COMANCHE PEAK STEAM ELECTRIC STATION

TRAIN C CONDUIT
TWO INCH AND UNDER

Criteria Document

REGULATORY GUIDE 1.29 ISSUE

(T.R.T. ISSUE 1.c)

Prepared for:

Texas Utilities Generating Company

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FORWARD

This report has been prepared completely by Impell Corporation.

Revision 1 is extensively changed from Revision 0 of this report. All appendices (A through F) of Revision 0 have been omitted from Revision 1.

Appendix A to Revision 1 includes a list of 26 questions posed by the NRC during a May 6, 1986 audit. Responses to these questions are included in Appendix A or are incorporated in this report. The Appendix A gives Section numbers of the report which pertain to each question.

1.0 INTRODUCTION

This report describes the program to resolve the TUGCo Technical Review Team (TRT) Issue 1.c regarding Train C conduit two inch diameter and under for Comanche Peak Steam Electric Station, Units 1 and 2. This program considers the issue, from engineering, walkdown, and possible rework perspectives.

The report includes the justification of the program. Justification is based on the USNRC Regulatory Guides and Standard Review Plan. Detailed procedures to implement the Train C program are included in separate project instructions.

The Train C program will provide the following: (a) a tracking system which documents conduit supports that are qualified, and the manner in which they are qualified; (b) a tracking system which documents the reworked conduit supports; and (c) the documentation of all work performed to support this activity.

Except as specifically noted in the text, this criteria document does not address Train C conduit greater than or equal to two and one-half inch diameter.

2.0 BACKGROUND

2.1 Regulatory Requirements

2.1.1 Regulatory Guide 1.29

Regulatory Guide 1.29 [1] requires that "portions of structures, systems, or components, whose continued function is not required, but whose failure could reduce the functioning of any plant feature to an unacceptable safety level should be designed and constructed so that the Safe Shutdown Earthquake would not cause such failure."

2.1.2 Standard Review Plan 3.7.2

Standard Review Plan (SRP) 3.7.2 [2] describes the methods used by the NRC to review how TUGCo evaluates the interaction of non-Category 1 structures with Category 1 structures. The Train C conduit and support system at Comanche Peak are non-Category 1 structures.

To be acceptable, the interfaces between Category 1 and non-Category 1 structures and plant equipment must be designed for the dynamic loads and displacements produced by both the Category 1 and non-Category 1 structures and plant equipment. All non-Category 1 structures and equipment may meet any one of the following requirements:

1. The collapse of any non-Category 1 structure will not cause the non-Category 1 structure to strike a seismic Category 1 structure or component.
2. The collapse of any non-Category 1 structure will not impair the integrity of seismic Category 1 structures or components.
3. The non-Category 1 structures will be analyzed and designed to prevent their failure under SSE conditions in a manner such that the margin of safety of these structures is equivalent to that of Category 1 structures.

TUGCo plans to use a combination of these three requirements to address the Train C conduit issue. This plan is described in detail in Section 3.0 of this report.

The Train C conduit must be considered for both seismic loads and seismic displacements. In this report, the "loads" check is referred to as a "strength" check; this "strength" check is met by showing that the conduit meets the acceptance criteria described in Section 3.2.2 of this report. The "displacement" check is met by showing that the conduit cannot impact a target or by showing that the target is not impaired by any impacts. The impacts considered arise from either a "falling" conduit with supports (if a support is hypothesized to fail the strength check) or a "swaying" conduit supports (if a conduit displaces during the SSE enough so as to bump into adjacent safety-related features).

The underlying philosophy incorporated in this plan is as follows:

1. Review 100 percent of the Train C conduit supports and conduit runs for both "strength" and "sway/displacement" requirements.

2. Screen out the conduit supports and conduit runs using an eight level screening process (Section 3.3). This screening process will identify all conduit supports and runs which meet the SRP 3.7.2 requirements.

3. For supports and runs which do not meet the SRP 3.7.2 requirements, suitable rework options will be taken such that these supports or conduits meet the SRP requirements.

2.1.3 CPSES FSAR Commitments

The CPSES FSAR Section 3.2.1.2 [3] states that non-Category 1 equipment and components will comply with the provisions of R.G. 1.29.

2.2 Technical Review Team Item 1.c

The TRT Item 1.c is described in the CPRT action plan [4]. The following sections describe these issues, summarize the results of the sample study and estimate the scope of Train C conduit.

2.2.1 Technical Review Team Concerns

The Train C conduit at Comanche Peak are non-Category 1 features and are not needed for plant safety. The original plant design called for dead-weight hangers for these conduits. Subsequent to construction of these supports, the question arose whether or not these dead-weight supports could withstand the SSE motions, and whether or not the requirements of Regulatory Guide 1.29 were met.

The Train C conduits are divided into two groups: those conduit with diameters two and one-half inches or greater, and those conduit with diameters two inches or less. Prior damage study evaluations have considered the larger size Train C conduit.

Some of the two inch diameter and under Train C conduit at Comanche Peak are "gang" hung; that is, many conduit are supported on a single support. The total mass of conduit on a single "gang" support could be substantial. Therefore, the CPRT instituted an action plan [4] to review the small diameter conduit.

From December 1984 to March 1986, a sampling program was initiated to evaluate the small diameter Train C conduit. The sampling study is described below.

2.2.2 Sampling Study

The sampling study was performed by Gibbs and Hill [5] to determine the capability of the small diameter Train C conduit to meet the requirements of Regulatory Guide 1.29 and SRP 3.7.2. The study addressed 257 conduit runs and 2413 supports. The study was subdivided into two subsamples:

Random subsample:	126 runs	1227 supports
Engineering subsample:	131 runs	1186 supports
Total	257 runs	2413 supports

The Random subsample contained conduits of 1.5 or 2 inch diameter.

The Engineering subsample included conduits which met any five of nine criteria:

1. safety related equipment nearby
2. 1.5 or 2 inch diameter
3. spans over 20 feet of total conduit run
4. spans over 8 feet (for a single span)
5. greater than 15 feet of conduit unrestrained longitudinally
6. 3 conduits or greater on one support
7. a conduit run with more than 25 percent "special" supports
8. conduit in a congested area (i.e., being closer than 6 inches to unrelated hardware)
9. conduit located in the upper half of the building

Although the Random and Engineering subsamples have somewhat different selection criteria, for summary purposes, all 257 runs and 2413 supports are considered to be from one single larger sample. This report does not draw any distinctions in the Train C conduit seismic capabilities based upon the above two subsamples.

