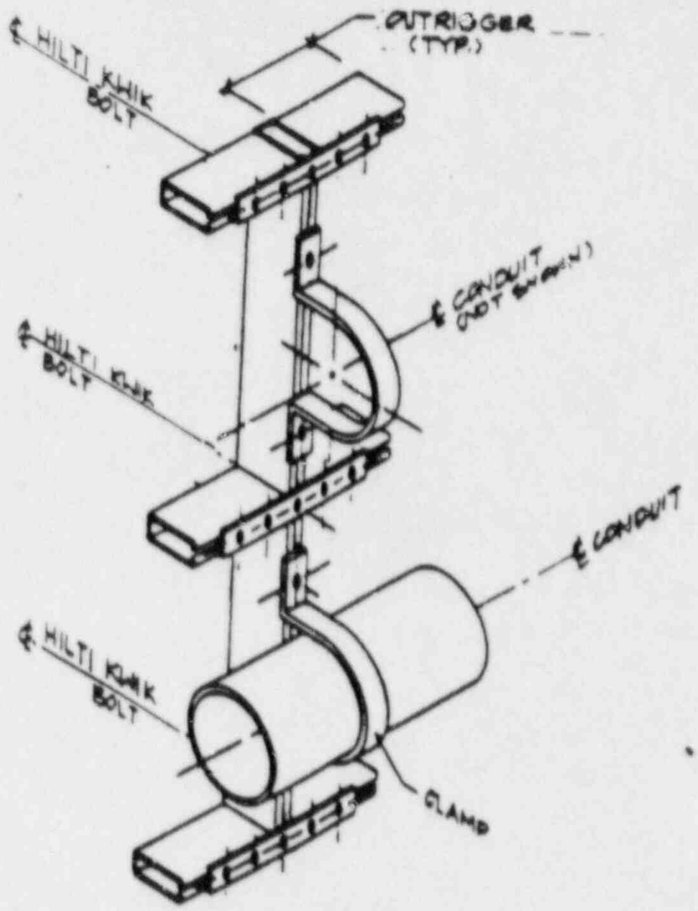
- ONLY UNISTRUT CONFIGURATIONS WHICH WERE UNAFFECTED BY THE TEST SET-UP ARE EMPLOYED AT CPSES. CONFIGURATIONS WHICH WERE NOT TESTED OR WERE UNSATISFACTORY WERE REPLACED. THE ALLOWABLE LOAD CAPACITIES FOR THE UNISTRUT SUPPORTS AT CPSES WERE DETERMINED UTILIZING TEST RESULTS. THESE ALLOWABLE LOAD CAPACITIES ARE SHOWN ON THE REVISED DRAWING NO. 2323-S-0910 PACKAGE.

- CONDUIT CLAMP CAPACITIES FOR ALL CLAMP TYPES USED IN CPSES CONDUIT SUPPORTS WERE ESTABLISHED BY TESTS (CCL REPORT NOS. A-699-85 AND A-702-86) AND INCORPORATED IN THE DESIGN VALIDATION PROCEDURE SAG.CP10.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A8
(GIR APPENDIX 8)

TORSION OF UNISTRUT MEMBER
(CONTINUED)



TEST CONFIGURATION FOR CONDUIT SUPPORT TYPE CA-1

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A9
(GIR APPENDIX 9)

USE OF CATALOG COMPONENTS

EXTERNAL SOURCE ISSUE:

A. THE ORIGINAL DESIGN WAS BASED ON THE APPLICATION OF AISC TO UNISTRUT CATALOG COMPONENTS WHICH MAY NOT BE CONSERVATIVE. AISI SHOULD HAVE BEEN USED.

B. THE FOLLOWING COMPONENTS WERE USED IN WAYS NOT RECOMMENDED BY THE VENDOR: UNISTRUT COMPONENTS, CLAMPS (UNISTRUT AND SUPERSTRUT), ANCHORAGES (HILTI-KWIK BOLT AND RICHMOND INSERTS) AND NELSON STUDS.

ISSUE RESOLUTION/IMPLEMENTATION - A & B:

ALL COMPONENTS EMPLOYED IN THE CONDUIT SUPPORTS ARE EITHER IN COMPLIANCE WITH VENDOR ALLOWABLES, OR ALLOWABLES HAVE BEEN DETERMINED BY TESTS AS RECOMMENDED BY AISI.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A10
(GIR APPENDIX 10)

ANCHOR BOLTS

EXTERNAL SOURCE ISSUE:

A. PRYING ACTION EFFECTS ON ANCHOR BOLT TENSION MAY NOT HAVE BEEN UNIFORMLY CONSIDERED IN THE ORIGINAL DESIGN.

ISSUE RESOLUTION/IMPLEMENTATION - A:

PRYING ACTION EFFECTS ARE INCLUDED IN DESIGN VALIDATION OF ALL BASE MEMBER ANCHORAGES. REQUIREMENTS ARE SPECIFIED IN DESIGN VALIDATION PROCEDURES SAG.CP10, SAG.CP17, AND SAG.CP29.

ANCHOR BOLTS
(CONTINUED)

EXTERNAL SOURCE ISSUE:

B. FOR CONDUIT SUPPORT CST-17, TYPE 17, THE ORIGINAL DESIGN DOES NOT CONSIDER MOMENTS INDUCED IN THE ANCHOR BOLT DUE TO SHEAR FORCES APPLIED ABOVE THE CONCRETE SURFACE.

ISSUE RESOLUTION/IMPLEMENTATION - B:

MOMENTS INDUCED IN THE ANCHOR BOLTS DUE TO SHEAR FORCES APPLIED ABOVE THE CONCRETE SURFACE ARE CONSIDERED IN DESIGN VALIDATION OF ALL MULTIDIRECTIONAL SUPPORTS (SAG.CP10 AND SAG.CP29). THE CST-17 TYPE SUPPORTS IN THIS PARTICULAR ISSUE ARE TRANSVERSE TYPE SUPPORTS, ALL OF WHICH ARE BEING ELIMINATED OR REPLACED BY MULTIDIRECTIONAL TYPE SUPPORTS.

ANCHOR BOLTS

(CONTINUED)

EXTERNAL SOURCE ISSUE:

C. OUTRIGGER HILTI-KWIK BOLTS FOR THE ORIGINAL CA-2A SUPPORTS WERE ASSUMED NOT TO TAKE ANY LOAD. HOWEVER, SOME LOAD MAY BE IMPOSED DUE TO CONDUIT LOADS AND PRESTRESSING OF THE SUPPORT. THE OUTRIGGER HILTI-KWIK BOLTS MAY NOT BE ADEQUATE IN RESISTING THESE LOADS SINCE THE DESIGN DRAWING WAIVES SEPARATION VIOLATIONS BETWEEN HILTI-KWIK BOLTS IN THE OUTRIGGERS AND ANY OTHER BOLTS.

