INSPECTION CG&E/CATALYTIC, INC. (CI)

AUGUST 10 - SEPTEMBER 17, 1982

AREAS OF CONCERN

QA PROGRAM

- QA/TRAINING
- DESIGN CONTROL
- PROCEDURES
- DOCUMENT CONTROL
- INSPECTIONS
- NONCONFORMING CONDITIONS
- CORRECTIVE ACTION
- RECORDS
- AUDITS

QA PROGRAM/TRAINING

FINDINGS

LACK OF ADEQUATE WRITTEN POLICIES, PROCEDURES, INSTRUCTIONS WITH MAJOR ORGANIZATIONS/FUNCTIONS DEFINED INCLUDING

- RESPONSIBILITIES AND AUTHORITIES
- ORGANIZATIONAL CHARTS AND FUNCTIONAL DESCRIPTIONS — CG&E denies violation
- INTERFACES DEFINED

LACK OF ADEQUATE TRAINING — lack of adequate program for training → CG&E sees as prod / QA function divorced & believes adeq. training

- GENERAL INDOCTRINATION TRAINING
- QA/QC PROCEDURAL AND TECHNICAL TRAINING

PREVIOUS FINDINGS BY NRC (INSPECTION REPORTS)

- 80-16 QA/QC ORGANIZATION CHANGES WITHOUT UPDATE OF FSAR, QAM, AND PROCEDURES.
- 80-25 REACTOR CONTROLS, INC., QA MANUAL
- 81-13 CG&E QA PROGRAM BREAKDOWN
- 82-01 CG&E QAD PERSONNEL RESPONSIBILITIES, AUTHORITIES, AND PERSONNEL CERTIFICATIONS
- 82-06 HJK ENGINEERING ASSISTANTS PERFORMING WELDING ENGINEER FUNCTIONS

corrective action for these ... of previous

DESIGN CONTROL

FINDINGS

CORPORATE DESIGN CONTROLS

- INSUFFICIENT DESIGN REQUIREMENTS SPECIFIED
- LACK OF DESIGN CONSIDERATIONS
- FIELD PROCEDURES OUTSIDE S&L DESIGN CRITERIA

SITE DESIGN CONTROLS

- ALTERATION OF GENERIC DESIGN REQUIREMENTS BY SITE RESIDENT ENGINEER
- CHANGES TO BOLT SPACING AND STRUCTURAL BOLTING BY SITE RESIDENT ENGINEER

PREVIOUS FINDINGS BY NRC (INSPECTION REPORTS)

- 80-05 DESIGN CONTROL ASSOCIATED WITH SMALL BORE PIPING SUSPENSION SYSTEM
- 80-19 DRAWINGS NOT REFLECTED IN THE FIELD
- 80-22 DDC AND SPECIFICATION CONTROLS
- 80-25 S&L SPECIFICATION INADEQUACIES
- 81-07 INADEQUATE DESIGN REVIEW BY S&L AND CG&E GED
- 81-13 OVERALL DESIGN CONTROL
- 81-15 CG&E NPD DESIGN CHANGE CONTROL PROGRAM

PROCEDURES

FINDINGS

PROCEDURE ADEQUACY

- UNCLEAR PROCEDURES CONTROLLING RCCs AND DDCs
- INADEQUATE CONTROL OF WORK ASSIGNMENTS
- INADEQUATE CONTROL OF WORK CLASSIFICATIONS

PROCEDURE IMPLEMENTATION

- FAILURE TO ISSUE A DDC WHEN REQUIRED
- FAILURE TO ISSUE A WORK REQUEST (WR)

PREVIOUS FINDINGS BY NRC (INSPECTION REPORTS)

- 80-16 HANGER QC INSPECTION PROCEDURE DEFICIENT
- 80-25 INCOMPLETE PROCEDURES FOR CRD SUSPENSION SYSTEM, VOIDING OF NRs BY QAM
- 81-13 VOIDING OF NRs
- 81-17 INADEQUATE PROCEDURE REVIEW (11 MONTHS)
- 82-01 INADEQUATE PROCEDURES
- 82-06 FAILURE TO FULLY IMPLEMENT CALIBRATION PROCEDURE

DOCUMENT CONTROL

FINDINGS

- FAILURE TO ENSURE LATEST DRAWINGS AND DDCs IN CWPs
- FAILURE TO CONTROL ISSUANCE OF DRAWINGS
- FAILURE TO CONTROL DDCs AND REVISIONS
- FAILURE TO ESTABLISH MEASURES TO EVALUATE CHANGES RELATED TO ONGOING AND COMPLETED WORK

PREVIOUS FINDINGS BY NRC (INSPECTION REPORTS)

- 80-05 CONTROL AND APPROVAL OF DDCs
- 81-13 CONTROL OF DDCs AND INSPECTIONS

INSPECTION

FINDINGS

- INADEQUATE QC INSPECTION PROGRAM
- LACK OF INPROCESS INSPECTION PROGRAM

PREVIOUS FINDINGS BY NRC (INSPECTION REPORTS)

- 80-15 INADEQUATE INSPECTION OF STRUCTURAL DESIGN CHANGES
- 80-25 FAILURE TO INSPECT CONCRETE ANCHOR BOLTS AND SUSPENSION SYSTEM
- 81-13 LACK OF INPROCESS INSPECTIONS

NONCONFORMING CONDITIONS

FINDINGS

- INADEQUATE NCR AND DDC NOT ISSUED
- MAPPING OF CORE DRILL HOLES - NO NR ISSUED
- USE OF DDC IN LIEU OF NCR

PREVIOUS FINDINGS BY NRC (INSPECTION REPORTS)

- 80-05 FAILURE TO ISSUE NRs
- 80-09 INADEQUATE HANDLING OF NONCONFORMING ITEMS
- 80-25 DDCs IN LIEU OF NRs
- 81-13 PROCESSING OF NRs
- 81-17 DDCs ISSUED IN LIEU OF NRs
- 81-18 FAILURE TO IDENTIFY NONCONFORMANCES

CORRECTIVE ACTIONS

FINDINGS

INADEQUATE CORRECTIVE ACTIONS

- REPETITIVE ITEMS IN ALL AREAS INCLUDING CORRECTIVE ACTIONS
- PROCEDURES REVIEWED BY UNQUALIFIED PERSON

UNTIMELY CORRECTIVE ACTION

- FAILURE TO ENSURE AUDIT FINDING PROMPTLY CORRECTED
- FAILURE TO CORRECT THE DEFICIENCY REGARDING WORK CLASSIFICATION

PREVIOUS FINDINGS BY NRC (INSPECTION REPORTS)

- 80-14 INADEQUATE RESPONSE TO AUDIT FINDINGS AND INADEQUATE CORRECTIVE ACTION REGARDING WELD ROD CONTROL
- 80-19 INADEQUATE CORRECTIVE ACTIONS - WELD ROD CONTROL (11 CASES IN 5 YEARS)
- 80-25 INEFFECTIVE CORRECTIVE ACTIONS
- 80-26 INADEQUATE CORRECTIVE ACTIONS ASSOCIATED WITH AN AUDIT FINDING
- 81-13 INADEQUATE CORRECTIVE ACTION
- 81-18 REPEATED FAILURE TO TAKE CORRECTIVE ACTIONS
- 82-05 INADEQUATE CORRECTIVE ACTION TIMELINESS, PROCEDURE ADHERENCE, UNDERSTANDING, AND OBJECTIVE EVIDENCE

RECORDS

FINDINGS

- LACK OF SURVEILLANCE ACTIVITY DOCUMENTATION
- FAILURE TO PROVIDE/RECORD INSPECTION PROCEDURE/ACCEPTANCE CRITERIA

PREVIOUS FINDINGS BY NRC (INSPECTION REPORTS)

- 81-13 INADEQUATE RECORDS

AUDITS

FINDINGS

AUDITS

- FAILURE TO ADEQUATELY AUDIT ACTIVITIES

AUDIT FOLLOWUP

- FAILURE TO REQUIRE FOLLOWUPS OF AUDIT CONCERNS

AUDIT EFFECTIVENESS

- PROVISION OF DETAILED AUDIT CHECKLISTS TO AUDITED GROUP PRIOR TO THE AUDIT

PREVIOUS FINDINGS BY NRC (INSPECTION REPORTS)