The sampling study was reviewed twice. The criteria used in the first review are described in Section 3.1 of this report. The key results of this first review are as follows:

- 2413 supports were reviewed
- 230 supports failed the strength criteria

The above results need to be considered in light of some conservative and simplifying assumptions that were incorporated into this first review of the sample study. The following actions were undertaken to quantify these conservatisms:

1. conduct tests of various support components to determine their actual strength to withstand seismic events [6, 7, 8].
2. conduct investigations of the conduit runs to eliminate conservative modeling assumptions made in the sampling analyses.
3. determine the actual conduit fill masses.
4. use acceptance criteria consistent with the functional requirements of Train C conduit. (This approach is consistent with the CPRT action plan which states in 4.1.2.3 that "Later screening may be considered if it is required to verify acceptable performance of runs which do not pass the initial screening criteria. Analytical techniques may be refined and/or limited ductility considered, consistent with the intended performance requirements." [4])

The criteria used in the second review are described in Section 3.2 of this report.

The key results from this second review are as follows:

- 2413 supports were reviewed
- 43 supports failed the strength criteria

The conclusions from these sampling studies are as follows:

1. The first review of the sampling study was over conservative, and predicted a support failure rate of about 9 to 10 percent.
2. The second review of the sampling study predicted that about 1.8 percent of all supports may possibly be overloaded during the SSE.
3. The failure rate of 1.8 percent for strength requires TUGCo to perform a plant walkdown to identify and correct these possible problems.

2.2.3 Application of Sample Study Results to Train C Program

In April, 1986, Impell was assigned complete responsibility for resolution of the Train C program. Impell collected all prior work performed by Gibbs and Hill. Before applying the results of the sample study directly to the Train C Program, Impell performed a detailed review of the sample study to ensure that all Cygna and related issues were suitably incorporated in the study. About one-quarter of all Gibbs and Hill calculations were reviewed. It was found that some over-simplifying assumptions were made in the sampling study, and potentially not in accordance with the assumptions used for safety-related systems.

The conclusions from this review of the sample study are as follows:

1. The prior results (43 failed supports out of 2413) are approximately correct. By redoing the entire sample study, and incorporating consistent assumptions, the number of failed supports would vary, but not significantly.

2. The screen levels 1 and 2 (See Section 4.3) in the Train C program could not be soley based on the Gibbs and Hill sample study. Additional restrictions would be placed which offset the inconsistent assumptions.

3. For cases where the restrictions are too severe, portions of the Gibbs and Hill sample study would be revised to include correct assumptions; and then the level 1 and 2 screens would be suitably modified.

2.2.4 Total Scope of Train C Conduit (2 inch and Under)

In Unit 1 and Common areas of CPSES, there are estimated to be the following:

- 13,500 Conduit Runs
- 60,000 Supports

These are broken down further as follows:

Diameter	% of Total	Number
2 inch	9	1,215
1.5 inch	19	2,523
1 inch	17	2.337
0.75 inch	55	7,425
		13,500

Unit 2 of CPSES is estimated to have two thirds to three quarters in quantity of the above Train C conduit.

3.0 SAMPLING STUDY CRITERIA

As described in Section 2.2.2, a sampling study was performed for 257 conduit runs, and 2413 conduit supports. This section describes the criteria used in this study. It should be noted that this study was an interim step in responding to the Train C issue. The sample study criteria are not used in the Train C Program. They are presented here to provide continuity as to the development of the criteria actually used in the Train C Program, which are described in Section 4.0.

3.1 Sample Study - "Old" Criteria

In Section 2.2.2, it is stated that the sample study was performed twice. In the first review, very conservative criteria were applied. In the second review, refined criteria were applied. Section 3.1 describes the criteria used in the first review (called the "old" criteria). Section 3.2 describes the criteria used in the second review (called the "refined" criteria).

The following are the "old" criteria used in the first review of the sample study:

- check Safe Shutdown Earthquake loads only
- stress allowable = $0.90F_y$
- F_y = 36 ksi for structural steel shapes
- F_y = 33 ksi for unistrut shapes
- SSE factor of safety of three for Hilti Kwik Bolt concrete expansion anchors
- 7 percent damping for conduit
- use either dynamic response spectrum or equivalent static force methods of analysis
- use maximum fill weights for all conduit
- all gang-type supports qualified using absolute summation of individual conduit reaction loads
- floor response spectra are the "refined" CPSES floor response spectra (these spectra are the same floor spectra being used for all CPSES design verification work, including piping and cable tray efforts).

The analyses calculate the deflections (sway) of the conduit. Deflections which are under 1/2 inch are considered to have no potential for impact to adjacent plant features. Deflections which are over 1/2 inch are considered as potential candidates for impact to adjacent plant features.

Details of the assumptions and criteria used in the original sampling study are included in Gibbs and Hill calculation files [5].

3.2 Sampling Study - "Refined" Criteria

This section describes the refined criteria used in the sample study. The details of these criteria are given in an Impell Project Instruction [9]. These refined criteria are based upon qualifying the non-safety related Train C conduit to withstand the SSE earthquake without any collapse that could impair plant safety features.

The refined criteria allow a limited amount of yielding in ductile unistrut supports. The criteria are consistent with CPRT action plan [4]. The criteria are also consistent with the CPSES commitment in the FSAR (3.7B.2.1.5) which states:

> "For the SSE earthquake, primary stresses should remain below yield, based on elastic system analysis, or primary stresses may exceed yield, if validated by plastic analysis. Secondary (self-limiting) stresses need not be considered. Some permanent deformations are allowed after the SSE earthquake, provided functionality is maintained" [3].

For Train C conduit, no functionality requirement exists, either for performance during or after the SSE earthquake. Therefore, permanent deformations of either the conduit itself or the conduit supports are acceptable. However, the refined criteria assure that collapse of the conduit supports cannot occur.

The following are the key "refined" criteria used in the second review of the sample study:

- check Safe Shutdown Earthquake loads
- stress allowable = 1.0 F_y (structural steel shapes)
- stress allowable = 1.0 F_{ya} (unistrut shapes)
- F_{ya} determined using AISI rules
- SSE factor of safety of three for Hilti Kwik Bolt concrete expansion anchors
- 7 percent damping for conduit
- use either dynamic response spectrum or equivalent static force methods of analysis
- use maximum or as-built conduit fill weights
- gang-type supports may be qualified by SRSSing individual conduit reaction loads, if frequencies of conduits are not closely spaced

- floor response spectra are the "refined" CPSES floor response spectra (the same as used for the "old" criteria)
- supports may be qualified for behavior past yield using either a fatigue usage factor method or ductility method, based on test results.

Details of these criteria are provided in [9], and in the Revision 0 to this report. Note that these refined criteria are applicable only to the sample study.

4.0 WALKDOWN PLAN

4.1 Scope of Plan

The Train C program is centered on a walkdown of all Train C conduit, two inches and under, in Unit 1, Unit 2 and Common areas. The walkdown will identify which Train C conduit supports are acceptable. Conduit which are not acceptable will be reworked.

4.2 Overall Criteria of the Plan

As described in Section 2.1 of this report, TUGCo will conduct the Train C Program to meet the requirements of Regulatory Guide 1.29. As will be described in the following sections, there are several methods which TUGCo will use to qualify the Train C conduit. Each method has detailed criteria. In Section 4.3 and 4.4, the key criteria are described. In Section 4.5 and 4.6, the screening levels are described.