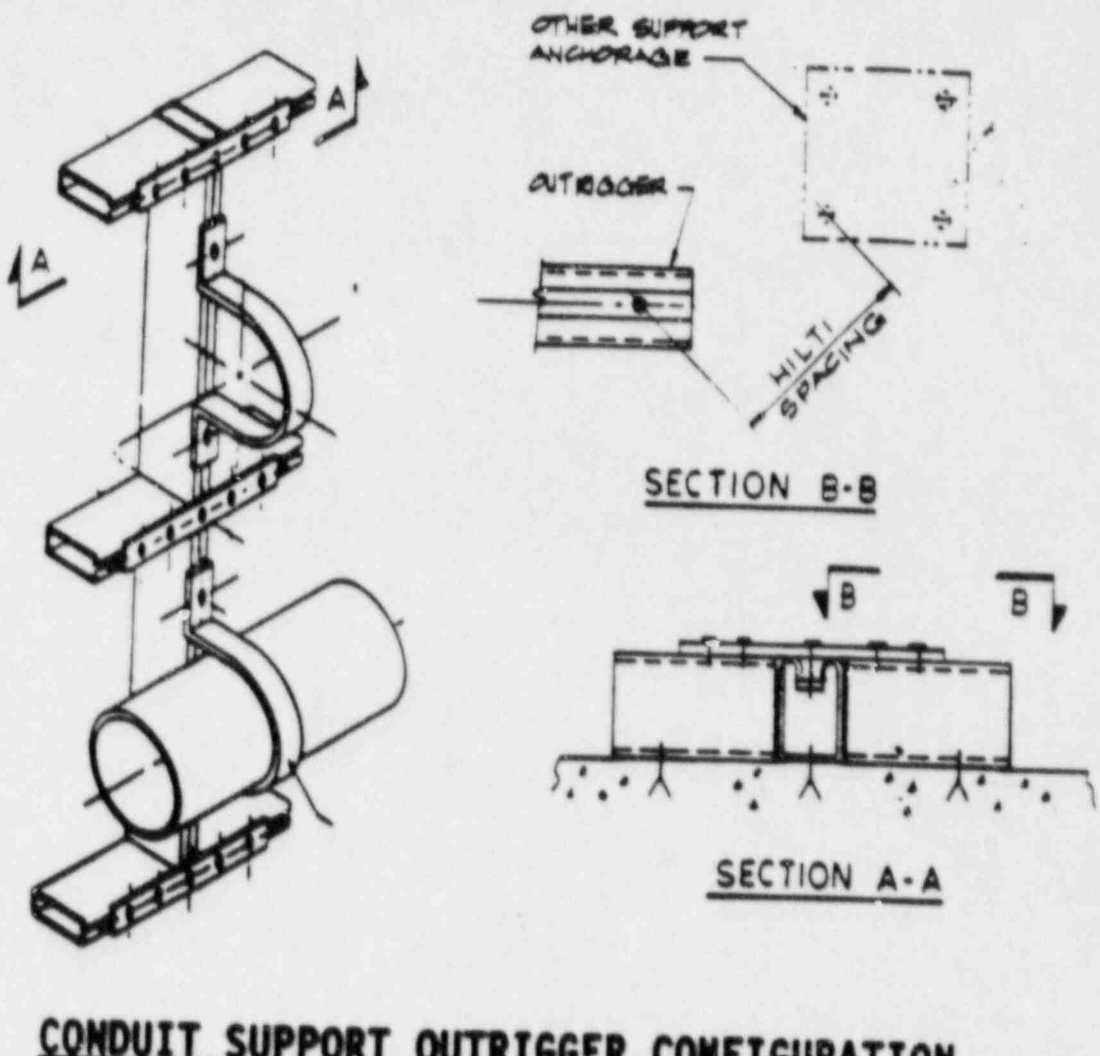
ISSUE RESOLUTION/IMPLEMENTATION - C:

CA-2A TYPE UNISTRUT SUPPORT WAS TESTED (CCL REPORT NO. A-678-85) WITHOUT HILTI-KWIK BOLTS ON THE OUTRIGGERS. THEREFORE, THESE HILTI-KWIK BOLTS ARE NOT REQUIRED TO ACHIEVE THE SUPPORT CAPACITY. VALIDATION OF OTHER SUPPORTS WHICH DO NOT COMPLY WITH SEPARATION CRITERIA WILL BE PERFORMED AS PART OF THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX-A10
(GIR APPENDIX 10)

ANCHOR BOLTS
(CONTINUED)



CONDUIT SUPPORT OUTRIGGER CONFIGURATION

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A10
(GIR APPENDIX 10)

ANCHOR BOLTS
(CONTINUED)

EXTERNAL SOURCE ISSUE:

D. ORIGINAL DRAWING NO. 2323-S-0910 SH. G-4A ALLOWED SUBSTITUTION OF RICHMOND INSERTS FOR HILTI-KWIK BOLTS. THIS SUBSTITUTION MAY HAVE RESULTED IN LOWER BOLT/INSERT CAPACITIES THAN THE ORIGINAL DESIGN BECAUSE RICHMOND INSERTS IN CLUSTER ARRANGEMENTS MAY HAVE LOWER CAPACITIES.

ISSUE RESOLUTION/IMPLEMENTATION - D:

REVISED DRAWING NO. 2323-S-0910 SH. G-4A NO LONGER PERMITS SUBSTITUTION OF RICHMOND INSERTS FOR HILTI-KWIK BOLTS. AS PART OF THE ENGINEERING WALKDOWN (CPE-EB-FVM-CS-033), ALL SUPPORTS HAVE BEEN INDIVIDUALLY AS-BUILT INCLUDING CONCRETE ANCHORAGE TYPE AND ARRANGEMENT. THE AS-BUILT CONFIGURATIONS HAVE BEEN DESIGN VALIDATED IN ACCORDANCE WITH DESIGN VALIDATION PROCEDURES SAG.CP10 AND SAG.CP29.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A11
(GIR APPENDIX 11)

LONGITUDINAL LOADS ON TRANSVERSE SUPPORTS

EXTERNAL SOURCE ISSUE:

LONGITUDINAL LOADS MAY NOT HAVE BEEN CONSIDERED IN THE ORIGINAL DESIGN OF SOME TRANSVERSE SUPPORTS.

ISSUE RESOLUTION/IMPLEMENTATION:

ALL LOADING DIRECTIONS ARE EVALUATED IN THE DESIGN VALIDATION OF CONDUIT SUPPORTS. ALL PREVIOUS "TRANSVERSE ONLY" SUPPORTS HAVE EITHER BEEN CONVERTED TO MULTI-DIRECTIONAL SUPPORTS OR REPLACED.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A12
(GIR APPENDIX 12)

HILTI KWIK BOLT SUBSTITUTIONS

EXTERNAL SOURCE ISSUE:

Note 4 on Sh. G-4A of original drawing No. 2323-S-0910 package, allowed substitution of Hilti-Kwik bolts with larger size Hilti-Kwik bolts. A situation may occur where the substituted bolts have a lower capacity than bolts in the original design.

ISSUE RESOLUTION/IMPLEMENTATION:

Drawing No. 2323-S-0910 SH. G-4A was revised to delete note 4. These bolt substitutions are no longer allowed.