- 80-25 INADEQUATE AUDIT OF REACTOR CONTROLS, INC.
- 81-13 INADEQUATE AUDITS

SPECIFIC REPETITIVE PROGRAM DEFICIENCIES

QA PROGRAM	80-25, PARAGRAPH 1.B - SIMILAR FINDINGS DISCUSSED IN THE REPORT
SITE DESIGN CONTROL	80-05, PARAGRAPHS 4.B(1) AND 4.B(2) - SAME FINDING DISCUSSED IN THE REPORT
PROCEDURES	80-16, PARAGRAPHS 3 AND 5; 80-22, PARAGRAPH 2; 80-25, PARAGRAPHS 1.C AND 3.D; AND 81-17, PARAGRAPHS 1 AND 3E - SIMILAR FINDINGS DISCUSSED IN THE REPOR
INSPECTION	80-25, PARAGRAPH 1.D - SIMILAR FINDINGS DISCUSSED IN THE REPORT
AUDIT	80-25, PARAGRAPH 2 - SAME FINDINGS WERE DISCUSSED IN THE REPORT
NONCONFORMANCES	80-05, PARAGRAPH 4.A (2); 80-25, PARAGRAPH 4.B; AND 81-17, PARAGRAPH 2.C - SAME FINDINGS WERE DISCUSSE IN THE REPORTS. USE OF DDC IN LIEU OF NRs IS A VIOLATION OF THE CG&E SWO-80-12

SPECIFIC MANAGEMENT AND STAFF MEETINGS

PIPING SUSPENSION SYSTEM PROBLEMS

- 03/07/80 REGION III, REPORT 80-05, PARAGRAPH 6, CONCERNING HANGERS AND RESTRAINTS, QC INSPECTIONS, AND OTHER NEEDED IMPROVEMENTS.

- 08/15/80 EXIT INTERVIEW, REPORT 80-16, REGARDING THE PIPE SUPPORT SYSTEM PROBLEMS.

- 11/20/80 SALP, REPORT 80-27, PARAGRAPH 3C, REGARDING PIPE SUSPENSION SYSTEM PROBLEMS.

- 01/28/81 REGION III ENFORCEMENT CONFERENCE, REPORT 81-04, RELATED TO INSPECTION FINDINGS ASSOCIATED TO REACTOR CONTROLS, INC. DESIGN AND INSTALLATION OF THE CRD SYSTEM INCLUDING THE UPGRADE OF THE CG&E QA PROGRAMS.

- 03/31/81 SITE STAFF DISCUSSION, REPORT 81-17, PARAGRAPH 3, REGARDING VOIDING OF NRs: LACK OF CG&E AUDITS OF REACTOR CONTROLS, INC: 100% INSTALLATION INSPECTION OF HANGER WELDING, AND INADEQUATE PROCEDURE REVIEW.

OTHER RELATED MANAGEMENT AND STAFF MEETINGS

- 08/19/81 REGION III, REPORT 81-23, REGARDING THE PLANS TO UTILIZE CATALYTIC, INC., TO PERFORM WORK AT ZIMMER

- 02/12 & 19/82 SITE AND TELEPHONE DISCUSSIONS, REPORT 82-03, PARAGRAPH 3, REGARDING PERSONNEL QUALIFICATIONS AND PROCEDURE ADEQUACY

FAILURE TO MEET PREVIOUS COMMITMENTS

NRC - RIII DECEMBER 24, 1980 IAL

- ITEM 3 "NOT ALLOW ANY FURTHER WORK BY RCI UNTIL NRC HAS RECEIVED YOUR CORRECTIVE ACTIONS AND DETERMINED THAT SUCH ACTIONS ARE SATISFACTORILY COMPLETED."

CG&E SWD 80-14, REVISION 1, DATED DECEMBER 31, 1980

- "EFFECTIVE IMMEDIATELY, ALL WORK ON MATERIALS, EQUIPMENT OR SUPPORTS FURNISHED OR INSTALLED BY RCI...SHALL BE DISCONTINUED. THIS SWO WILL BE RESCINDED FOLLOWING ACCEPTANCE OF RCI QA PROGRAM AND PROCEDURES, AND SUCCESSFUL COMPLETION OF AN AUDIT TO EVALUATE QA PROGRAM IMPLEMENTATION."

CG&E/CI PROGRAM INADEQUACIES

- NUMEROUS AREAS OF CONCERN
- FAILURE TO ADEQUATELY AUDIT CI
- INEFFECTIVENESS OF CORRECTIVE ACTION

ZIMMER - 10/28/82

CHRONOLOGY OF EVENTS SINCE LAST COMMISSION BRIEFING

JUNE 10, 1982	CONGRESSIONAL HEARING
JUNE 29, 1982	ALLEGED CONTINUING INTIMIDATION AND HARASSMENT • MEETING WITH QA/QC INSPECTORS
JULY 1982	ALLEGATIONS RE WELDER QUALIFICATIONS
JULY 14, 1982	PUBLIC UTILITIES MEETING
AUGUST 1, 1982	REDUCE 100% REINSPECTION EFFORT
AUGUST 4, 1982	OI ASSUMED RESPONSIBILITY FOR INVESTIGATION
AUGUST 10, 1982	NATIONAL BOARD MEETING • THREE INTERIM REPORTS
SEPTEMBER 1982	FIRST MONTHLY STATUS REPORT ISSUED
SEPTEMBER 14, 1982	CONGRESSIONAL HEARING
SEPTEMBER 16, 1982	CINCINNATI ENVIRONMENTAL ADVISORY COMMITTEE HEARING
SEPTEMBER 24, 1982	"DEMAND FOR INFORMATION"
OCTOBER 19, 1982	REGION III - CG&E MEETING • CG&E/CATALYTIC, INC. INSPECTION FINDINGS • STOP WORK ORDERS ISSUED CONCERNING CRD SYSTEM, MISCELLANEOUS, AND ALL OTHER safety related ESSENTIAL WORK BY CATALYTIC (AUGUST - OCTOBER)
OCTOBER 25, 1982	KAISER QC INSPECTOR DISCHARGED.
OCTOBER 26, 1982	CG&E REDUCTION-IN-FORCES BY 25%

OCT 27 1982

IONAL BOARD

A NUMBER	SUBJECT	OCP TASK
1	GENERIC DESIGN SPECIFICATION	VII. IX
2	MATERIAL RELEASE BY NON-CERTIFICATE HOLDERS	III
3	MATERIAL MANUFACTURE, CERTIFICATION, AND SUPPLY	I, III
4	CG&E TAKEOVER OF PARTIAL PIPING SYSTEMS	
5	OWNER'S ANI	I, III
6	CATALYTIC'S MODIFICATIONS TO PIPING SYSTEMS	
7	STATE ACCEPTANCE OF CONTAINMENT LINER	II, III
8	VESSEL MODIFICATION BY HJK	III, VIII, IX
9	MANDATORY PREHEAT REQUIREMENTS	II
10	PUMPS AND VALVES TO THE 1968 CODE	III, VIII, IX
11	SHIMMING OF PENETRAMETERS	V
[illegible]	OVERSTRESS DURING HYDROSTATIC TESTS	
13	IMPROPERLY STAMPED FLOW CHECK VALVES	III
14	NON-CODE COMPONENTS	
15	AS-CONSTRUCTED DRAWINGS	II, III, IX
16	CLOSURE OF NR'S PRIOR TO STAMPING	
17	ISSUANCE AND CONTROL OF NR'S	
18	REVIEW OF CONSTRUCTION PROCEDURES	
19	REVIEW OF IIDR'S	
20	TEMPORARY CHANGE NOTICES	
21	QUALIFICATION OF NDE PERSONNEL	I, II, III, X
22	RADIOGRAPHIC WELD IDENTIFICATION	

OCT 2 7 1982

SUMMARY OF THE PROGRESS OF QUALITY CONFIRMATION PROGRAM (QCP) TASK AREAS
AS OF APRIL, JUNE, JULY, AUGUST, AND SEPTEMBER 1982

TASK AREA		PERCENT COMPLETE/EXPECTED COMPLETION AS OF				
		APRIL	JUNE	JULY	AUGUST	SEPTEMBER
I.	STRUCTURAL STEEL*	4% 12/01/82	31% 12/01/82	35% 12/01/82	50% 12/01/82	57% 12/01/82
II.	WELD QUALITY*	34% 10/31/82	58% **	58% **	62% **	68% **
III.	HEAT NUMBER TRACEABILITY*	55% 10/06/82	30% **	30% **	33% **	33% **
IV.	SOCKET WELD FITUP	96% 08/13/82	98% 08/01/82	95% 10/01/82	96% 10/01/82	98% 12/01/82
V.	RADIOGRAPHS	95% 10/04/82	97% 08/01/82	97% 09/15/82	98% 11/15/82	98% 11/15/82
VI.	CABLE SEPARATION *	49% 07/30/82	54% 12/31/82	52% 12/31/82	35% 06/01/83	44% 06/01/83
I.	NONCONFORMANCES	66% 08/20/82	61% 12/31/82	40% 12/31/82	52% 12/31/82	61% 01/30/83
VIII.	DESIGN CONTROL AND VERIFICATION	90% 06/01/82	97% 07/15/82	99% 08/15/82	99% **	99% **
IX.	DESIGN DOCUMENT CHANGES	28% 12/31/82	34% 12/31/82	35% 12/31/82	<32% 04/15/83	<33% 04/15/83
X.	SUBCONTRACTOR QA PROGRAMS	37% 07/16/82	60% 08/13/82	65% 09/15/82	75% 10/15/82	75% 10/30/82
XI.	AUDITS	45% 07/16/82	70% 10/08/82	72% 10/08/82	74% 11/15/82	80% 11/15/82

*Areas viewed by Region III as potentially requiring a significant amount of rework.
**Estimated completion date to be determined.