The criteria given in Section 4.3 demonstrate that Train C conduit will not collapse due to the SSE, as the margin of safety for these criteria are equivalent to that for Category I structures. The criteria are based on industry standards applicable to Category I structures.

4.3 Train C Walkdown Program Criteria

This section describes criteria used in the Train C Program to show that Train C conduit can withstand the SSE loads without collapse. These criteria are an outcome of the work performed in the sample study.

The underlying philosophy of these criteria is to demonstrate that the Train C conduit can withstand the SSE without any collapse, while maintaining a margin of safety equivalent to that for Category I structures.

4.3.1 Analysis Methods

There are three alternative analysis methods:

Method 1

Method 1 is an elastic analysis and qualification procedure. This method is used if stresses of the conduit and supports are limited to yield. (See Section 4.3.1.1 for details).

Methods 2 and 3

If stresses exceed yield, then nonlinear evaluations are performed using either of two methods. To ensure that margin is maintained equivalent to margins for Category I structures, the procedures used for nonlinear evaluations follow those given in nuclear plant standards for nonlinear behavior, such as ASME code Appendix F [10]. For example, Appendix F provides rules and limits for structures subjected to loads for which Level D service limits are specified. The SSE load case on Train C conduit is a Level D service limit. Therefore, by using the limits and rules of Appendix F, we ensure that structural integrity of Train C is maintained with margin equivalent to that for Category I structures.

Method 2

If stresses exceed yield, then an elastic system analysis (including the conduit run and its supports) is performed; then the resultant loads are applied to a nonlinear subsystem load-deflection curve (the subsystem being the yielding support). The nonlinear subsystem (support) load-deflection curve is taken from test data of the support in question. (See Section 4.3.1.2 for details). This method is called the "Simple Nonlinear" method.

Method 3

If the stresses exceed yield, then a detailed inelastic system analysis is performed. A complete nonlinear system and subsystem model of the conduit system is developed and analyzed. This method is called the "Detailed Nonlinear" method.

Although all of the above qualification methods are adequate to qualify the conduit system, in practice only the first two methods are used. This is to maintain low analysis costs.

All analyses include provisions for both the weight of the conduit and conduit supports. All analyses consider the three directions or earthquake loads on each support, considering the three directional capabilities of each support.

4.3.1.1 Elastic Analysis Method

The Elastic Analysis method is used to qualify most of conduit supports. This method allows use of equivalent static force or dynamic response spectrum analyses.

Only the SSE load condition is checked. This is justified, as this method keeps all supports at or below yield. This load case is in conformance with CPSES PSAR Section 3.2.1.2 [3].

When using the equivalent static force method, a higher mode factor of 1.25 is used, when the conduit is a straight run. For supports adjacent to bends, a higher mode factor of 1.5 is used, unless a lower factor is justified by more refined analyses.

When using the dynamic response spectrum method, all modes to 33 hz (or the rigid cut-off frequency) are included. A missing mass correction is made for all frequencies above the cut-off frequency.

Details of the elastic analysis method are given in Impell Project Instructions [11, 12].

4.3.1.2 Simple Nonlinear Analysis Method

The Simplified Nonlinear Analysis method is used to qualify a small portion of conduit supports. This method uses elastic system analysis (using the methods described in Section 4.3.1.1). The resultant loads from this elastic system analysis are then used in an inelastic component (the conduit support) qualification. The elastic system analysis is checked to account for effects due to inelastic support deformations.

To evaluate the component's plastic deformations, the limits are based either on analytically computed stress and strains, or test data. Stress and strain limits follow the guidelines of ASME Appendix F. Static test data limits follow the guidelines of ASME Appendix F. Cyclic test data limits follow the guidelines of ASME Code Case N-420 [13].

In practice, components are evaluated versus test data limits. Any qualification by analytically computed stress or strain limits is noted specifically in the calculations.

4.3.1.2.1 Use of Static Test Data

Qualification of components may be performed by load rating, based on static test data. For the SSE load case, the following procedures may be used to determine acceptable limits, based on static test data.

The allowable design load (TL) is 70 percent of the design test load (TL_u) when there is no possibility of buckling instability. This is accordance with ASME F-1334.8 and F-1332.7.

The allowable design load (TL) is 67 percent of the design test load (TL_u) when the failure mode is caused by buckling instability. This is in accordance with ASME F-1334.3.

For simplification, all allowable design loads (TL) are based upon 67 percent of the design test load (TL_u), unless specifically noted in the calculations that buckling instability does not govern.

The determine the design test load, the following procedures are taken.

A minimum of three static tests are performed. The ultimate load of any test is the load at which there is no increasing resistance to increased displacement. This is in accordance with ASME NF-3382.1.

The design test load (TL_u) may be taken as the mean of the test ultimate loads, if no individual test exceeds the mean result by more than + 10 percent. This is in accordance with AISI 6.2(a) [14] and ASTM E488 [15].

If individual test results exceed the mean test result by more than ± 10 percent, then the lowest test result is used as the design test load.

If more than three tests are performed, then the design test load may be taken at the lower bound for the 95% confidence level.

4.3.1.2.2 Use of Cyclic Test Data

Qualification of components may be performed by use of low cycle fatigue test data for the SSE load case. The following procedures may be used to determine acceptable limits, based on cyclic test data.

The allowable cumulative fatigue usage is computed considering both the OBE and SSE contributions to fatigue damage. The fatigue damage is defined as follows:

$$\frac{10}{N_{SSE}} + \frac{50}{N_{OBE}} \leq 1.0$$

This fatigue damage formula is typical of the requirement of IEEE 344-1975 [16] for qualification by test, which assumes five OBE earthquakes and one SSE earthquake. This fatigue damage formula is also based upon on assumed 10 equivalent peak-to-peak load cycles per earthquake, as recommended as being an acceptable cyclical load basis for fatigue analysis of earthquake loading, per Section N-1214 of the ASME code [10]. The NRC S.R.P. 3.7.3 [17] states that 10 maximum stress cycles per earthquake may be assumed.

The values N_{SSE} and N_{OBE} are developed from test data, and incorporated in a design fatigue curve. The design fatigue curve is taken as the average test fatigue data, reduced by either a factor of 1.5 or the mean minus two standard deviations at 95% confidence level, on cycles. This method to determine the design fatigue curve is described in ASME Code Case N-420 [13].

Reference [11] provides the design fatigue curves for use in the qualification of CPSES unistrut supports and unistrut connections.

4.3.2 Stress Allowables

For hot rolled structural steel members, the stress allowable = 1.0 F_y. This limit is conservative as compared to the ASME code Appendix XVII [10] code recommendation of 1.2 F_y for pipe supports loaded to Level D limits.

For cold-rolled steel members, the stress allowable = 1.0 F_{ya}. F_{ya} is the term used in the AISI code to consider the effects of cold working, as per AISI code section 3.1.1 [14].

Detailed descriptions of stress allowables are given in [11].