The size and type of anchorage bolts were identified as part of an engineering walkdown (CPE-EB-FVM-CS-033). As-built configurations including bolt substitutions were evaluated on a case-by-case basis utilizing design validation procedure SAG.CP10.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A13

(GIR APPENDIX 13)

SUBSTITUTION OF SMALL CONDUITS ON CA TYPE SUPPORTS

EXTERNAL SOURCE ISSUE:

CA TYPE SUPPORT DRAWINGS ALLOWED SUBSTITUTION OF SMALLER CONDUITS FOR LARGER CONDUITS. SINCE CA TYPE SUPPORTS WERE DESIGNED USING ZPA VALUES FOR LARGE SIZE CONDUIT, AND SMALL CONDUIT SIZES WERE DESIGNED FOR PEAK ACCELERATIONS, THIS SUBSTITUTION MAY RESULT IN LARGER LOADS THAN REFLECTED IN THE ORIGINAL CALCULATIONS.

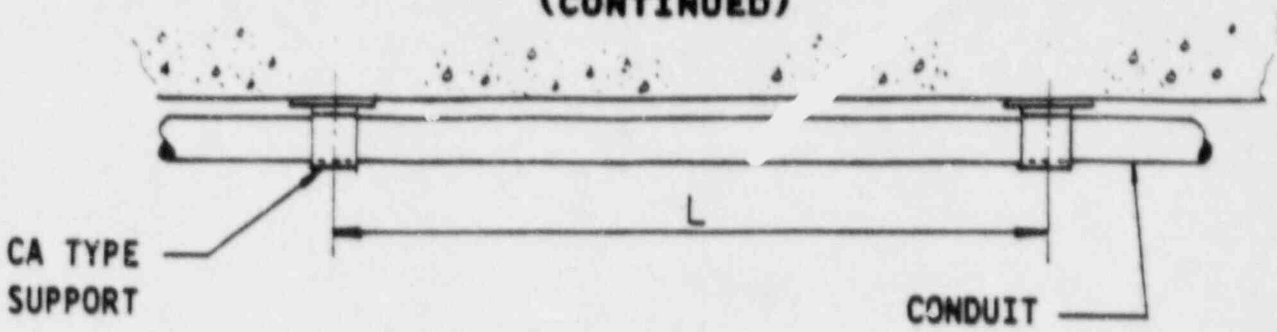
ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION PROCEDURE SAG.CP10 SPECIFIES THAT CA TYPE SUPPORTS SHALL BE DESIGN VALIDATED BASED ON DESIGN ACCELERATIONS WHICH BOUND ALL CONDUIT SIZES.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A13
(GIR APPENDIX 13)

SUBSTITUTION OF SMALL CONDUITS ON CA TYPE SUPPORTS
(CONTINUED)



ORIGINAL DESIGN

0 FOR LARGE SIZE CONDUITS (≥ 2" Ø), CONDUIT SPAN (L) IS RIGID AND CA TYPE SUPPORTS WERE DESIGNED FOR ZPA.

0 FOR SMALL SIZE CONDUITS (< 2" Ø), CONDUIT SPAN (L) IS FLEXIBLE AND DESIGNED FOR PEAK ACCELERATIONS.

PRESENT DESIGN

0 CONDUIT SPAN (L) IS ASSUMED TO BE FLEXIBLE FOR ALL CONDUIT SIZES.

0 CA TYPE SUPPORTS ARE DESIGN VALIDATED FOR DESIGN ACCELERATIONS WHICH BOUND ALL CONDUIT SIZES.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A14
(GIR APPENDIX 14)

USE OF CA TYPE SUPPORTS IN FLEXIBLE SPANS

EXTERNAL SOURCE ISSUE:

CA TYPE SUPPORTS FOR CONDUIT WITH DIAMETER EQUAL TO OR GREATER THAN 2" WERE DESIGNED FOR ZPA. THE ORIGINAL CALCULATIONS DID NOT CONSIDER THE FACT THAT SEISMIC ACCELERATIONS OF THE CA SUPPORT MAY BE AFFECTED BY THE FLEXIBILITY OF THE CONDUIT SPAN (LS).

ISSUE RESOLUTION/IMPLEMENTATION:

ZPA IS NOT USED FOR DESIGN VALIDATION OF CA TYPE SUPPORTS. THE DESIGN VALIDATION PROCEDURE SAG.CP10 SPECIFIES THAT ALL CA TYPE SUPPORTS ARE TO BE DESIGN VALIDATED BASED ON DESIGN ACCELERATIONS WHICH INCLUDE THE FLEXIBILITY EFFECT OF THE SPANS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A15
(GIR APPENDIX 15)

STRESSES IN CABLE TRAYS DUE TO ATTACHED CONDUIT SUPPORTS

EXTERNAL SOURCE ISSUE:

SH. CSD-16 OF DRAWING NO. 2323-S-0910 PACKAGE ALLOWS CONDUIT TO BE ATTACHED TO CABLE TRAY. IN THE ORIGINAL DESIGN, CABLE TRAY MAY HAVE BEEN DESIGNED WITHOUT ADDITIONAL CONDUIT LOAD. IN ADDITION, ZPA SHOULD NOT BE USED TO COMPUTE CONDUIT LOAD SINCE CABLE TRAY MAY BE FLEXIBLE.

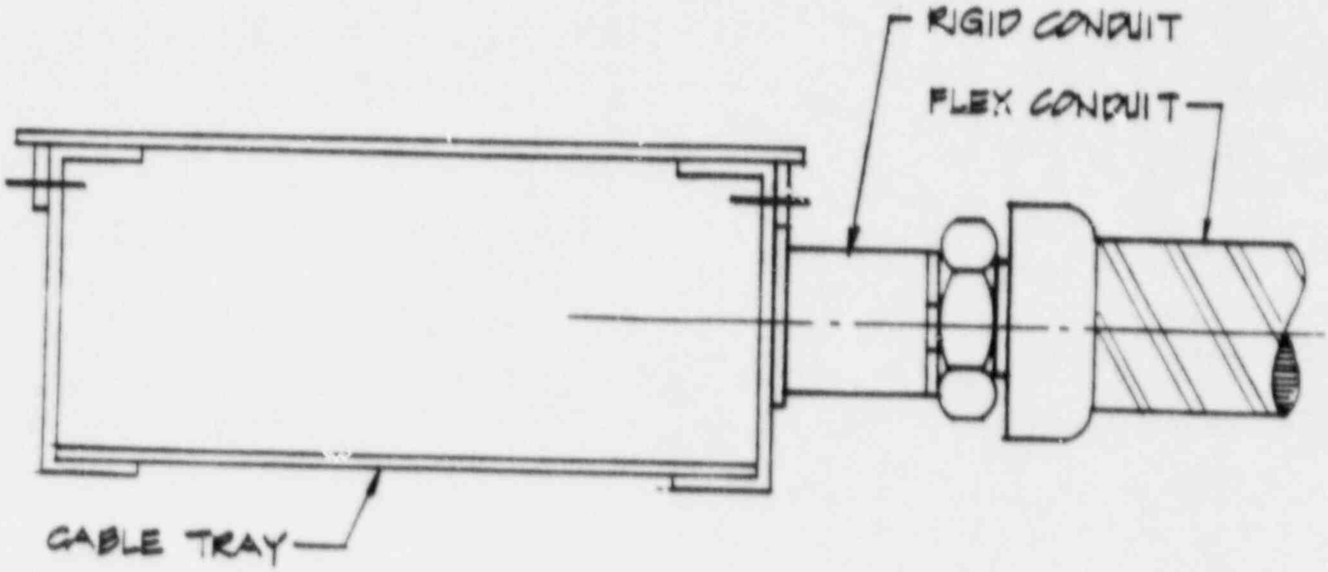
ISSUE RESOLUTION/IMPLEMENTATION:

THE DESIGN VALIDATION PROCEDURE SAG.CP10 SPECIFIES THAT THE CONDUIT AND ITS CONNECTION TO THE CABLE TRAY ARE TO BE DESIGN VALIDATED FOR 1.5 TIMES RESPONSE SPECTRA PEAK ACCELERATION. DEADWEIGHT FOR BOTH THE RIGID AND MAXIMUM FLEXIBLE CONDUIT ALLOWED IN SH. CSD-16 OF DRAWING NO. 2323-S-0910 PACKAGE WERE INCLUDED IN THE DESIGN VALIDATION OF THE CONDUIT. IN ACCORDANCE WITH CABLE TRAY WALKDOWN PROCEDURE CPE-EB-FVM-048, SUCH CONFIGURATIONS ARE BEING IDENTIFIED AND EVALUATED IN THE CABLE TRAY POST CONSTRUCTION HARDWARE VALIDATION PROGRAM (SEE EXTERNAL SOURCE ISSUE NO. 32 FOR CABLE TRAY AND CABLE TRAY HANGERS).

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A15
(GIR APPENDIX 15)

STRESSES IN CABLE TRAYS DUE TO ATTACHED CONDUIT SUPPORTS
(CONTINUED)



TYPICAL FLEXIBLE CONDUIT CONNECTED TO LADDER/SOLID BOTTOM TRAY DRAWING NO. 2323-S-0910, SHEET CSD-16.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A16
(GIR APPENDIX 16)

INCREASES IN ALLOWABLE SPAN LENGTHS

EXTERNAL SOURCE ISSUE:

ALLOWABLE CONDUIT LENGTHS (LA SPANS) WERE INCREASED IN THE ORIGINAL CALCULATIONS BASED ON CHANGES IN RESPONSE SPECTRA. THE EFFECT OF THIS CHANGE ON CONDUIT STRESS LEVELS WAS NOT PROPERLY EVALUATED.

ISSUE RESOLUTION/IMPLEMENTATION:

SPANS OF THIS TYPE (LA SPANS) HAVE BEEN DELETED FROM REVISED DRAWING NO. 2323-S-0910 PACKAGE. DESIGN VALIDATION PROCEDURES SAG.CP10, SAG.CP20, AND SAG.CP25 REQUIRE THAT CONDUIT STRESSES BE EVALUATED FOR ACTUAL SPAN LENGTHS.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A17

(GIR APPENDIX 17)

SUBSTITUTION OF NEXT HEAVIER STRUCTURAL MEMBER

EXTERNAL SOURCE ISSUE:

No[illegible]n Sh. G-1A of the original drawing No. 2323-S-0910 package all[illegible]ed the substitution of the next heavier structural member. Documentation of this substitution in the original design was inadequate and self-weight of the support was not properly considered.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A17
(GIR APPENDIX 17)

SUBSTITUTION OF NEXT HEAVIER STRUCTURAL MEMBER
(CONTINUED)

ISSUE RESOLUTION/IMPLEMENTATION:

NOTE 5 ALLOWING SUBSTITUTION OF THE NEXT HEAVIER STRUCTURAL MEMBER WAS DELETED FROM SH. G-1A OF THE REVISED DRAWING NO. 2323-S-0910 PACKAGE.

MEMBER SIZES WERE IDENTIFIED DURING ENGINEERING WALKDOWN (CPE-EB-FVM-CS-033). FOR OPEN SECTION MEMBERS THE ACTUAL SECTION THICKNESS WAS RECORDED FOR DESIGN VALIDATION. FOR SINGLE CANTILEVER TYPE AND L-SHAPED CANTILEVER TYPE SUPPORTS UTILIZING TUBE STEEL MEMBERS, AN ENGINEERING STUDY (EBASCO CALCULATION BOOK NOS. SUPT-0247 AND SPAN-1189) WAS PERFORMED TO EVALUATE THE EFFECT OF SUBSTITUTION OF THE NEXT HEAVIER MEMBER ON SUPPORT CAPACITIES. RESULTS OF THE ENGINEERING STUDY ARE INCORPORATED INTO DESIGN VALIDATION PROCEDURE SAG.CP2[illegible] FOR THE DESIGN VALIDATION OF SUCH SUPPORTS. OTHER SUPPORTS UTILIZING TUBE STEEL SECTIONS WERE CONSERVATIVELY VALIDATED (DESIGN VALIDATION PROCEDURE SAG.CP25) UTILIZING THE WEIGHT OF THE NEXT HEAVIER MEMBER AND THE SMALLER SECTIONAL PROPERTIES OF THE AS-DESIGNED MEMBER SHOWN ON THE DESIGN DRAWINGS.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A18

(GIR APPENDIX 18)

CLAMP USAGE

EXTERNAL SOURCE ISSUE:

THE ORIGINAL DESIGN ALLOWED ALTERATION OF CLAMP ASSEMBLY COMPONENTS. THESE ALTERATIONS MAY HAVE CREATED A MINIMUM EDGE DISTANCE VIOLATION AND DISTORTION DURING INSTALLATION. JUSTIFICATION IS REQUIRED FOR OMISSION, ALTERATION OR DISTORTION OF WASHERS, REAMING OF CLAMP HOLES AND CUTTING OFF A PORTION OF THE CLAMP EARS.

ISSUE RESOLUTION/IMPLEMENTATION:

THE CLAMP TEST PROGRAM PERFORMED BY CCL (CCL REPORT NOS. A-699-85 AND A-702-86) UTILIZED THREE DIRECTIONAL LOADING AND CONSIDERED THE FOLLOWING:

- REAMING OF CLAMP HOLES
- CLAMP EDGE DISTANCE
- BOLT TYPE AND SIZE
- OMISSION, ALTERATION OR DISTORTION OF WASHERS
- CLAMP DISTORTIONS
- CLAMP MODIFICATION BY CUTTING OFF A PORTION OF CLAMP EARS

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A18
(GIR APPENDIX 18)

CLAMP USAGE
(CONTINUED)

THE CLAMP ALLOWABLES ARE BASED ON THE ABOVE TESTS AND WERE INCORPORATED INTO DESIGN VALIDATION PROCEDURE SAG.CP10.