OCT 2 7 1982

AE – Sargent & Lundy
PA – CG&E
Const – Kaiser

ZIMMER -- PLANNED INITIATIVES

1. HALT CONSTRUCTION + stop QC work

2. REQUIRE THIRD PARTY TO MANAGE THE TOTAL PROJECT

→ you may not want CG&E to go ahead rework

3. REQUIRE THIRD PARTY TO REVIEW QCP AND OVERVIEW CG&E QA PROGRAM

4. ALLOW WORK TO RESTART AFTER PROJECT MANAGEMENT TEAM IS OPERATIONAL AND THIRD PARTY IS FUNCTIONING TO REVIEW CG&E QA PROGRAM

5. REQUIRE THIRD PARTY REVIEW OF DESIGN AND CONSTRUCTION OF ONE OR MORE SYSTEMS

how to be written in a way to [illegible]

show cause why your license should not be suspended until your mgmt organ is changed.
need to obtain approval for future work

show cause why [illegible] all ongoing construction work including rework
until (1) there is a new management system and
(2) rework ~~in progress~~ is given prior approval by NRC

Don't have confidence in mgmt controls

DRAFT
LTBL
10/4/82

(3)

SECTION I

~~Reviewed~~ Prepared by: I. T. Yin
~~Prepared~~ Reviewed by: D. H. Danielson, Chief
Materials and Processes Section

~~The NRC RIII management~~ Region III was informed by the licensee that they had placed a Stop Work Order (SWO) on Catalytic, Inc. (CI) on August 5, 1982, pertaining to the removal of hangers and supports. The SWO number is 82-01, and the reason given was "work may not proceed until release of the existing SWO 80-14 is approved by NRC per confirm letter dated December 24, 1980." The purpose of this inspection was to determine the adequacy of licensee control of CI work program activities, and to determine if the licensee had violated ~~the~~ SWO 80-14 and the requirements stated in the ~~NRC RIII~~ Region III Immediate Action Letter (IAL), dated December 24, 1980. Prior to the completion of the inspection, the CG&E QA issued a Management Corrective Action Request, No. 82-04, dated August 12, 1982 to CG&E Generation Construction Division stating, "CG&E has proceeded with the testing of the CRD system and the removal of line hangers prior to obtaining the required NRC release."

1. ~~Ineffective~~ CI Program

The inspector reviewed the following CI work procedures and Control Work Packages (CWPs), :

a. CI Nuclear Maintenance Procedures

- NMP-2, "Preparation of CWP/WP," Revision 1, dated December 19, 1981.

- NMP-5, "Job Completion and Walkdown," Revision 0, dated November 9, 1981.

- NMP-13, "Noncompliance, Corrective Action, and Stop Work Notification," Revision 0, dated November 10, 1981.

- NMP-18, "Preparation of Design Document Changes," Revision 0, dated December 7, 1981.

- NMP-20, "Work Implementation Interface Requirements," Revision 0, dated June 11, 1982.

b. CI Quality Assurance Procedures

- QAP 10-2, "Inspection of Weldments," Revision 0, dated January 11, 1982.

- WAP 10-8, "Inspection of Piping Hangers," Revision 0, dated January 11, 1982.

- WAP 17-2, "Review and Turnover of CWP/WPS," Revision 0, dated December 16, 1981.

c. CI Engineering Instruction Welding (not yet reviewed and accepted by CG&E)

- EIW-1, "Fillet Weld Inspection Requirements per AWS D1.1-72 and H-2174, Section 5.2 Supp. 4 for Welds Requiring Visual Inspection Only," Revision 2B, August 4, 1982.

- EIW-3, "Weld Inspection Requirements, Welds per Section III ASME Boiler and Pressure Vessel Code," Revision 2A, July 22, 1982.

- EIW-4, "ANSI B31.1-1972 Edition Welding Requirements," Revision 0, June 11, 1982.

- EIW-5, "Weld Inspection Requirements per AWS D1.1-72 for Welds Requiring Visual Inspection Only," Revision 1C, July 22, 1981.

d. CI CWPs Relative to CRD Work

- CWP 82.007.05, "Removal of N_2 Cylinders, North Side."

- CWP 82.007.07, "Removal of N_2 Cylinders, South Side."

- CWP 82.007.14, "Removal of Restraints S-9 and S-10, North and South Sides."

- CWP 82.007.18, "Rebar Probe, Base Plates, South Side."

- CWP 82.007.20, "Rebar Probe, Base Plates, North Side."

- CWP 82.007.21, "S-12, S-13, and S-14, North and South Sides."

At the end of the review, the inspector concluded that the CI program was not inclusive relative to the purpose and function of the site safety related work activities. ~~Which~~ The portions of the CI QA/QC program that ~~were~~ are applicable or effective at any specific time period cannot be determined prior to the issuance of the CWPs.

The CI program, that may include work to be performed in CRD system piping, electrical, structural coating, and possibly other areas, was not defined by the licensee. The program work scope~~s~~, the authorities, and responsibilities were not established in the form~~s~~ of a contract or purchase order. There were no ~~intra~~organizational functional, communication charts or descriptions to ensure effective work interface. Rather, the CI scope was defined on each of the CWPs, wherein segments of the work activities were approved by the CG&E responsible staff. The inspector recognize~~d~~s the need of the CWP system, which is essentially a Work Traveler (WT) system~~,~~ commonly seen in all other construction projects, with ~~the only~~ one difference, i.e., the WTs normally reference the program procedure instructions, whereas the CWP generates specific work instructions on each individual package. In order to determine the CI overall program measure adequacy, the inspector selected CWP 82.007.18 and 19 for detailed review and observation. The numerous findings documented in the subsequent paragraphs ~~concluded~~ indicate that the licensee's control of CI and the CI program were both insufficient and ineffective.

This ~~was considered to be a violation of~~ is contrary to 10 CFR 50, Appendix B, Criterion I, ~~requirements. (358/82-13-01)~~ and CG&E QA Manual, Section 1. (358/82-13-01)

2. ~~Inadequate~~ Design Control

The inspector reviewed the following S&L Drawings, CG&E DDCs, and the CI CWP:

- S-680, "Reactor Building HCU Support Framing Plans Sections and Details," Revision H, dated July 30, 1982.
- S-686, "Reactor Building HCU Support Base Plate Location Plan El. 546'-0"," Revision F, dated July 30, 1982.
- DDC No. S-4190, Revision 0, dated August 20, 1982.
- DDC No. S-4190, Revision A, dated August 31, 1982.
- CI CWP 82.007.20, Change Notice 1, dated July 13, 1982.

Subsequent to the review, the inspector determined that the licensee design control of installation tolerance was inadequate in the following ways:

a. At the time of hole drilling for the installation of ~~the~~ base plates, there were insufficient design requirements~~, such as~~ for core drill hole angularity, and hole diameter deviation acceptance tolerances. After almost all the holes were drilled, then these requirements were stated in DDC No. S-4190. Furthermore, there were no general or specific design provisions or considerations on how to handle those holes drilled that could not meet the DDC No. S-4190 requirements. (358/82-13-02 A)

b. The lack of design consideration of the large reinforced concrete cross beam below the floor had resulted in great difficulties in installation hole positioning and drilling. ~~The~~ A design change was subsequently made using structural steel channels ~~to be~~ placed on top of all the long base plates near the CRD N_2 bottles. (358/82-13-02B

~~c. The CI CWP 82.007.20 did not reference all the S&L design drawings. In Paragraph 1.4, "Reference," it did not include S&L drawing S-680, "HCU Support Framing Plan Sections and Details," Revision H, including the "HCU & CRD Support Notes."~~

~~d.~~ c. SK-CWP 82.007.20, embedment hole detail for the 1" diameter anchor bolts to be installed at base plates A, B, F, and J was not in accordance with the S&L design. The referenced S&L drawings S-686, Revision C, Detail P1 provide~~d~~s for installation of 3/4" diameter anchor bolts only. (358/82-13-02C)