4.3.3 Concrete Expansion Anchor Factor of Safety

The Factor of Safety (F.S.) for Hilti Kwik Bolt concrete expansion anchors is 3, assuming 4000 psi concrete.

A report [18] has been compiled concerning the Hilti Kwik Bolt Factor of Safety. The following paragraphs highlight the key conclusions of this report:

1. A set of 651 static tests for Hilti Kwik Bolts shows a zero failure rate at F.S. = 3.
2. Cyclic tests show that earthquake type loading has no effect on Hilti Kwik Bolt ultimate strength.

It is concluded from the above that the Criteria of F.S. = 3 is acceptable and safe for Train C applications.

4.3.4 Damping

A damping value of 7% is used for the SSE load case.

A report [19] has been compiled concerning damping for Train C conduit. The following paragraphs highlight the key conclusions of this report.

This damping value is consistent with the SSE level damping values used for the unistrut-hung conduit at many other nuclear plants, including San Onofre 1, 2, 3; Diablo Canyon 1, 2; Palo Verde 1, 2, 3; Hope Creek, Braidwood 1, 2; Byron 1, 2; South Texas 1, 2; and many other plants of similar vintage to Comanche Peak [20].

This value of 7% damping is also suggested for bolted structures, as described in Regulatory Guide 1.61 [21].

Recent test programs [22] also support that 7% damping is expected for conduit installed per CPSES specifications.

4.3.5 Quadratic Interaction for HKB

A quadratic interaction equation shall be used for Hilti Kwik Bolts. A quadratic interaction equation has been used at other nuclear power plants and has been confirmed by correlation with experimental results [23, 24, 25].

4.3.6 Gang Supports

These are qualified using an SRSS summation of individual conduit reaction loads, if conduit frequencies are widely spaced; otherwise, summation is by absolute summation. The SRSS summation is used only if conduit frequencies (including support flexibilities) are widely spaced, using the R.G. 1.92 criteria [26]. The SRSS summation has also been checked for specific application to CPSES conduit [27].

4.3.7 Floor Response Spectra

Floor response spectra are the "refined" CPSES floor response spectra. The same spectra that has been used in the original sampling analysis (Section 3.0).

4.4 Target Analysis - Acceptance Criteria

As described in Section 2.1.2, one of the three methods to show acceptance to the R.G. 1.29 issue is to demonstrate that the collapse of Train C conduit will not impair the integrity of seismic Category 1 structures or components. For purposes of this Train C conduit program, this check for integrity is called "target" analysis.

Target analysis is commonly used in the pipe break issue, as well as the R.G. 1.29 issue. For all target evaluations performed for the CPSES Train C conduit, the same criteria normally used to address the pipe break issue are used.

4.4.1 Scope of Targets

The following types of features can be considered as targets:

1. Safety and non-safety class piping and conduit systems
2. HVAC ducts and supports
3. Structural members
4. Cable trays and cable tray supports

Category 1 safety features that are not considered as targets (these targets may be considered as targets only if substantiated by specific analyses, and will be so noted in the calculations):

1. Pipe fittings, including elbows, tees, reducers, stanchions, valves, valve extended operators, tubing, snubbers, springs, and other active or passive components.

2. Electrical cabinets, battery racks, or other electrical components required to be operable during or after the earthquake.

3. Cables exposed directly to possible impacts (i.e., trays with no covers that a falling conduit or conduit support can directly hit).

4. Mechanical equipment, such as tanks, heat exchangers, etc.

5. Any structural connection.

6. Any impact to a cable tray, HVAC, structural members, pipe, or conduit that occurs within one-sixth of the span length from the span's supports.

7. Flexible hose.

8. Tubing or electrical equipment attached to pipe (like heat tracers, pressure temperature gauges, pneumatic tubing, etc.).

9. Any structural member directly connected to concrete.

Further restrictions as to acceptable targets are described in the following sections.

4.4.2 Acceptance Criteria

This section describes the acceptance criteria used for targets.

Targets will be shown acceptable if the potential energy of the postulated falling Train C conduit and supports can be absorbed by plastic strain energy. The maximum allowable strain is limited to the lesser of:

1. 10 percent of the strain at ultimate tensile stress for the material.

2. 10 times the yield strain. Yield strain is defined as the yield stress divided by Young's modulus.

These strain limitations ensure that no subsequent SSE loading on the target will cause any failures.

The usable strain energy absorbed by the target due to the impact cannot double count the energy being used to withstand the deformations imposed by other loading conditions. A conservative assumption is made that the target structure prior to impact is stressed all the way to its yield stress, or to the highest design stress (or strain) that the target's applicable code will allow, whichever is greater. The energy corresponding to this stress (or strain) is then deducted from the allowable strain energy of the target structure which will then be available for impact.

In addition to the above deformation-related criteria, safety-related targets must also be able to maintain fuctionality during and after the impact. Accordingly, distortions in the target structures are limited to assure the target can properly perform its function.

For potential Train C conduit missiles caused by postulated support failures, it is assumed that there is only one impact during the earthquake. For Train C conduit that can sway during the earthquake and thereby occasionally interact with other neighboring features, the target analysis is adjusted to account for potential multiple impacts for the duration of the 10 second earthquake event.

Pipes and Conduits

The target piping may be Class I, II, or III. It is conservatively assumed that all pipes are class I. Conduit may be classified as pipes. Impacts are allowed if the impacted pipe is a straight pipe, with or without insulation.

If the impacted span is shorter than one-half the maximum span allowed by ANSI B31.1, no impacts are allowed. This provision ensures that the pipe span is long enough to absorb energy by plastic deformations. (A table will be provided in the walk-down procedure.)

The above limitations may only be relaxed through further detailed engineering evaluations of the particular case.

The distortion of the pipe cross sections shall not cause a reduction of the net flow area by more than five percent.

HVAC Ducts

The maximum allowable reduction in net flow area of the duct is less than ten percent.

Structural Members

Spans must be longer than four times the structural member's depth.

Missile Evaluation

To perform the target evaluation, the weight of the potential Train C missile needs to be be established. In this section, the procedure to get the weight of a falling Train C conduit is presented.

First, the number of Train C supports, in a row, that are prone to fail are identified by the walkdown engineer. The engineer may consider if adjacent Train C supports are prone to also fail (zipper) due to the first failure, or may consider that the entire length of conduit fails (from end to end, including termination points).

Once the entire length of a potentially unsupported conduit is identified, all targets in the possible zone of failure are identified. This step is performed with the aid of a catenary design chart, showing the maximum possible deflections (vertical and horizontal) of the unsupported conduit.

If any targets exist within this identified zone of failure, it is assumed that the targets must resist the energy associated with a portion of the length of this span of unsupported conduit and support. If it has been conservatively assumed that the entire length of conduit falls, then the entire span of unsupported conduit is assumed to be in free fall. Not all the weight of a very long unsupported conduit will be effective in impacting a single target. Thus, based upon the results of detailed impact analyses, the following length reduction factors may be employed:

Length of unsupported conduit	Percent of unsupported span used to evaluate weight (%)
up to 16 feet	100
16 to 23 feet	80
over 23 feet	60

Each target is assumed to have to bear the entire impact of the falling conduit and any support hardware remaining attached to the conduit, without benefit of other target's capabilities. This assumption can be relieved with further engineering evaluation.