IN ADDITION, EBASCO REVIEWED AND IDENTIFIED REVISIONS REQUIRED TO THE INSTALLATION SPECIFICATIONS, CONSTRUCTION PROCEDURE, AND QUALITY CONTROL INSPECTION PROCEDURE (NQA 3.09-2.03 AND ECP-19) TO PRECLUDE UNAUTHORIZED MODIFICATIONS TO CLAMP AND CLAMP ASSEMBLY COMPONENTS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A19
(GIR APPENDIX 19)

DOCUMENTATION DEVIATIONS BETWEEN INSPECTION REPORTS, CMCs AND IN-FP DRAWINGS

EXTERNAL SOURCE ISSUE:

DIFFERENCES WERE IDENTIFIED BETWEEN SOME FINAL CONDUIT LINE INSPECTION REPORTS (IRs) AND THE CORRESPONDING COMPONENT MODIFICATION CARDS (CMCs) AND/OR INDIVIDUALLY ENGINEERED FIRE PROTECTED CONDUIT SYSTEM (IN-FP) DRAWINGS. ADDITIONALLY, DIFFERENCES WERE IDENTIFIED BETWEEN THE FINAL IRs AND THE INSTALLED CONDUIT CONFIGURATIONS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A19
(GIR APPENDIX 19)

DOCUMENTATION DEVIATIONS BETWEEN INSPECTION REPORTS, CMCs AND IN-FP DRAWINGS
(CONTINUED)

ISSUE RESOLUTION/IMPLEMENTATION:

AN ENGINEERING WALKDOWN (CPE-EB-FVM-CS-033) OF CONDUITS AND CONDUIT SUPPORTS WAS PERFORMED TO DETERMINE THE AS-BUILT CONFIGURATIONS. DESIGN VALIDATION OF THE CONDUIT AND CONDUIT SUPPORTS WAS PERFORMED IN ACCORDANCE WITH DESIGN VALIDATION PROCEDURES (SAG.CP10, SAG.CP17, SAG.CP25 AND SAG.CP29) AND REVISED DRAWING NO. 2323-S-0910 PACKAGE UTILIZING THE AS-BUILT DATA.

EACH OF THE IDENTIFIED DOCUMENTATION AND CONDUIT CONFIGURATION DISCREPANCIES IDENTIFIED UNDER THIS ISSUE WERE EVALUATED. A DETERMINATION WAS MADE THAT THERE IS NO SAFETY SIGNIFICANCE TO ANY OF THE IDENTIFIED DEVIATIONS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A20
(GIR APPENDIX 20)

NELSON STUDS

EXTERNAL SOURCE ISSUE:

ORIGINAL CALCULATIONS TO QUALIFY NELSON STUDS USED IN CONDUIT CONNECTIONS DETAILS MAY NOT ACCOUNT FOR THE FLEXIBILITY OF CLAMP AND SHIM PLATE, RELAXATION OF PRELOAD AND ADDITIONAL MOMENT ON THE STUD. ALSO, ANALYSIS OF THE SHIM PLATE SUBJECTED TO PRETENSION LOADS IN THE NELSON STUDS MAY NOT BE ADEQUATE.

ISSUE RESOLUTION/IMPLEMENTATION:

ALLOWABLE CAPACITIES FOR CLAMPS USING NELSON STUDS HAVE BEEN ESTABLISHED BASED ON CCL TESTS (CCL REPORT NOS. A-699-85 AND A-702-86). THESE TESTS TOOK INTO ACCOUNT THE FLEXIBILITY OF THE CLAMP AND SHIM PLATE, RELAXATION OF THE PRELOAD AND ADDITIONAL MOMENT ON THE STUD (SEE EXTERNAL SOURCE ISSUE NO. 18). THESE ALLOWABLE CLAMP CAPACITIES WERE INCORPORATED INTO THE DESIGN VALIDATION PROCEDURE SAG.CP10.

IN ADDITION, THE ADEQUACY OF SHIM PLATE CONFIGURATIONS SUBJECTED TO PRETENSION LOADS IN THE NELSON STUDS WAS CONFIRMED BY ENGINEERING STUDIES (EBASCO CALCULATION BOOK NOS. 44 AND SPAN-1191).

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A21
(GIR APPENDIX 21)

CONDUIT FIRE PROTECTION CALCULATIONS

EXTERNAL SOURCE ISSUE:

A. ORIGINAL DESIGN CONSIDERED A ROUND CONFIGURATION OF THERMOLAG MATERIAL AROUND CONDUITS. A SQUARE CONFIGURATION OF THERMOLAG MATERIAL IS ALSO USED AT CPSES. DOCUMENTATION OF THE SPECIFIC CONFIGURATION INSTALLED WAS NOT MAINTAINED.

B, C, D. ORIGINAL CALCULATIONS USED SUPPORT CAPACITIES WHICH MAY NOT BE APPLICABLE TO THE SPECIFIC CONFIGURATIONS.

ISSUE RESOLUTION/IMPLEMENTATION - A, B, C, & D:

THE THERMOLAGGED CONDUIT SYSTEMS WERE AS-BUILT AND THE ACTUAL THERMOLAG CONFIGURATIONS WERE DOCUMENTED. DESIGN VALIDATION OF THERMOLAGGED SYSTEMS WAS PERFORMED USING SUPPORT CAPACITIES CONTAINED IN THE REVISED 2323-S-0910 DRAWING PACKAGE AND THE AS-DESIGNED SUPPORT CONFIGURATIONS. AS-DESIGNED SUPPORT CONFIGURATIONS ARE BEING CONFIRMED AS PART OF THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A22
(GIR APPENDIX 22)

SPAN INCREASE FOR FIRE PROTECTED SPANS

EXTERNAL SOURCE ISSUE:

THE ORIGINAL DESIGN USED THE CONDUIT YIELD STRESS DATA FROM VENDOR'S TESTS IN WHICH THE YIELD STRESS VALUE VARIES WITH CONDUIT NOMINAL SIZE. THIS IS NOT CONSIDERED TO BE APPROPRIATE. ORIGINAL DESIGN ALSO USED A DAF (DYNAMIC AMPLIFICATION FACTOR) OF 1.0 IN THE CALCULATIONS.

ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION PROCEDURE SAG.CP10 SPECIFIES THAT THE CONDUIT YIELD STRESS SHALL BE 25,000 POUNDS PER SQUARE INCH (PSI) FOR ALL CONDUIT SIZES WHICH IS THE LOWEST YIELD STRESS FOR ANY CONDUIT USED AT CPSES.

IN ADDITION, FIRE PROTECTED CONDUIT SYSTEMS WERE DESIGN VALIDATED UTILIZING THE RESPONSE SPECTRA ANALYSIS METHOD WHICH INHERENTLY INCORPORATES DYNAMIC AMPLIFICATION EFFECTS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A23
(GIR APPENDIX 23)

GROUTED PENETRATIONS

EXTERNAL SOURCE ISSUE:

IN THE ORIGINAL DESIGN, ALL GROUTED PENETRATIONS WERE CONSIDERED TO BE MULTIDIRECTIONAL SUPPORTS. THE LONGITUDINAL LOAD CAPACITY (PARALLEL TO CONDUIT) FOR GROUTED PENETRATIONS MAY NOT HAVE BEEN COMPLETELY ADDRESSED IN THE ORIGINAL DESIGN CALCULATIONS.

ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION PROCEDURE SAG.CP10 PROVIDES DESIGN CRITERIA AND ALLOWABLE BOND STRESS BETWEEN THE CONDUIT AND CONCRETE WALLS OR SLABS FOR CONDUIT PENETRATIONS. THIS CRITERIA IS USED FOR THE DETERMINATION OF THE LONGITUDINAL LOAD CAPACITY FOR GROUTED PENETRATIONS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A24
(GIR APPENDIX 24)

RIGIDITY OF CA-TYPE SUPPORTS

EXTERNAL SOURCE ISSUE:

IN THE ORIGINAL DESIGN, CA TYPE SUPPORTS WERE ASSUMED TO BE RIGID (HAVING SUPPORT FREQUENCY EQUAL TO OR GREATER THAN 33.0 HZ). THIS ASSUMPTION WAS NOT VALIDATED IN THE ORIGINAL DESIGN CALCULATIONS.