The lack of S&L sufficient design consideration prior to hardware installation, and the ~~lack~~ failure of CI to obtain design review and approval from S&L ~~were considered to be a violation of~~ are contrary to 10 CFR 50, Appendix B, Criterion III, ~~requirements. (358/82-13-02)~~ and CG&E QA Manual, Section 3. (358/82-13-02 A, B, C as stated)

3. ~~Inadequate~~ Site Design Change Control

a. The inspector reviewed CWP 82.007.18, "Rebar Probe Base Plate - South Side," where some of the work was signed off in July, 1982. The CWP identified that they could not meet the requirements relative to core hole spacings and minimum bolt to plate edge distances. A Request for Clarification/Change (RCC) No. C-098 was issued by CI on June 15, 1982 and dispositions ~~were~~ was provided by the S&L site resident engineer on June 22, 1982. The generic S&L design requirements as documented in CWP 82.007.18, Paragraph 5.5, Note B states, "Design tolerance for all core drill holes to avoid cutting or nicking rebar is ± 1.5 inches any direction for two inches diameter, and ± 1.75 inches in any direction for 2 1/2 inches diameter." These requirements were revised to "Increase tolerance along the plate in NS direction to six inches providing four inches minimum spacing is maintained. If this cannot be achieved, chip concrete six inches wide EW direction to three inches deep" without review and approval from the S&L corporate design engineering departments. (358/82-13-03 A)

b. Another CI RCC No. C-110, authorized by S&L site design resident engineer on July 29, 1982 allowed bolt spacing and structural bracing design change without review and concurrence commensurate with the original design requirements. (358/82-13-03 B)

The alteration of generic S&L design tolerance requirements by the S&L Resident Design Engineer, whose responsibility was restricted to resolution of specific site problems on a case by case basis, ~~was~~ is contrary to ~~considered to be a violation of~~ 10 CFR 50, Appendix B, Criterion III, and CG and E QA Manual, Section 3. ~~requirements. (358/82-13-03)~~ . (358/82-13-03 A, B as stated)

As a result of the inspection findings discussed in Paragraphs 2 and 3, the licensee issued the following Stop Work Order and Corrective Action Request:

- Stop Work Order No. 82-01, Revision 2, dated September 10, 1982 to CI. Reason: "The adequacy of S&L's design modifications for the installation of CRD system supports is questioned due to the inability of placing anchor bolt holes in the specified locations."

- Corrective Action Request No. 82-63, dtaed September 10, 1982 to S&L, stating, "The adequacy of the design modifications for the CRD system supports and hangers is indeterminate due to insufficient selection and review of design inputs as documented in the...DDCs...."

4. ~~Lack of~~ Procedure Implementation

In conjunction with the CWP 82.007.18, as discussed in Paragraph 3 above, the CWP Paragraph 5.5, Note E states, "Where the requirements of Notes B and D of this work step cannot be satisfied, the instructions of Enclosure 1.5.12 shall be followed. A DDC shall be prepared and added to this CWP once a suitable location for these core drill holes is found."

- Note B states the bolt spacing requirements.

- Note D states that the base plate minimum edge distance shall be 1.75 inches for 1 inch diameter bolts and 1.25 inches for 3/4 inch diameter bolts.

- Enclosure 1.5.12 is RCC No. C-098, as stated in Paragraph 2.

- DDC stands for Design Document Change (DDC).

The inspector determined that the CWP instruction had not been followed because ~~no~~ a DDC ~~was~~ had not been generated and approved prior to the actual drilling of the core holes. This is ~~a violation of~~ in contrary to the 10 CFR 50, Appendix B, Criterion V, ~~requirements, (358/82-13-04)~~ and CG and E QA Manual, Section 5. (358/82-13-04 A).

Prior to the conclusion of the inspection, CI issued NCR No. 013, dated August 24, 1982, ~~stating~~ documenting the above problems.

5. ~~Inadequate~~ Site Procedure Provisions

In conjunction with the inspection findings included in Paragraphs 3 and 4 above, the RCC system prescribed in Attachment B of the CI Nuclear Maintenance Procedure (NMP) -2, "Preparation of CWP/WP," Revision 1, dated December 19, 1981 could, ~~such as~~ as illustrated by CWP 82.007.18, circumvent ~~shortchange~~ the DDC requirements. The DDC requires that final design review approval ~~to~~ be made by the S&L corporate design organizations, but the RCC does not. Furthermore, the processing of an RCC as stated in NMP-18, "Preparation of DDC," Revision 0, dated December 7, 1981 appear~~ed~~s to be an intermixing of the two systems' preparation and review requirements. It also does not clearly define the difference and the relationship between the RCC and DDC systems.

As a result of the procedural deficiencies, a number of RCCs that were written requiring design drawing revisions, did not receive S&L corporate design drawing change review as required in the DDC system. Examples are:

- C-036, authorized on March 3, 1982
- C-038, authorized on March 3, 1982
- C-041, authorized on April 21, 1982
- C-042, authorized on March 17, 1982
- C-048, authorized on April 6, 1982
- C-052, authorized on April 1, 1982
- C-054, authorized on April 6, 1982
- C-063, authorized on April 1, 1982

. C-064, authorized on April 1, 1982

. C-065, authorized on April 1, 1982

. C-090, authorized on May 26, 1982

Furthermore, ~~the~~ RCC No. C-101, authorized on June 30, 1982, was used to provide resolution to ~~the~~ NCR No. 009, dated June 23, 1982, relative to ~~the~~ excessive sacrificial shield metal removal~~s~~ during ~~the~~ performance of a CRD restraint modification.

The lack of clearly defined, integrated, and workable procedures is contrary to ~~considered to be a violation of~~ 10 CFR 50, Appendix B, Criterion V, ~~requirements. (358/82-13-05)~~ and CG&E QA Manual, Section 5. (358/82-13-05A)

6. <u>Observation of Drilled Base Plate Holes</u>

In observation of the base plate~~s~~ core holes drilled ~~in~~ for the N_2 bottles, South Sides per CWP 82.007.18, and ~~those in~~ North Sides per CWP 82.007.20, the inspector found that hundreds of holes of 2 to 2.5 inch diameter~~s~~ and small exporation holes, had been drilled in random pattern and configuration. Concrete areas were chipped off in various sizes, shapes, and depths apparently without any control measure~~s~~ in effect.

The inspector selected the following 12'-6" x 8" long base plate holes contained in CWP 82.007.18 for observation, and had the following specific findings:

Acceptable Depths: 3" max. for chip-outs

9" min. for 2" diameter drill holes

9 3/4" max. for 2" diameter drill holes

Findings:

- C-1 Plate — Chip-Outs: one measured to be 4 3/4" deep, and one measured to be 4 1/2" deep among the two chipped-outs.

  Drilled Holes: one measured to be 8 1/2" deep, and one measured to be 8 3/4" deep among the 12 drilled holes.

- C-2 Plate — Chip-Outs: one 4", one 6", and one 5" among the three chipped-outs.

- G-1 Plate — Chip-Outs: one 5", one 3 1/2", and one 8" among the three chipped-outs.

  Drilled Holes: one 8 3/4", one 13", and one 7 1/2" among the 12 drilled holes.

The lack of the CI QC inspection program to ensure timely identification ~~of~~ and resolution of nonconformances is ~~a violation of~~ contrary to 10 CFR 50, Appendix B, Criterion X, ~~requirements (358/82-13-06)~~ and CG and E QA Manual, Section 10. (358/82-13-06A).

Based on the findings discussed in Paragraphs 6 and 7, in disposition of the NCR No. 013 (an administration type NCR, issued on August 24, 1982) on September 13, 1982, the CI project engineer extended the corrective actions to identification and resolution of technical and programmatic problems. Also, a stop work order, contained in CI Corrected Memorandum No. I.O. 82-664, was issued on September 13, 1982. Acknowledgement from the CI construction department was signed on September 14, 1982.

7. ~~Lack of~~ Documentation on Inspection Surveillance

The inspector reviewed CWP 82.007.18, and 20 relative to installation status and QC surveillance and inspection records.

- CWP 82.007.18 included 16 long plates with 3 to 15 core drill hole patterns.

- CWP 82.007.20 included 21 long plates with 3 to 17 core drill hole patterns.

- Surveillance Report No. 466, dated September 1, 1982, stating holes drilled per CWP 82.007.20, work step 5.4, ~~that~~ were out of tolerance.

- Surveillance Report No. 467, dated September 2, 1982, stating that one embedded angle iron and one rebar were damaged in carrying out core drilling per CWP 82.007.18, work step 5.3.