4.5 Eight Screening Levels

TUGCo plans to close out the Train C conduit issue by using a full plant walkdown approach. There are eight screening levels which the walkdown team may use before opting to use a rework option (rework option are described further in Section 4.6). All of these screening levels are in accordance with the requirements of R.G. 1.29 and S.R.P. 3.7.2.

In this section of the report, the eight screening levels are briefly described. Figure 1 shows the flow of the screening levels.

4.5.1 Screen 1 - Weight

If a support has less than 6 pounds per foot of conduit, it is satisfactory. This criteria is met by supports having only one two-inch diameter conduit, or combinations of other smaller conduit, with a total weight less than 6 pounds per foot. One of the following two methods is used to justify this screen.

1. Each support type qualified is checked by generic "worst case" engineering calculations. These calculations meet all the criteria described in Section 4.3 of this report. A walkdown checklist is prepared that allows the walkdown team to identify supports which match the supports covered by these engineering calculations. Restrictions in the walkdown checklist ensure that span lengths, support hardware configurations, weights, or other key parameters meet those included by the generic worst case engineering calculations.

2. Each support type qualified is checked by comparison to results of a sample of "typical" engineering calculations. These calculations meet all the criteria described in Section 4.3 of this report. The criteria are included directly in the engineering calculation, or by restrictions to the walkdown checklist. The typical engineering calculations consider actual loads seen by supports, considering complete conduit system behavior. Restrictions in the walkdown checklist ensure that maximum span lengths, types of support hardware, system configurations, weights, or other key parameters meet that covered by the typical engineering calculations.

Typical engineering calculations (method 2) will show that longer allowable span lengths than worst case engineering calculations (method 1), owing to the benefit of system response spectrum dynamic analysis of actual rather than worst case configurations. As such, the walkdown checklist, when based on typical engineering calculations, includes restrictions that ensure that supports in the plant so qualified fall within the sample of typical engineering calculations.

Sway displacement checks are made for conduits prone to have large displacements.

4.5.2 Screen 2 - Good Supports

There are unistrut supports used for the Train C conduit which are very resistent to seismic loads, even though they support more than six pounds per foot of conduit. One of the following two methods is used to justify this screen.

1. Each support type qualified is checked by generic "worst case" engineering calculations. These calculations meet all the criteria described in Section 4.3 of this report. A walkdown checklist is prepared that allows the walkdown team to identify supports which match the supports covered by these engineering calculations. Restrictions in the walkdown checklist ensure that span lengths, support hardware configurations, weights, or other key parameters meet those included by the generic worst case engineering calculations.

2. Each support type qualified is checked by comparison to results of a sample of "typical" engineering calculations. These calculations meet all the criteria described in Section 4.3 of this report. The criteria are included directly in the engineering calculation, or by restrictions to the walkdown checklist. The typical engineering calculations consider actual loads seen by supports, considering complete conduit system behavior. Restrictions in the walkdown checklist ensure that maximum span lengths, types of support hardware, system configurations, weights, or other key parameters meet that covered by the typical engineering calculations.

Typical engineering calculations (method 2) will show longer allowable span lengths than worst case engineering calculations (method 1), owing to the benefit of system response spectrum dynamic analysis of actual rather than worst case configurations. As such, the walkdown checklist, when based on typical engineering calculations, includes restrictions that ensure that supports in the plant so qualified fall within the sample of typcial engineering calculations.

Sway displacement checks are made for conduits prone to have large displacements.

4.5.3 Screen 3 - No Interaction Potential Check

By using this screen, the walkdown team ascertains whether there is any possible targets within the zone of possible conduit fails.

If there are no possible targets in this zone, the support is considered acceptable.

Note that for conduits supported on rod hangers or long lengths of "unsupported" conduit, an additional check must be made to assure that no "sway" displacements from the vibrating conduit can result in interactions with other plant features. A chart is provided to the walkdown team which defines the maximum possible sway for rod hung conduit. This chart varies according to the elevation of building, and the length of the rod support. More refined checks may be made by the walkdown team to minimize the sway deflections, including pendulum effects, and stiffening effects of adjacent conduit branches and conduit supports.

If there are no sway potentials for interaction, the support and attached conduit is considered qualified.

Conduit with seismic deflections less than 0.5 inches do not need to be checked for sway interactions. This criteria is based upon an assumed minimum separation of one inch between all features.

4.5.4 Screen 4 - Seismic Capacity Check (In the Field)

By using this screen, the walkdown engineer calculates a conservative seismic load for a particular support, and compares this load to a pre-calculated seismic capacity. The pre-calculated seismic capacities are available to the walkdown engineer in the field in tabulated forms.

There are two basic activities the walkdown engineer performs: (1) determines the tributary spans and associated deadweight of all the conduit attached to the support in question. (2) compares this deadweight to the allowable deadweight from the load capacity tables.

The criteria involved are as follows:

1. Tributary spans. The walkdown engineer determines the spans for all conduit on the support being design verified. This calculation depends on each conduit's schematic (layout), and the types (one-directional, two-directional or three-directional) of adjacent supports. The tributary span is calculated for each of the three orthogonal directions. These orthogonal spans may differ due to the differences in load resistance direction capability of the adjacent supports. Once the span to the adjacent support is known, then one-half of this span is assumed to cause reactions to the support being design verified. For spans which terminate with flex conduit or into junction boxes, the entire span is assumed to cause reactions to the support being design verified. Finally, this span is multiplied by the maximum weight per unit length for the conduit diameter, for each conduit. The final weight to be applied to the support being design verified is the sum of the span weights.

2. Load Capacity. For each type of generic support often found in the plant, generic load capacities are developed. The criteria used in developing these load capacities are the same as those described in Section 4.3 of this report. The load capacities are given for loads applied in one, two or three directions, depending on support type and behavior.

Screen level 4 differs from screen levels 1 and 2 in that it develops a support-specific load versus capacity. Screen level 4 is applied in the field, without the necessity of preparing a sketch of the support.

4.5.5 Screen 5 - Seismic Capacity Check (In Office)

This screen is intended to be used only if screen 4 shows that the support is overloaded but by a margin within the bounds possible to be demonstrated by using more detailed analysis techniques. Other factors include the complexity of potential support modifications or seismic restraints.

Should the walkdown team decide that this screen should be employed, the procedures to qualify the support are based upon the same criteria and procedures given in Section 4.3. Walkdown information as to the extent of conduit runs and adjacent support details will be collected in order for a detailed evaluation and analysis to be performed in the office.

4.5.6 Screen 6 - Target Check

The walkdown engineer will evaluate the acceptability of impacts to adjacent plant features by using this screen.