ISSUE RESOLUTION/IMPLEMENTATION:

CA TYPE SUPPORTS WERE NOT ASSUMED TO BE RIGID IN THE DESIGN VALIDATION. FREQUENCIES FOR SUCH SUPPORTS WERE CALCULATED IN ACCORDANCE WITH DESIGN VALIDATION PROCEDURES SAG.CP10, SAG.CP25 AND SAG.CP29.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A25

(GIR APPENDIX 25)

ENVELOPING CONFIGURATIONS FOR DESIGN

EXTERNAL SOURCE ISSUE:

THE ORIGINAL GENERIC SUPPORT DESIGN DID NOT CONSIDER THE MOST CRITICAL SUPPORT CONFIGURATIONS, I.E. MAXIMUM LOAD ECCENTRICITIES, INSTALLATION TOLERANCES, MEMBER SUBSTITUTIONS, BOLT SUBSTITUTIONS, WEIGHT OF SUPPORT MEMBER COMPONENTS AND OVERHANG PORTION OF SUPPORT MEMBERS.

ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION OF GENERIC SUPPORTS SHOWN IN REVISED DRAWING NO. 2323-S-0910 PACKAGE WAS PERFORMED TO ESTABLISH GENERIC SUPPORT CAPACITIES. THIS VALIDATION INCLUDED MAXIMUM LOAD ECCENTRICITIES, ALLOWED INSTALLATION TOLERANCES, MEMBER SUBSTITUTIONS (SEE EXTERNAL SOURCE ISSUE NO. 17), BOLT SUBSTITUTIONS (SEE EXTERNAL SOURCE ISSUE NO. 12), WEIGHT OF SUPPORT MEMBER COMPONENTS AND OVERHANG PORTION OF SUPPORT MEMBERS.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A26

(GIR APPENDIX 26)

DESIGN DRAWING DISCREPANCIES

EXTERNAL SOURCE ISSUE:

CERTAIN DISCREPANCIES AND INCONSISTENCIES MAY EXIST BETWEEN THE ORIGINAL DESIGN DRAWINGS (GENERIC, MODIFIED AND "IN" SUPPORTS) AND ORIGINAL CALCULATIONS, INCLUDING MISSING INFORMATION SUCH AS BASE PLATE SIZE, CLAMP TYPE AND EDGE DISTANCE.

ISSUE RESOLUTION/IMPLEMENTATION:

AN ENGINEERING WALKDOWN (CPE-EB-FVM-CS-033) WAS PERFORMED TO PROVIDE AS-BUILT INFORMATION FOR CONDUIT SUPPORT CONFIGURATIONS. THE DRAWING NO. 2323-S-0910 PACKAGE WHICH CONTAINS GENERIC, MODIFIED AND "IN" SUPPORTS WAS REVISED TO INCORPORATE THE AS-BUILT DATA. THE AS-BUILT SUPPORT CONFIGURATIONS WERE DESIGN VALIDATED IN ACCORDANCE WITH DESIGN VALIDATION PROCEDURES SAG.CP10, SAG.CP25 AND SAG.CP29.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A27
(GIR APPENDIX 27)

WALKDOWN DISCREPANCIES

EXTERNAL SOURCE ISSUE - A, B, C, D, E, AND F:

CONDUIT SUPPORT DISCREPANCIES EXISTED BETWEEN THE INSTALLED CLAMPS, ANCHOR BOLTS, STRUCTURAL STEEL MEMBERS AND UNISTRUT COMPONENTS AND CORRESPONDING ORIGINAL DESIGN DRAWINGS. IN ADDITION, SOME COMMODITY CLEARANCES AND ANCHOR BOLT SPACINGS WERE NOT IN ACCORDANCE WITH DESIGN CRITERIA.

ISSUE RESOLUTION/IMPLEMENTATION - A, B, C, D, E AND F:

CONDUIT AND CONDUIT SUPPORTS WERE AS-BUILT AS PART OF AN ENGINEERING WALKDOWN (CPE-EB-FVM-CS-033). THE AS-BUILT CONFIGURATIONS WERE DOCUMENTED IN THE DRAWING NO. 2323-S-0910 PACKAGE AND DESIGN VALIDATED IN ACCORDANCE WITH DESIGN VALIDATION PROCEDURES SAG.CP10, SAG.CP17, SAG.CP25 AND SAG.CP29.

COMMODITY CLEARANCES AND ANCHOR BOLT SPACINGS ARE BEING VALIDATED AS PART OF THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A28
(GIR APPENDIX 28)

SYSTEMS CONCEPT

EXTERNAL SOURCE ISSUE:

IN THE ORIGINAL DESIGN OF TWO-BOLT CONCRETE SURFACE MOUNTED SUPPORTS, THE ACCEPTABILITY OF THE SUPPORT WAS ESTABLISHED BY ASSUMING THAT THE MOMENT GENERATED BY THE ECCENTRICALLY APPLIED LONGITUDINAL LOAD WOULD NOT BE RESISTED BY THE SUPPORT. THIS MOMENT WOULD BE BALANCED BY A LOAD COUPLE CONSISTING OF FORCES GENERATED AT THE SUPPORT OF INTEREST AND THE NEXT SUPPORT. POSSIBLE DIFFERENCES IN SUPPORT AND CONDUIT STIFFNESSES WERE NOT CONSIDERED. APPLICABILITY OF THESE CALCULATIONS TO OTHER SUPPORTS WAS NOT DEMONSTRATED.

ISSUE RESOLUTION/IMPLEMENTATION:

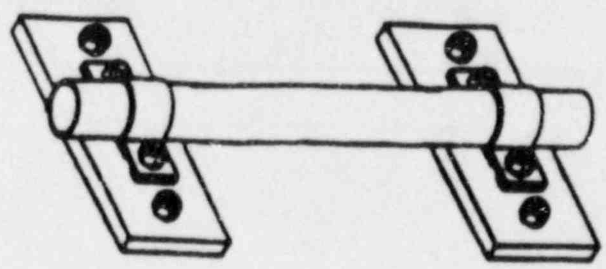
DESIGN VALIDATION PROCEDURES SAG.CP10 AND SAG.CP29 REQUIRE THAT LOAD ECCENTRICITY EFFECTS BE INCLUDED IN THE DESIGN VALIDATION OF ALL CONDUIT SUPPORTS.