The inspector determined that there ~~were~~ was no documentation of core bore hole drilling surveillances and inspections ~~documentation~~ prior to September 1, 1982. ~~The~~ Surveillance Reports No. 466 ~~to~~ thru No. 468 were written subsequent to the inspector's expressed concern about the subject matters. The lack of CI maintenance of sufficient records to furnish evidence that ~~the~~ safety related activities had been carried out in a controlled manner is ~~a~~ contrary to ~~was considered a violation~~ of 10 CFR 50, Appendix B, Criterion X ~~XVII~~, ~~requirements. (358/82-13-07)~~ and CG&E QA Manual, Section 10. (358/82-13-06 B)

8. ~~Inadequate~~ CI Personnel Training Program

a. The inspector reviewed training provisions for the three QC inspectors, Mr. M. Simon, Mr. P. Weaver, and Mr. G. Thompson, who signed work completion status in ~~the~~ CWP 82.007.18 and 20. The review included: (1) CI QAP 1-2, "Indoctrination, Training, Qualification, and Certification of QA/QC Personnel," Revision 0, dated December 14, 1981; and (2) the general and specific training records. No item of noncompliance, ~~was~~ or deviations were identified.

b. The inspector reviewed hole drilling work signoffs contained in the following CWPs:

CWP 82.007.18

Mr. G. Schneider

Mr. R. Baugh

Mr. J. Britt

CWP 82.007.20

Mr. R. Baugh

Mr. J. Britt

Mr. G. Owens

In review of the CI "Training/Indoctrination Attendance Record", the inspector had the following findings:

Subject 82.007.18 Conducted on May 20, 1982

Only Mr. G. Schneider, among the three, was listed in the attendance.

Subject 82.007.20 Conducted on June 3, 1982

Only Mr. J. Britt, among the three, was listed in the attendance.

At the time of the hole drilling activities, these people were qualified and assigned as craft foremen and there were no personnel training records to show that these individuals had been trained to understand QA/QC, procedural, and technical requirements. In discussion with the CI QA Manager, the inspector was presented a draft training procedure for field construction and purchasing department personnel to be included in CI-QAI-204, "Checklists, ASME Nuclear QA Manual."

The lack of CI training program for the construction personnel ~~was considered to be a violation of~~ is contrary to 10 CFR 50, Appendix B, Criterion II, ~~requirement. (358/82-13-08)~~ and CG & E QA Manual, Section 2. (358/82-13-07)

9. ~~Inadequate~~ Licensee Corrective Measures

In conjunction with deficiencies discussed in Paragraph 4 above, CI issued a Nonconformance Report (NCR) No. 013, on August 24, 1982 stating that, "A DDC shall be prepared and added to this CWP once a suitable location for these core drill holes is found. A suitable location was found per Enclosure 1.5.12 and the anchor bolt core drill was completed. A DDC was not issued at this time. This is in violation of Work Step 5.5, Note E of this CWP." The inspector stated that the licensee measure in correcting the problem was inadequate ~~in the following ways:~~ because

~~a.~~ ~~The~~ NCR No. 13 was an administrative type NCR, and did not identify the technical deficiencies that required timely resolution.

~~b.~~ The mapping of the core drill holes for CWP 82.007.18, and CWP 82.007.20 was without proper determination and control. The generic corrective measures ~~that~~ should include evaluations of the affected areas that had a dense~~r~~ concentration of large and small holes, concrete spallings. ~~and~~ In addition, the acceptability of the existing loading distribution conditions, had not been planned or scheduled by the licensee.

This is ~~a violation of the~~ contrary to 10 CFR 50, Appendix B, Criterion XVI, and CG&E ~~requirements. (358/82-13-08)~~ QA Manual, Section 16. (358/82-13-08A)

10. Document Control

a. The inspector reviewed the following design document changes:

<u>S&L Drawing S-686, Revision E, May 19, 1982, Note 2, Relative to the Core Drill Hole Location Tolerance for Grouted Anchor Bolts</u>:

- Note 2: for 2" diameter, ± 1.5" any direction
  for 2 1/2" diameter, ± 1.75 any direction

- RCC C-098, dated June 15, 1982 and DDC CS-30, dated August 23, 1982: for both 2" and 2 1/2" diameter, ± 6" N/S, and min. 4" bolt distance; or chip-out 6" E/W to 3" deep, no restriction on N/S.

- DDC CS-30, Revision A, dated September 3, 1982:

  Continuous Plate: 3/4" bolt (2" hole): N/S ± 6"
  E/W ± 2 3/4"

  1" bolt (2 1/2 hole): N/S ± 3"
  E/W (no requirement)

Minimum bolt distance and chip-out requirements remained the same.

Individual Plate: Ang. hole size, ± 2.25" any direction

<u>S&L Drawing S-680, Revision H, dated July 30, 1982, "HCU and CRD Support Notes," Relative to the Core Drill Hole Location Tolerance for Grouted Anchor Bolts</u>:

- S-680, Revision H, no requirements

- DDC CS-34, dated September 2, 1982: ± 1 3/4" in any direction for expansion anchors and ± 2 1/4" in any direction for grouted anchors.

The above DDCs, in addition to DDCs S-4190, Revision 0 and S-4190, Revision A (as discussed in Paragraph 2) showed many design tolerance changes that took place in relatively short period of time. The design tolerance basis and justification will be reviewed at S&L. This is an unresolved item. (358/82-13-[redacted]09)

b. The inspector reviewed the latest S&L approved design drawings that were referenced in ~~the~~ CI CWP 82.007.18 and 20:

CWP 82.007.18 (Change Notice 4, July 13, 1982)

- Reference 1.4.2, S-686, Revision F, issued July 30, 1982, and received by CI on August 5, 1982.

- Reference 1.4.3, S-687, Revision E, issued July 30, 1982, and received August 5, 1982.

- Reference 1.4.8, S-680, Revision H, issued July 30, 1982, and received August 5, 1982.

CWP 82.007.20 (Change Notice 1, July 13, 1982)

- Reference 1.4.2, S-686, Revision F

- Reference 1.4.3, S-687, Revision E

At the time of the inspector's review ~~that was performed~~ on September 8, 1982, none of the above up-to-date DDCs and S&L drawings were incorporated in the CWPs.

The lack of licensee document control to ensure that the latest procedures or drawings were being applied in the installation procedures is ~~a violation of~~ contrary to Criterion VI, ~~requirements.~~ ~~(358/82-13-11)~~, and CG&E QA Manual, Section 6. . (358/82-13-10 A)

11. ~~Inadequate~~ CG&E Audit of CI

The inspector reviewed the following subject audit reports:

a. No. 388, conducted on March 1-11, 1982 involving audits of CI procurement and storage, procedural training and qualification, document control.

b. No. ~~4~~ 402, a pre-audit meeting was conducted on May 25, 1981. The audit is considered to be "ongoing." The audit was without an approved audit plan and audit checklists. The scope and the purpose of the audit were not defined prior and subsequent to the pre-audit meeting.

c. Audit scheduled beginning on August 2, 1981. Same deficiencies as b. above.

The lack of CG&E audit of CI ~~was c nsidered to be a violation of~~ is contrary to 10 CFR 50, Appendix B, Criterion XVIII, ~~requirements. (358/82-13-12)~~ and CG&E QA Manual, Section 18.

12. Use of DDC In Lieu of NCR (358/82-13-11 A)

The inspector reviewed CI Surveillance Report No. 468, dated September 2, 1982. It was stated in the results of the surveillance that, "During the drilling of anchor bolt core drill holes on C1-10 of CWP 82.007.18 steel was encountered. Work was stopped and the field engineer was notified per work step 5.3. The field engineer instructed craft to precede drilling with a core drill machine and cut through the 2" piece of angle lying horizontally in the center of the hole. During the core drill cutting of the angle iron a piece of number 6 rebar was directly under the angle and was inadvertently drilled into and nicked on one side. Work was stopped at this point." The "Action Taken" section stated, "Notified Field Engineer, and a DDC will be issued to S&L."

A DDC No. SLS-739, Revision 0, was issued on September 13, 1982. The "Reason for Change" given was "For ease of installation of base plate anchors, due to interference of rebar." The "Description of Change" was "See attachment for area on El. 546' where rebar may or may not be cut. Only the top rebar directly below the base plates shown on S-686 may be cut as shown on the attachment. Any rebar cut shall be documented and submitted to the consulting engineer as required under Spec. H-2174. Size of bars cut, their location and direction shall be provided in a sketch."

The above disposition was accepted by S&L site design resident engineer on September 13, 1982.