This screen may be used to evaluate the acceptability of either falling conduit, or swinging conduit. The details of the falling and swinging target evaluations are similar, as described in Section 4.4.2 of this report.

This screening procedure is explicitly allowed by SRP 3.7.2. The criteria for acceptability of targets have been described in detail in Section 4.4.2.

4.5.7 Screen 7 - Safe Shutdown System Check

As described in R.G. 1.29 [1], it is necessary to demonstrate that only certain safety functions of the CPSES are needed during and after the SSE. If the walkdown team identifies a support which is not qualified through the use of the other screen levels, then a safe shutdown system check can be performed.

4.5.8 Screen 8 - Seismic Restraints

In some areas of CPSES, there have already been installed seismic restraints (also known as aircraft cable restraints). The purpose of these supports is to restrain any possible falling non-safety related features, as determined from prior damage studies of the plant. Some of these restraints may be able to also withstand the loading of potential Train C conduit.

The criteria to judge whether the existing seismic restraints are adequate are based upon the criteria used in Section 4.6.1 of this report. A calculation will be made by the walkdown engineer for the existing restraints that are required by this screen.

4.6 Rework Options

Should a support not be qualified by any of the 8 screen levels, then any of three rework options may be pursued. First, a new seismic restraint (aircraft cable) may be installed. Second, the existing support may be modified. Third, the conduit may be rerouted.

4.6.1 Rework Option 1 - New Seismic Restraint

The criteria for design and installation of new seismic restraints require that all stresses remain at or below yield.

In designing these seismic restraints, the maximum possible conduit weight is determined, considering all possible supports that can fail. Weight from other plant features that could also fail due to the Train C failure are also considered.

4.6.2 Rework Option 2 - Modify Existing Support

The criteria for design and installation for support modifications are the same as described in Section 4.3.1 of this report, with the exception that the minimum factor of safety for Hilti Kwik Bolt expansion anchors is 4.

4.6.3 Rework Option 3 - Reroute Conduit

The walkdown team may determine that rerouting the conduit is an effective solution for certain instances. In Unit 1 and Common areas, this option will not be considered.

Any rerouted conduit will be supported such that these supports can meet any of the screen levels 1 through 8.

In addition, any rerouted conduit will have all functional tests performed as is required for Train C conduit.

5.0 CONCLUSIONS

This report summarizes the criteria to be used to close out the Train C T.R.T. Issue 1.c. This report gives justifications for each of the criteria. This report also refers to backup documentation which provides the details of the criteria.

All criteria meet the commitments of the FSAR and the requirements of R.G. 1.29. There are no FSAR changes required by this plan to close out the Train C issue.

6.0 REFERENCES

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2. USNRC Standard Review Plan 3.7.2, NUREG 0800, "Seismic System Analysis," Rev. 1, U.S. Nuclear Regulatory Commission, July, 1981.

3. Comanche Peak Steam Electric Station, Final Safety Analysis Report, through Amendment 54, Texas Utilities Generating Company, Dallas, Texas, January, 1985.

4. Comanche Peak Response Team Action Plan, Item CPRT 1.c, "Electrical Conduit Supports," Revision 1, January 11, 1985.

5. Gibbs and Hill, Train C Sampling Study Calculations, 1984-1986.

6. CCL Procedure No. 1903.03-01, "Test Procedure for Structural Testing of Train C Conduit Support Systems for Comanche Peak Steam Electric Station," Rev. 3 Corporate Consulting Laboratory, Research Triangle, North Carolina, Nov. 27, 1985.

7. CCL Report No. 85-1903.03/.11 (Prelim.), "Preliminary Summary of Static Testing Results, Train C Conduit Supports," Corporate Consulting Laboratory, Research Triangle, North Carolina, Dec. 23, 1985.

8. CCL Report A-707-86, Project 85-1903.18, "Test Report for Static and Cyclic Testing of Train C Conduit Support Components, CPSES," CC+L, February 14, 1986.

9. Impell Project Instructions PI-0210-051-01, "Seismic Evaluation of Train C Conduit Using Refined Criteria," Rev. 2, Job 0210-051-1355, Impell Corporation, Walnut Creek, California, February, 1986.

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11. Impell Project Instructions PI-0210-052-03, "Seismic Evaluation of Train C Conduit," Rev. 0, Job 0210-052-1355, Impell Corporation, Walnut Creek, California, July, 1986.

12. Impell Project Instructions PI-0210-052-06, "Procedures for Modeling and Analysis of Conduit Systems", Rev. 0, Job 0210-052-1355, Impell Corporation, Walnut Creek, California, July 1986.

13. ASME Code Case N-420, 1985.

14. AISI Code, Specification for the Design of Cold-formed Steel Structural Members, American Iron and Steel Institute, Washington DC, Sept. 3, 1980.

15. ASTM Standard E-488-84, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements", American Society for Testing and Materials, 1984.

16. IEEE Standard 344-1975, "IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Generating Stations," Institute of Electrical and Electronics Engineers, New York, NY, 1975.

17. USNRC Standard Revision Plant 3.7.3, "Seismic Subsystem Analysis," U.S. Nuclear Regulatory Commission, November, 1975.

18. Hilti Kwik Bolt Concrete Expansion Anchors, Justification of Factor of Safety, Impell Report No. 01-0210-1483, Revision 1, July 1986.

19. Impell Report No. 01-0210-1527, "Justification of Damping Value, Train C Conduit", Revision 0, Impell Corporation, Walnut Creek, CA, June, 1986.

20. Impell Report 01-0210-1457, "Technical Evaluation of Chapter 3 of the Comanche Peak FSAR," Rev. B, Impell Corporation, Walnut Creek, California, Oct., 1985.

21. USNRC Regulatory Guide 1.61, "Damping Values for Seismic Design of Nuclear Power Plants," U.S. Nuclear Regulatory Commission, Washington DC, Oct. 1973.

22. ANCO Report No. 1053-21.1-4, "Cable Tray and Conduit Raceway Seismic Test Program," Vols. I and III (Release 4, Final), ANCO Engineers, Inc., Culver City, California, 1978.

23. "Nuclear Plant Equipment Anchorage Study", Progress Report, by URS Blume, Electric Power Research Institute, Palo Alto, California, April 1985.