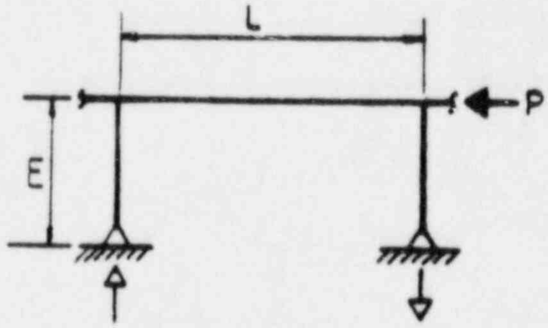
TWO-BOLT CONCRETE SURFACE MOUNTED SUPPORTS HAVE BEEN DESIGN VALIDATED BY CONSIDERING THAT THE MOMENTS INDUCED BY ECCENTRICALLY APPLIED LONGITUDINAL LOADS ARE SHARED BETWEEN THE SUPPORT AND THE CONDUIT IN ACCORDANCE WITH THE STIFFNESS OF THE SYSTEM COMPONENTS.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

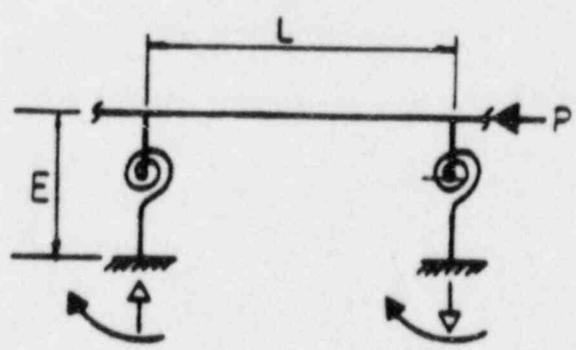
PSR SUBAPPENDIX A28
(GIR APPENDIX 28)

SYSTEMS CONCEPT
(CONTINUED)





ORIGINAL DESIGN



PRESENT DESIGN

P = ECCENTRICALLY APPLIED CONDUIT LONGITUDINAL LOAD

L = CONDUIT SPAN LENGTH

E = ECCENTRICITY FROM CENTER OF CONDUIT TO BASE PLATE

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A29
(GIR APPENDIX 29)

CUMULATIVE EFFECT OF REVIEW ISSUES

EXTERNAL SOURCE ISSUE:

SMALL UNCONSERVATISMS RESULTING FROM SEPARATE ISSUES MAY HAVE SIGNIFICANT CUMULATIVE EFFECT FOR SUPPORTS IMPACTED BY MORE THAN ONE ISSUE.

ISSUE RESOLUTION/IMPLEMENTATION:

THERE IS NO CUMULATIVE UNCONSERVATIVE EFFECT OF ISSUES BECAUSE:

- OVERALL DESIGN VALIDATION APPROACH HAS ADDRESSED EACH ISSUE BOTH INDIVIDUALLY AND COLLECTIVELY.
- DESIGN VALIDATION WAS BASED ON AS-BUILT DATA.
- DESIGN VALIDATION PROCEDURES SAG.CP10, SAG.CP17, SAG.CP21, SAG.CP25, AND SAG.CP29 PROVIDE CONTROL OF THE DESIGN PROCESS.
- ALL FINAL DESIGNS ARE IN CONFORMANCE WITH APPLICABLE CODES.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX A30
(CPRT - QOC ISSUE NO. 1)

CONDUIT UNIONS

EXTERNAL SOURCE ISSUE:

CONDUITS JOINED TOGETHER BY UNIONS WHICH ARE LOOSE COULD RESULT IN THE TWO ENDS OF THE CONDUIT BECOMING FREE UNDER VIBRATION. THE STRUCTURAL CONTINUITY OF THE CONDUIT COULD THEN BE AFFECTED AND THE CABLE HOUSED THEREIN MAY BE SUBJECT TO LOADS NOT CONSIDERED IN DESIGN.

ISSUE RESOLUTION/IMPLEMENTATION:

THE ISSUE HAS BEEN RESOLVED BY THE SPECIFIC UNION TIGHTNESS VERIFICATION REQUIREMENTS INCORPORATED INTO THE CONSTRUCTION/ INSTALLATION AND QUALITY CONTROL INSPECTION PROCEDURES (ECP-19 AND NQA 3.09-2.03). THIS VERIFICATION IS PART OF THE POST CONSTRUCTION HARDWARE VALIDATION PROGRAM.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX B1

(SDAR CP-85-19)

CONDUIT SUPPORT SPANS

CAP ISSUE:

THE ORIGINAL DESIGN USED THE CONDUIT YIELD STRESS DATA FROM VENDOR'S TESTS IN WHICH THE YIELD STRESS VALUE VARIES WITH CONDUIT NOMINAL SIZE. THIS IS NOT CONSIDERED, TO BE APPROPRIATE.

ISSUE RESOLUTION/IMPLEMENTATION:

DESIGN VALIDATION PROCEDURE SAG.CP10 SPECIFIES THAT THE CONDUIT YIELD STRESS SHALL BE 25,000 POUNDS PER SQUARE INCH (PSI) FOR ALL CONDUIT SIZES WHICH IS THE LOWEST YIELD STRESS FOR ANY CONDUIT USED AT CPSES.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX B2

(SDAR CP-85-31)

ELECTRICAL RACEWAY SUPPORT SYSTEM

CAP ISSUE:

Separation Barrier Material (SBM) and Radiant Energy Shield (RES) material were installed on Class 1E conduit in order to meet the FSAR and Regulatory Guide 1.75 electrical separation criteria. However, the original design of conduit and conduit supports constructed prior to the installation of the SBM and RES did not account for the additional weight imposed.

ISSUE RESOLUTION/IMPLEMENTATION:

Conduit and conduit supports with Separation Barrier Material (SBM) and Radiant Energy Shield (RES) material were design validated in accordance with design validation procedure SAG.CP25 which included SBM and RES weights.

In addition, the procedure governing design changes (ECE 5.01-I3) requires that when SBM or RES material is added to electrical raceways, the conduit and conduit supports discipline group be notified.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX B3
(SDAR CP-85-34)

CONDUIT SUPPORT DESIGN

CAP ISSUE:

DISCREPANCIES MAY HAVE EXISTED BETWEEN AS-BUILT AND AS-DESIGNED CONDUIT AND CONDUIT SUPPORT CONFIGURATIONS. IN ADDITION, THE ORIGINAL DESIGN CRITERIA MAY NOT HAVE APPROPRIATELY ADDRESSED CERTAIN DESIGN REQUIREMENTS. A DESCRIPTION OF THESE CONCERNS IS PROVIDED IN SUBAPPENDICES A1 THROUGH A20 AND A23 THROUGH A29 OF THE PSR.

ISSUE RESOLUTION/IMPLEMENTATION:

TO RESOLVE THIS ISSUE, TU ELECTRIC INITIATED THE CONDUIT AND CONDUIT SUPPORT CORRECTIVE ACTION PROGRAM (CAP). UNDER THE CAP, RESOLUTION OF THIS ISSUE WAS ACCOMPLISHED THROUGH IDENTIFICATION OF LICENSING COMMITMENTS, ESTABLISHMENT OF DESIGN CRITERIA AND DEVELOPMENT OF DESIGN VALIDATION PROCEDURES (SAG.CP10, SAG.CP17, SAG.CP20, SAG.CP21, SAG.CP25, SAG.CP29 AND SAG.CP35), THAT INCLUDE THE FOLLOWING:

- o USE OF AS-BUILT DATA AS DESIGN INPUT FOR CONDUIT AND CONDUIT SUPPORT VALIDATION.

CONDUIT AND CONDUIT SUPPORTS
TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX B3
(SDAR CP-85-34)

CONDUIT SUPPORT DESIGN
(CONTINUED)

- Validation of conduit and conduit supports to design criteria that is in compliance with CPSES licensing commitments, and responsive to all Comanche Peak Response Team (CPRT) and external issues.
- Testing to establish allowable load capacities and suitable methods for modification of conduit.
- Engineering studies implemented to provide additional confidence in the conservatism of the design validation procedures used for conduit and conduit supports.
- Implementation of hardware modifications as necessary to assure that all conduit and conduit supports comply with the validated design.