The use of a DDC to document and to resolve installation nonconformances ~~was considered to be a violation of~~ is contrary to 10 CFR 50, Appendix B, Criterion VI, ~~requirements. (358/82-13-13)~~ and CG&E QA Manual, Section 6. (358/82-13-10B).

13. Repetitive Licensee Program Deficiencies

Many of the findings identified during this inspection were similar to or exactly the same as previously reported in the ~~NRC-RIII~~ Region III piping suspension system inspection reports ~~findings~~ issued from 1980 to the present. These items are:

- Paragraph 1, "~~Ineffective~~ CI Program" ~~of this report~~ - Similar findings were discussed in RIII Report No. 50-358/80-25, Paragraph 1.b.

- Paragraph 3, "~~Inadequate~~ Site Design Change Control" ~~of this report~~ - Same findings were discussed in RIII Report No. 50-358/80-05, Paragraphs 4.b.(1) and 4.b.(2).

- Paragraph 5, "~~Inadequate~~ Site Procedure Provisions" ~~of this report~~ - Similar findings were discussed in RIII Reports No. 50-358/80-16, Paragraphs 3 and 5; No. 50-358/80-22, Pargraph 2; 50-358/80-25, Paragraphs 1.c. and 3.d.; and 50-358/81-17, Paragraphs 1 and 3.e.

- Paragraph 6, "Observation of Drilled Base Plate Holes," ~~of this report~~ - Similar findings were discussed in RIII Report No. 50-358/80-25, Paragraph 1.d.

- Paragraph 11, "~~Inadequate~~ CG&E Audit of CI" ~~of this report~~ - Same findings were discussed in RIII Report No. 50-358/80-25, Paragraph 2.

- Paragraph 12, "Use of DDC In Lieu of NCR" ~~of this report~~ - Same findings were discussed in RIII Reports No. 50-358/80-05, Paragraph 4.a.(2); No. 50-80-25, Paragraph 4.b.; and No. 50-358/81-17, Paragraph 2.c. This item was also in violation of CG&E Stop Work Order (SWO) No. 80-12,

  ~~SWO No. 80-12,~~ dated December 9, 1980, which stated, "...Effective immediately, the preparation of DDCs on all pipe supports shall be stopped." The reason given was: "Contrary to procedure, DDCs are being used to request approval for as-built conditions which deviate from design drawings."

A number of RIII staff and management meetings were also held with the licensee in 1980 and 1981 relative to the piping suspension system problems identified by the RIII inspection staff. These meetings were documented in the following reports:

- Report No. 50-358/80-05, Paragraph 6 relative to the licensee presentation ~~as~~ and discussions held at the RIII office on March 7, 1980.

- Report No. 50-358/80-16, Exit Interview Section documenting the RIII management discussions with CG&E staff at the site on August 15, 1980.

- Report No. 50-358/81-04 documenting the Enforcement Conference conducted by RIII management at RIII on January 28, 1981.

. Report No. 50-358/81-17, Paragraph 3 relative to the inspector's discussion of continuing problems being identified at the site.

The lack of licensee program corrective measure ~~was a violation of~~ is contrary to 10 CFR 50, Appendix B, Criterion XVI, ~~requirements. (358/82-13-14)~~ and CG&E QA Manual, Section 16. (358/82-13-08B).

14. Licensee QA Program Breakdown

The inspector concluded, based on the findings discussed in this report, that the licensee has violated:

. Item 2 of the NRC-RIII IAL, dated December 24, 1980, which states, "Not allow any further work by RCI until the NRC has reviewed your corrective actions and determined that such actions are satisfactorily completed."

. CG&E SWO No. 80-14, Revision 1, dated December 31, 1980, which states, "Effective immediately, all work on materials, equipment or supports furnished or installed by RCI...shall be discontinued. This SWO will be rescinded following acceptance of RCI QA Program and Procedures, and successful completion of an audit to evaluate QA Program Implementation."

The conclusion was based on the following considerations:

a. The issuance of the IAL was based on the fact that CG&E's QA/QC control over the contractor [illegible] performing the CRD system work was found to be inadequate. The CG&E followup audits, the r in dismissal of RCI from any future design, modificatic installation activities, indicated that CG&E ~~was in~~ rec in action ~~of~~ the problem. ~~The removal of RCI from the involvement, does not, however, equivalent to the CG&E's control over another appointed contractor has been reviewed and satisfied by the NRC RIII staff~~.

b. In view of the present unacceptable CI program, the failure of CG&E implementing its QA audit program, and other deficiencies identified during the inspection, it was determined that the intent and requirements of the IAL and the SWO were violated.

In conclusion, the inspector stated that the licensee program provisions and measures, despite repeated NRC enforcement actions, appeared to be with little improvements in terms of personnel understanding, implementation, and effectiveness. The QA program breakdown was determined to be violation of the NRC regulation at a high severity level.

SECTION II
Prepared by: P.A. Barrett
F.A. Maura
Reviewed by: D.R. Hunter

1. On September 8, 1982, the RIII inspectors reviewed the purchase contract between CG&E and Catalytic, Inc., C.I. The contract was for services to be supplied by Catalytic which could change day-to-day. The contract specified that safety related (essential and nonessential-seismic) activities, performed by Catalytic, would have to comply with the requirements of 10 CFR 50 Appendix B.

   a. During discussions with the site Catalytic management personnel, six different methods were identified, for which CG&E was designating the functions (scope of work) of Catalytic. These six methods were:

      (1) The CG&E punchlist which was addressed in CG&E's Owner's Project Procedure 2.1, revision 0, dated March 8, 1982.

      (2) Letters of assignment from CG&E's Generation Construction Department, GCD. (Often redundant to the punchlist).

      (3) Work Requests, WR, issued by CG&E's Nuclear Production Department, NPD per procedure EC.S*D.05, revision 4, dated February 1, 1982.

      (4) Catalytic Work Authorizations which were initiated by NPD to assign specific Engineering Change Requests (ECRs), punchlist items, and maintenance items.

(5) Quality Confirmation Program, QCP, Work Orders which were addressed in CG&E Procedure 19-QA-13, revision 0, dated September 16, 1981.

(6) Verbal

b. The RIII inspectors reviewed the measures established to control the above six methods:

(1) Procedure 2.1, Section 1.0 stated that the purposes of the procedure were to establish instructions, to assign responsibilities, and to define the required interfaces ... in the generation, compilation, and maintenance of a master "Open Item" punchlist...

Procedure 2.1 Section 2.0 stated that this procedure established a method of reporting these open items, ... and for closeout of these items.

This procedure essentially excluded the QA program in that it did not establish any QA controls for input, change of status of work assignments (duties), or closure of items in the punchlist. This concern has been an NRC open item (358/79-06-03) since 1979. The procedure also did not establish any requirements to control the distribution of the punchlist.

The fact that the master punchlist ~~is~~ was not the controlling document for work assignments, was demonstrated by the fact that CI used two ways of numbering their Controlled Work Packages (CWP). The CWP numbers were based on whether the assignment ha~~s~~d a punchlist number or not. As of the time of this inspection, only one of the 16 approved CWPs used the punchlist number for identification.

The licensee also acknowledged that maintenance work ~~(~~initiated by NPD) was not necessarily being entered in the master punchlist.

(2) There were no established procedures to control work assignments issued by letter from GCD.

Note: GCD ~~is~~ was not part of the QA program.

(3) Procedure EC-SAD-05, revision 4 establishe~~s~~d controls for the issuance, review, processing and disposition of work requests at the Zimmer station. Section 2 of the procedure state~~s~~d that ~~it~~ The procedure applie~~s~~d to all work requests initiated to perform work on and modification to safety related items, ASME code items and fire protection items. WRs may also be used on other non-safety related items. Presently, the licensee is controlling all work performed on systems and components turned over to NPD for preoperational testing through WRs,

independent~~ly~~ of whether the work ~~it~~ is safety related or not. However, not all work assignments to C.I. end up as WRs. QCP Work Orders to C.I., which in addition to not being listed in the punchlist, would ~~will~~ bypass the WR system since there was ~~is~~ no way for NPD to be aware that such work had ~~has~~ been issued or was ~~is~~ being performed. An example of this type of item is discussed in paragraph (5) below.

(4) There was no established procedure to control work assignments issued on forms titled, Catalytic Work Authorization. As a result, the following ECRs were assigned twice to CI because of confusion within CG&E personnel as to whether the ECRs ~~they~~ had ever been assigned:

1.SU ECR #527 on 10/7/82 and 11/17/81

2.SU ECR #1137 on 10/7/81 and 11/17/81

3.SU ECR #1148 on 10/7/81 and 6/20/81

4.SU ECR #1193 on 12/4/81 and 6/3/82

In the case of ECR #1193, the licensee stated the second letter was issued because after the initial assignment was made to CI, another subcontractor was found doing work on the equipment.