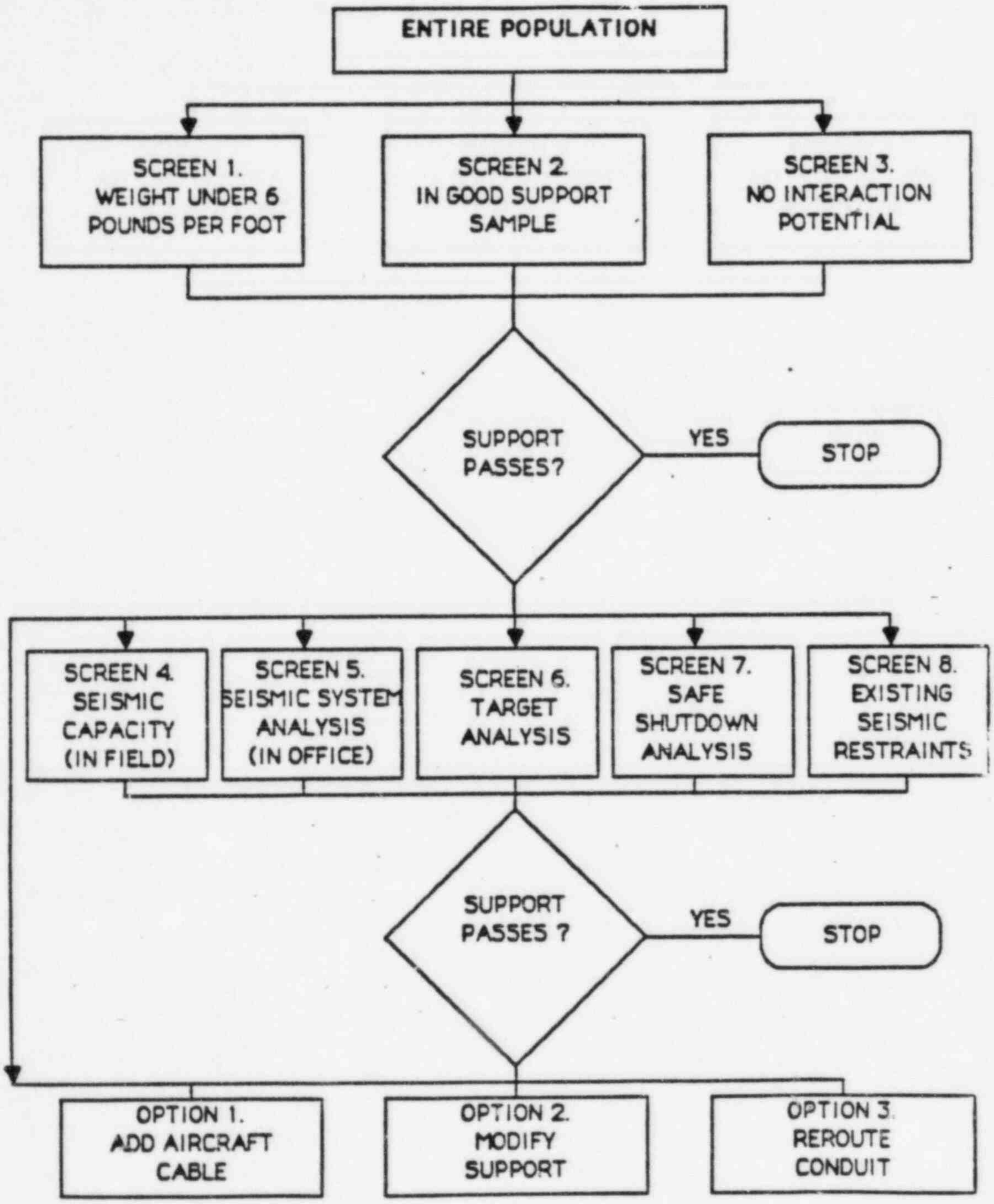
24. Clatto, R.D. and Boentgen, R.R., "Strength of Concrete Expansion Anchors for Pipe Supports," *Effect of Piping Restraints on Piping Integrity*, ASME Century II Emerging Technology Conference, San Francisco, California, August, 1980.

25. "Electrical Raceway Supports Seismic Reevaluation Criteria," San Onofre Nuclear Generating Station Unit 1, Southern California Edison Co., Rosemead, CA., August, 1982.

26. USNRC Regulatory Guide 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis," Rev. 1, U.S. Nuclear Regulatory Commission, Washington DC, Feb. 1976.

27. Impell Calculation ROTC-003, Closley Spaced Mode Summation Procedure for Conduit Gang Supports," Revision 0, May 1986.

FIGURE 1 - WORKFLOW



APPENDIX A - RESPONSES TO NRC QUESTIONS

On May 6, 1986, an audit of Train C work was performed by the NRC. The outcome of this audit was a set of 26 questions pertaining to the Train C program.

This appendix lists these 26 questions and responses to each.

LIST OF NRC QUESTIONS

1. Justification for 7 percent damping
2. Justification for Hilti Kwik bolt factor of safety
3. Target acceptance criteria vs. pipe rupture acceptance criteria
4. Unit 1 and Unit 2 Scope resolution
5. Screen 1: Sample vs. Worst Case
6. Screen 2: Sample vs. Worst Case
7. Screen 3: Zone of Influence
8. Screen 4: Tributary Span Lengths
9. Screen 7: Safe Shutdown Analysis
10. Sway Interactions: Which Screens
11. Cold-formed Steel Local Buckling
12. Self Weight of Supports
13. Fatigue Factor of Safety
14. Longitudinal Loads on Cantilever Supports
15. Sample Calculation Errors
16. Carbon vs. Stainless Steel for Pipes
17. Target Effects on Nearby Supports
18. HVAC Duct Dimensions for Targets
19. Tables Missing from Appendix D
20. Type 7 - Good Supports
21. Type 8 - Good Supports
22. Screen 4: 2 and 3 Dimensional Loads
23. Do Refined Criteria Match Requirements of S.R.P. 3.7.2
24. Fatigue Analysis; Number of Cycles
25. Train C Load Combinations
26. Multi Mode Factor of 1.1

RESPONSES TO NRC QUESTIONS

Question 1: Justify the use of 7 percent damping for Train C Conduit.

Response 1: Justification for 7 percent damping is included in Section 4.3.4 of this report. In addition, a report on damping [19] has been compiled.

Question 2: Justify the use of a factor of safety of 3 for Hilti Kwik Bolts.

Response 2: Justification for a factor of safety of 3 for Hilti Kwik bolts is given in Section 4.3.3 of this report. In addition, a report on the factor of safety for Hilti-Kwik bolts [18] has been compiled.

Question 3: Is the use of pipe rupture acceptance criteria appropriate for Train C target acceptance criteria.

Response 3: Pipe rupture acceptance criteria are not used for the Train C target acceptance criteria. Train C target acceptance criteria are described in Section 4.4.2 of this report.

Question 4: Is Unit 2 part of the Train C walkdown path?

Response 4: Unit 2 is part of the Train C walkdown path. This is described in Section 1.0 of this report.

Questions 5 & 6: Screen 1 and 2 are based on the sample study with no load or dimensional restrictions.

Response 5 & 6: Screen levels 1 and 2 are based either on worst case engineering calculations or a sample of typical engineering calculations. In either case, the walkdown checklists used in screen levels 1 and 2 include restrictions which ensure that the supports qualified by these screen levels are within the bounds of the engineering calculations. This is further described in Sections 4.5.1 and 4.5.2 of this report.

Question 7: The criteria document (Revision 0) does not give a zone of influence for the interaction checks when using screen level 3.

Response 7: Table 3.1 of the walkdown instruction (Impell Project Instruction Number 0210-053-01, Revision 1) gives the zones of influence for use in screen level 3.