Resolutions to the specific concerns have been discussed in external source issues A1 through A20 and A23 through A29.

CONDUIT AND CONDUIT SUPPORTS

TRAINS A & B, AND TRAIN C LARGER THAN 2 INCH DIAMETER

PSR SUBAPPENDIX B4

(SDAR CP-85-53)

SEISMIC DESIGN OF CONDUIT

CAP ISSUE:

A NUMBER OF FREE ENDED CONDUIT ELBOWS ARE CONNECTED TO THE REMAINDER OF THE CONDUIT VIA A THREADED COUPLING, WITH NO SUPPORT BETWEEN THE COUPLING AND THE FREE END. THE COUPLING DOES NOT PROVIDE TORSIONAL RESISTANCE TO MOTIONS INDUCED BY SEISMIC EVENTS.

ISSUE RESOLUTION/IMPLEMENTATION:

THE ENGINEERING WALKDOWN PROCEDURE CPE-EB-FVM-CS-033 REQUIRES THE IDENTIFICATION OF THREADED FITTINGS IN THE RIGID OVERHANGING CONDUIT. TESTS (CCL REPORT NO. A-746-87) HAVE SHOWN THAT WRAPPING THE THREADED FITTING AND ADJACENT AREAS WITH FIBERGLASS CLOTH IMPREGNATED WITH SCOTCH CAST PRODUCT PRODUCES THE REQUIRED TORSIONAL RESISTANCE. ACCORDINGLY, ALL SUCH INSTANCES ARE BEING CORRECTED EITHER BY FIBERGLASS CLOTH WRAPPING OR BY PROVIDING SUPPORTS IN THE OVERHANGING PORTION OF THE CONDUIT.

CONDUIT SUPPORTS TRAIN C
2 INCH DIAMETER AND LESS

PSR SUBAPPENDIX A1

TRAIN C CONDUITS AND SUPPORTS

EXTERNAL SOURCE ISSUE:

THE ISSUE WAS THAT THE INSTALLATION FOR NON-SAFETY-RELATED CONDUITS TWO-INCH DIAMETER AND LESS WAS NOT ADEQUATE FOR SEISMIC LOADING. ACCORDING TO REGULATORY GUIDE 1.29 AND THE CPSES FSAR, THE NONSEISMIC ITEMS SHOULD BE DESIGNED IN SUCH A WAY THAT THEIR FAILURE WOULD NOT ADVERSELY AFFECT THE FUNCTION OF SEISMIC CATEGORY I SYSTEMS, STRUCTURES, OR COMPONENTS, OR CAUSE INCAPACITATING INJURY TO OCCUPANTS OF THE CONTROL ROOM.

ISSUE RESOLUTION:

THE CORRECTIVE ACTION PROGRAM (CAP) FOR TRAIN C ASSURES COMPLIANCE WITH THE LICENSING COMMITMENTS FOR THE SUPPORT OF TRAIN "C" CONDUITS AND CONDUIT SUPPORTS. THIS CAP ASSURES THAT TRAIN "C" IS DESIGNED SUCH THAT ITS FAILURE WOULD NOT ADVERSELY AFFECT THE FUNCTION OF SEISMIC CATEGORY I SYSTEMS, STRUCTURES, OR COMPONENTS, OR CAUSE INCAPACITATING INJURY TO OCCUPANTS OF THE CONTROL ROOM.

PSR SUBAPPENDIX A1

TRAIN C CONDUITS AND SUPPORTS
(CONTINUED)

TO ASSURE THAT LICENSING COMMITMENTS FOR TRAIN "C" WERE MET, THREE DESIGN VALIDATION METHODS WERE USED.

VALIDATION METHOD 1 -- NO INTERACTION POTENTIAL. VALIDATED THAT TRAIN "C" CONDUIT SUPPORTS IF THEY WERE TO COLLAPSE WOULD NOT STRIKE SEISMIC CATEGORY I SYSTEMS, STRUCTURES, OR COMPONENTS.

VALIDATION METHOD 2 -- ACCEPTABLE INTERACTION. VALIDATED THAT TRAIN "C" CONDUIT SUPPORTS IF THEY WERE TO COLLAPSE WOULD NOT REDUCE THE FUNCTIONING OF ANY SEISMIC CATEGORY I SYSTEM, STRUCTURE OR COMPONENT.

VALIDATION METHOD 3 -- STRUCTURAL INTEGRITY. VALIDATED THAT TRAIN "C" CONDUIT AND CONDUIT SUPPORTS WERE EVALUATED AND DESIGNED TO PREVENT FAILURE UNDER SAFE SHUTDOWN EARTHQUAKE (SSE) CONDITIONS.

CONDUIT SUPPORTS TRAIN C
2 INCH DIAMETER AND LESS

PSR SUBAPPENDIX A1

TRAIN C CONDUITS AND SUPPORTS
(CONTINUED)

DESIGN MODIFICATIONS WERE MADE WHEN TRAIN "C" COULD NOT BE DESIGN VALIDATED USING THE THREE VALIDATION METHODS DESCRIBED. THREE DESIGN MODIFICATION METHODS WERE USE.

MODIFICATION METHOD 1 -- MODIFY SUPPORT. THE TRAIN "C" CONDUIT SUPPORT WAS STRUCTURALLY MODIFIED TO ASSURE STRUCTURAL INTEGRITY, OR ELSE ADDITIONAL TRAIN "C" CONDUIT SUPPORTS WERE DESIGNED TO FURTHER SUPPORT THE CONDUIT.

MODIFICATION METHOD 2 -- PROVIDE SEISMIC RESTRAINT CABLE. RESTRAINT CABLES WERE USED TO RESTRAIN THE CONDUIT AND PROVIDE CONDUIT SUPPORTS IF THEY WERE POSTULATED TO FAIL.

MODIFICATION METHOD 3 -- REROUTE CONDUIT. THE CONDUIT WAS REROUTED AND SUPPORTED BY NEW CONDUIT SUPPORTS. THE CONDUIT AND NEW SUPPORTS WERE EVALUATED AND DESIGNED TO PREVENT FAILURE UNDER THE SAFE SHUTDOWN EARTHQUAKE (SSE) CONDITIONS.

CONDUIT SUPPORTS TRAIN C
2 INCH DIAMETER AND LESS

PSR SUBAPPENDIX A1

TRAIN C CONDUITS AND SUPPORTS
(CONTINUED)

IMPLEMENTATION

THE DESIGN CRITERIA REQUIRING CONSIDERATION OF THE EFFECTS OF SEISMIC LOADS ON THE UNIT 1 AND COMMON TRAIN "C" AND THE USE OF THE AS-BUILT DATA FOR DESIGN INPUT HAVE BEEN ESTABLISHED AND DOCUMENTED IN THE TRAIN "C" DESIGN BASIS DOCUMENT DBD-CS-093. THESE REQUIREMENTS ARE INCLUDED IN THE TRAIN "C" TWO-INCH DIAMETER AND LESS CONDUIT AND CONDUIT SUPPORTS DESIGN VALIDATION PROCEDURES.