The Catalytic Work Authorization form was developed by CG&E (NPD) to avoid having to issue WRs to C.I. prior to the review and approval of CWP/WP by CG&E. The purpose of this form conflicts with C.I. procedure NMP-2 revision 1, as discussed in subsection 2.b. of this report.

(5) CG&E Procedure 19-QA-13, revision 0, dated September 16, 1981 addressed Work Order Interfaces from the QCP Department and was being used to authorize work to be performed by C.I.

Example: A QCP Work Order (which had no CG&E control number) directed C.I. to remove fireproofing from structural steel members and to remove paint from welds. The fireproofing and welds were identified on CG&E Corrective Action Report, CAR, 82-47, revision 1 as being essential or nonessential seismic, and therefore, required controls in accordance with the QA program.

When the fireproofing and paint were removed, the affected areas were then nonconforming with the design requirements which required the fireproofing and paint. Therefore, measures ~~must be established~~ were needed to identify and control the nonconforming areas to assure that the areas ~~are~~ were put back into conformance with the design requirements. Procedure 19-QA-13, revision 0 did not provide measures to identify and control work assignments which directed that a part of the plant be placed into a nonconforming situation. Note: An uncontrolled memorandum, dated February 16, 1982, had been issued, which stated who was responsible for replacing ~~the~~ fireproofing and paint, and a CWP was prepared to do ~~the~~ replacement work.

Procedure 19-QA-13, revision 0, did not provide a method of identifying and controlling the number of Work Orders or the areas and systems affected by all Work Orders. The procedure did not require CG&E control numbers on the Work Orders.

Procedure 19-QA-13, revision 0, established no controls for classifying the QCP Work Orders as essential, non-essential seismic, or nonessential.

The RIII inspector noted that Procedure 19-QA-13, revision 0 had been approved by Mr. D. J. Schulte. The RIII inspector also noted that Procedure No. SU.PRP.01, revision 15, had been approved by Mr. Schulte. The RIII inspector did not review Procedure SU.PRP.01, revision 15. IE Report 82-01 had identified that adequate qualifications had not been established for Mr. Schulte to approve QA procedures. The CG&E response, QA-1917, dated August 4, 1982, to IE Report 82-01, stated that two individuals, certified as Level III in accordance with ANSI N45.2.6 and with broad QA experience, ~~are~~ were designated to perform technical evaluations of those procedures or activities for which such qualifications ~~are~~ were required. On September 17, 1982, the licensee stated that no additional evaluations per the CG&E response had been made of Procedure 19-QA-13, revision 0. This is contrary to 10 CFR Appendix B, Criterion XVI and the CG&E QA Manual, Section 16.3. This item is a repeat of an item of noncompliance identified in IE Report 82-01. (358/82-13-~~14~~)

(6) There were no established procedures to control work assignments which were issued verbally. (Example: The work related to S&L Drawing M-443, hanger modifications to the CRD system, was issued verbally).

~~The~~ Five of the six methods of designating C.I.s scope of work were either not documented in procedures, and/or the procedures did not include appropriate quantitative or qualitative acceptance criteria for determining that the full designated scope of C.I.'s work would be satisfactorily accomplished. This is contrary to 10 CFR 50, Appendix B, Criterion V and the CG&E QA Manual, Section 5.1. (358/82-13-15)

2. The RIII inspector reviewed C.I. Procedures NMP-20, Revision 0 dated June 11, 1982, titled, "Work Implementation Interface

Requirements" and NMP-2, Revision 1, dated November 6, 1981, titled, "Preparation of CWP/WP". Note: CWP is an abbreviation for Control Work Package, which is used to control and monitor safety related work. WP is an abbreviation for Work Package, which is used to control and monitor nonsafety related work. CWPs must conform to the respective QA requirements, WPS do not. In general, a CWP or WP will define all of the design, installation, inspection, testing, and/or documentation requirements necessary to complete a specific work assignment.

a. Procedure NMP-20, Revision 0, in essence, states that for work performed under C.I. system (1) the work shall be authorized by CG&E through the use of a Work Request, punchlist ticket, or by other written authorization; (2) the C.I. project engineer will classify (safety related or nonsafety related) the work and determine whether a CWP or WP will be used to control the work; (3) and then the CWP or WP will be prepared, reviewed, approved and distributed in accordance with the requirements of Procedure NMP-2. NMP-20, Revision 0, Section 7.1.4 also states that Catalytic shall be responsible for identifying the design documents required to implement a work assignment. Section 3.2.2 states that all work assignments received shall be logged in by the Central Distribution Center (CDC).

b. Procedure NMP-2, revision 1, in essence, defined the administrative requirements established for preparing, making changes to, reviewing, approving, and controlling CWPs and WPs. Sections 2.1 and 4.1 required the receipt of a WR from CG&E prior to the preparation of a CWP/CP. Section 9.0 state~~s~~d that all CWPs shall be reviewed by a second engineer and quality assurance. The engineer reviews required verification that the manner, in which work ~~is~~ was to be accomplished, ~~meets~~ met the engineering requirements contained in the specifications, procedures, and drawings. The quality assurance review required verification that code/regulation and QA/QC inspection requirements would be controlled and implemented. Appropriate approval signatures and dates were required after the CWP packages were adequately prepared and reviewed. Section 5.7 state~~s~~d that a list of required CWP/WPs shall be prepared and incorporated into a Document Control Log.

c. The RIII inspectors identified the following inadequacies related to the above procedures:

(1) The inspectors reviewed several approved CWPs and WPs against the records being maintained by the Work Request Coordinator, the punchlist and the records being maintained by the CG&E QE Clerk. The records revealed that at least the following ~~CWPs/WPs~~ CWPs/WPs had been prepared without an approved WR:

(a) CWP FC-01-424.00, Remove Existing Fuel Pool Heat Exchangers was approved June 18, 1982, while WR 82-0770 covering that job was dated June 21, 1982.

(b) CWP 82-007.21, Demolition of Existing S-12, S-12, and S-14, Supports to the CRD System was approved July 22, 1982, while WR 82-1028 covering that job was dated July 26, 1982.

(c) CWP 82-028, Refurbish Painted Welds and Fireproofing for QCP was approved June 3, 1982, while WR 82-0803 covering that job was dated June 23, 1982.

(d) The WP prepared by CI for the removal of fireproofing from structural steel members and to remove paint from welds for which no Work Request was ever generated. After the work had started, CG&E identified the work as being essential or nonessential seismic. Had C.I. prepared the WP after receipt of a WR, ~~it~~ the WP would have received the proper classification before actual work had commenced.

Failure to follow NMP-2 paragraphs 2.1 and 4.1~~, among others,~~ is considered to be a violation of 10 CFR 50, Appendix B, Criterion V and ~~is an example of an item of noncompliance.~~ the CG&E QA Manual Section 5. (358/82-13-04 B)

C.I. is now rewriting NMP-2 to ensure preparation of CWP/WP is properly controlled. The licensee stated the revised procedure will be in place by October 14, 1982.

(2) The RIII inspectors requested to review the log or logs of work assignments and CWPs which were addressed in Procedure NMP-2 and NMP-20. The C.I. Project Engineer presented a log (Work Status Log) which appeared to be comprehensive, except for the exclusion of QCP Work Orders. The Catalytic management personnel indicated that there was no procedure established to control the log (e.g., how entries and deletions would be controlled and distribution of the log).

During a review of the items listed in the log versus WR status being maintained by the work request coordinator, it was determined that punchlist items VT-1-281 and 282, had been designated in the Master Punchlist as completed per Work Request #82-0202. The Work Status Log indicated that these items were not completed.