Question 8: The method to calculate the tributary span lengths may be unconservative for screen level 4.

Response 8: The method to calculate the tributary spans lengths is described in Section 4.5.4 of this report. The tributary span length is used in the equivalent static force method to calculate applied loads to a support. This method is conservative and commonly applied for nuclear plant structures following the guidelines in R.G. 1.100.

Question 9: Details of the safe shutdown system method (screen 7) are not provided in the Revision 0 of the criteria document.

Response 9: Screen 7 may be implemented towards the end of the plant walkdown. As such, procedures for this screen 7 are not yet finalized. Procedures for this screen will be provided at the time that it is implemented.

Question 10: Sway interactions are included only in screen level 3.

Response 10: Sway interactions are described in Section 4.5.3, 4.5.6, and 4.4.2 of this report.

All type 4 and 8 (rod hung) supports will be checked for sway interactions for all screen levels. In addition, any support that is assumed to fail, but qualified by showing that adjacent supports do not fail, will be checked that for any possible sway interactions for the long unsupported length of conduit.

Question 11: Stress checks for unistrut shapes do not check for local buckling of compression flanges.

Response 11: A calculation (Impell Calculation ROTC-19, Job 0210-052-1355) has been performed to check all unistrut shapes at CPSES for local buckling. Local buckling must be checked for situations not covered by calculation ROTC-19.

Question 12: Self weight of supports do not appear to be included in the analysis.

Response 12: All walkdown procedures are based on including support self weight. Support self weight is described in Section 4.3.1 of this report.

Question 13: The fatigue curves define the allowable cycles based on a factor of safety of 1.5 on cycles.

Response 13: The factor of safety for the design fatigue curve is based on the lessor of 1.5 or the mean of the test data less two standard deviations. This is in accordance with ASME Code Case N-420. Section 4.3.1.2.2 of this report describes this procedure.

Question 14: What effect does longitudinal loads have on Train C supports.

Response 14: The effects of longitudinal loads are considered for all Train C supports, as described in Section 4.3.1 and 4.5.4 of this report.

Question 15: There are some errors in the sample calculations in PI-0210-051-01.

Response 15: These errors are corrected in PI-0210-052-03. PI-0210-051-01 is not used in the Train C walkdown program.

Question 16: Development of height versus weight curves for pipe targets assume stainless (screen level 6). What is the effect of carbon steel.

Response 16: Screen level 6 will be implemented at a later date. Effects of carbon steel material will be incorporated into screen level 6.

Question 17: When an impact occurs on a target pipe, how are pipe supports checked.

Response 17: Pipe spans are checked for target pipes to ensure that pipe supports are not effected by the impacting missile. This is done by ensuring that the pipe span is adequately long enough to form a plastic hinge, and that the impact occurs in the middle two thirds of the span. This is described in Section 4.4.1 and 4.4.2 of this report. In this way, the entire energy absorption required is taken by the target pipe, and not the pipe support.

Question 18: How are various HVAC dimensions checked for target impacts.

Response 18: Detailed computer analysis are performed for one HVAC set of dimensions to evaluate target impacts. Results from these analyses are extrapolated to other HVAC dimensions by engineering analysis procedures. These procedures will be included in the target analysis procedures for screen level 6, when this screen level is used in the walkdown.

Question 19: Some tables and figures are missing from Appendix D of Revision 0 of the criteria report.

Response 19: Applicable tables and figures are included in the target evaluation procedure, to be issued prior to implementing screen level 6 in the walkdown.

Question 20: Are support type 7s "good" supports that can be qualified by screen level 2.

Response 20: Support type 7s are not "good" supports that can be qualified by screen level 2.

Question 21: Are support type 8s "good" supports that can be qualified by screen level 2.

Response 21: Support type 8s can be qualified as "good" supports only if they are shown to be similar to support type 4s. Detailed criteria to compare support type 8s will be provided in the walkdown procedures for these supports.

Question 22: Screen level 4 needs to incorporate three directions of loading.

Response 22: See the response to question 14.

Screen level 4 includes provisions for checking three directions of loading.

Question 23: Do the Train C Criteria match the requirements of S.R.P. 3.7.2.

Response 23: As described in Section 2.1.2 of this report, the S.R.P. 3.7.2 allows three methods to show adequacy of Train C conduit. All the screen levels and rework options described in Sections 4.5 and 4.6 of this report fall under the three methods in S.R.P. 3.7.2.

In particular, S.R.P. states that when showing that Train C does not fail due to the SSE, the margin of safety of Train C must be equivalent to that for Category I structures. In section 4.2 of this report, it is stated that all criteria are based on industry standards applicable to category I structures. The specific standards are included with each criteria described in Section 4.3 of this report.

Question 24: Do the number of cycles used in the fatigue analysis (10 equivalent peak to peak cycles) meet FSAR commitments.

Response 24: The CPSES FSAR commitment for Train C is to meet the requirements of R.G. 1.29. To meet R.G. 1.29, it is acceptable to meet the S.R.P. 3.7.2 guidelines.

Section 4.3.1.2.2 of this report specifies that 10 equivalent peak to peak cycles are used in the fatigue analysis of Train C conduit. This number of cycles is acceptable per the N.R.C. S.R.P. 3.7.3, as well as the ASME Code Section N-1214, for Category I structures. Other nuclear power plants, such as Millstone 3, Byron 1 & 2, and Braidwood 1 & 2 specify 10 cycles per earthquake for category I structures.

Therefore, the use of 10 cycles meets the requirements for S.R.P. 3.7.2, to maintain equivalent margin to category I structures. Be meeting S.R.P 3.7.2, this criteria meets CPSES FSAR commitments.

Question 25: Are load combinations for Train C conduit in accordance with CPSES FSAR 3.8.4.

Response 25: CPSES FSAR 3.8.4 covers the load combinations for the category I structures listed in FSAR section 3.2.1.1. FSAR Section 3.8.4 does not cover those plant features that are not safety related.

CPSES FSAR Section 3.2.1.2 covers non safety-related plant features. FSAR Section 3.2.1.2 states that non safety-related features must meet R.G. 1.29. FSAR Section 3.2.1.2 also states that these non safety-related features must be designed and constructed such that the SSE does not cause any failure of the requirements of R.G. 1.29.

There is no CPSES FSAR commitment to design Train C conduit in accordance with the load combinations in FSAR Section 3.8.4. For example, R.G. 1.29 does not require that Train C conduit be designed for the OBE load case, even though the OBE load case is included in FSAR 3.8.4 load combinations.

Therefore, the Train C load combinations need not be in accordance with FSAR Section 3.8.4, but are in accordance with FSAR Section 3.2.1.2.

Question 26: The use of multimode factor of 1.1 requires justification.

Response 26: A multimode factor of 1.25 or higher is used for all Train C qualifications by the equivalent static force method, as described in Section 4.3.1.1 of this report. This factor has been justified by specific calculations.