On September 17, 1982, the C.I. management stated that a procedure would be established, to control the work status log, within the next few weeks. (358/82-13-~~12~~ 12)

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(3) Procedure NMP-20, Revision 0, Section 3.4 state~~s~~d the project engineer shall determine the safety classification of the work and the respective control package (CWP vs. WP) to be used. The project engineer ~~is~~ was not part of QA organization, in that, he ha~~s~~d direct responsibilities for cost and scheduling, and ~~does~~ did not have sufficient organizational freedom to identify quality problems. A specific deficiency that resulted from this procedural inadequacy involved a QCP Work Order. ~~which had no CG&E control number.~~ The Work Order was issued to ~~CI~~ C.I. to remove fire proofing and paint to allow inspection of beam welds. The CG&E QA program did not require classification of the Work Order (Reference paragraph ~~15.4~~ 1.6.5 of this ~~IE~~ NRC Report). Therefore, the Work Order was classified by the C.I. Project Engineer which was in accordance with C.I. Procedure NMP-20, Revision 0, Section 3.4. The Work Order was incorrectly classified as indicated by CG&E CAR 82-47, Revision 1. Since the Work Order was misclassified, a CWP was not generated and all QA requirements were bypassed. For the procedure to allow classification of work to be made by the project engineer (excluding QA) is contrary to 10 CFR 50 Appendix B, Criterion V and the CG&E QA Manual Section 5.1. The C.I. management indicated that Work Orders classified as nonsafety related (nonessential) were sampled on a surveillance basis by QA to assure proper classification. The licensee (CG&E) stated that this inadequacy would be resolved by requiring all work authorizations to be

classified before they are issued to contractors. (358/
82-13-~~18~~ 05C)

Insert → (4)

3. With respect to CAR 82-47, which originated on June 7, 1982, no specific or generic actions had been taken as of September 8, 1982, to either stop the related work or correct the identified deficiency that resulted from a misclassified safety related work order (authorization). This is contrary to 10 CFR 50, Appendix B, Criterion XVI and the CG&E QA Manual Section 16. Based on this finding, C.I. issued a Stop Work Notification SWN No. 001 on September 9, 1982 to stop all work, except scaffolding, on all QCP Work Orders issued to C.I. The SWN would be in affect until the Work Orders were adequately reviewed for proper classification. Also, CG&E issued Stop Work Order No. 82-02 on September 9, 1982 to stop work on all miscellaneous work requests issued by QCP. (358/82-13-~~19~~ 08D)

4. During the review of the QCP Work Order concerning removal of fire proofing from structural steel members, the RIII inspector requested the design, installation, and inspection requirements for the fireproofing that had already been installed and for the fireproofing that would have to be replaced. The licensee provided Corrective Action Report, CAR, No. 82-30, dated April 13, 1982. The CAR indicated that the original fireproofing was installed, excluding the QA requirements. The indicated corrective action to be taken stated that the fireproofing was nonessential and therefore did not

Insert

(4) Procedure HMP 30, revision ?, section 7.1.4 stated

that Catalytic shall be responsible for identifying

the design ~~do~~ documents required to implement

a work assignment. This statement alone ~~fail~~ does not establish

sufficient measures to control the issuance of documents, such

as drawings, ~~which~~ prescribe all design activities affecting quality.

A specific ~~A~~ ~~in~~ document control deficiency, which

~~occurred~~ ~~was~~ is related to this procedural statement, was

identified by RIII Inspector ~~Mr~~ I. Yin during the inspection.

The deficiency was identified in C.I. CWF No.

82.007.20 which did not reference S&L drawing

S-680, revision H, "HCU Support Framing Plan Sections and Details,"

including the "HCU and CRD Support Notes". Mr. Yin

Failure to control the issuance of the above drawing is contrary to 10 CFR 50

Appendix B, Criterion VI and the CG&E QA Manual Section 6.1.

stated that this deficiency was minor in that there appeared

([illegible]/82-13-[illegible])

to be no resulting adverse effects on the quality of the plant.

have to comply with the QA requirements. The indicated corrective action ~~appears~~ appeared to be made by an individual who ~~is~~ was outside the QA program. The ~~designation~~ classification of this specific CAR as nonessential and the dispositioning by an individual apparently outside the QA program is unresolved pending further review. (358/82-13-~~20~~) 13)

5. On September 7, 1982, the licensee stated that no safety related work ~~has~~ had been, or could be performed by Catalytic before a CWP was approved. The RIII inspector requested the list of all CWPs approved to date. C.I. provided a list of 16 approved CWPs. The 16 CWPs appeared to have specifically defined scopes of work (e.g., demolition of the existing S-7 and S-8 hanger supports).

   The RIII inspector selected one (No. 82-038) of the 16 CWPs for review. The scope of CWP 82-038 included the repair work on structural beams, which had been identified as nonconforming. Nonconformance Report NR, No. Q-QAD-82-2222, revision 1, was being used to document the beam deficiencies. The pertinent CG&E QCP personnel stated that the beams were being inspected by CG&E QC inspectors in accordance with CG&E Procedure 19-QA-28 as part of the QCP. When deficiencies were identified, they were documented as part of NR Q-QAD-82-2222, revision 1. The NR was an enclosure to CWP 82-038.

The NR was designated as a "Generic NR" because it identified all of the individual types of deficiencies (e.g., weld slag inclusions, unacceptable re-entrant corners) that the NR would address, prior to the initial inspections. Along with the individual types of deficiencies, the NR defined respective corrective actions which included references to the acceptance criteria (e.g., AWS D1.1-72 and Design Document Change, DDC, #SLS-709, revision A).

a. The RIII inspector checked the control of two of the DDCs (Nos. SLS-709, revision A and SLS-689, revision 0), defined as criteria in the NR and CWP. The site document control center status records indicated that DDC-SLS-689, revision 0 was current and properly controlled. The control center had no record of revision A or any subsequent revisions to DDC-SLS-709. The control center's records reflected only revision 0 to DDC-SLS-709.

DDC-SLS-709 was written against Sargent and Lundy, S&L, specification H-2174, Sections 5-2 and 5-3. The RIII inspector questioned the CG&E QCP personnel responsible for NR No. Q-QAD-82-2222, revision 1 about the proper revision and control of DDC-SLS-709. The QCP personnel provided copies of revisions A, B, and C to SLS-709, which had been transmitted directly to the QCP personnel from S&L and not through the site document control center. Also provided was a copy of specification H-2174, Section 5-2, Design Document Change Table 5-2-2, Revision 0, dated May 13, 1982. The table indicated that revision C to DDC-SLS-709 had been revised by DDC-SLS-711. The QCP personnel also provided DDC-SLS-713 which superseded SLS-711 and DDC-SLS-737 which superseded SLS-713. Failure to control the distribution of the above DDCs and subsequent revisions is contrary to 10 CFR 50 Appendix B, Criterion VI and the CG&E QA Manual Section 6.1. The QCP personnel indicated that none of the subsequent revisions to DDC-SLS-709 revision 0 changed the design requirements relating to NR No. G-QAD-82-2222, revision 1. Most of the revisions were for correcting typographical errors. This specific failure to control revisions to DDC-SLS-709 appears to have a very limited impact on the quality of the plant. (358/82-13-21) D.

The RIII inspector requested to review the control measures which had been established to assure that subsequent revisions to design documents (e.g., DDCs, drawing revisions, specification revisions, procedure revisions, etc.) would be evaluated for impact on CWPs that have been completed or partially completed. Specifically, what controls ~~have~~ has been established to evaluate the impact of the subsequent revisions, to DDC-SLS-709 Revision 0, on the work completed in CWP-038? The control measures are required to prevent the use of incorrect or defective material, parts, and components. The licensee stated that no such measures ~~have~~ had been established. ~~This~~ Failure to establish control measures to prevent use of incorrectly (superseded) designed materials, parts and components is contrary to 10 CFR 50, Appendix B Criterion VIII, and the CG&E QA Manual Section 8. The CG&E QCP personnel responsible for NR No. Q-QAD-82-2222 Revision 1, stated that the personnel had plans to revise (Revision 2) the NR to reflect the latest design documents. The personnel also stated that the plans did not include evaluation of the impact of those latest design documents on the work and inspections already completed. Thus, the potential would exist for the CWP records to incorrectly indicate that the affected plant systems were built to the latest design requirements when in actuality the affected systems were built to superseded design requirements. (358/82-13-~~21~~22) 14

b. The CG&E QCP cognizant personnel stated that all of the deficiencies identified on NR Q-QAD-82-2222, Revision 1 had been corrected and reinspected. The RIII inspector selected and reviewed the inspection records for the following four deficiencies (conditions), identified in CWP 82-038 (NR No. Q-QAP-82-2222, Revision 1): ~~for further review:~~

(1) Page 10 of the NR, Beam 76, Condition F identified undercut along weld No. 2 between beams 76 and 74.

(2) Page 3 of the NR, Beam 59, Condition E identified Weld No. 1, which connected beams 59 and 71, as being undersized.

(3) Page 4 of the NR, Beam 60, Condition N identified unacceptable re-entrant corners at the connection of beams 60 and 66.

(4) Page 2 of the NR, Beam 61, Condition L identified base metal reduction (overgrinding) on weld no. 3 of beam connection 61-71 and weld no. 6 of beam connection 61-74.

The reinspections, made after the rework/repair had been completed and performed by the Catalytic QC inspectors, were documented on C.I. forms titled, "Welding/Brazing Check List for NR Repair/Rework per

AWS D1.1-72". The C.I. form ha~~s~~d entries for welder identifi~~ed~~cation (I.D.), filler metal, and weld procedure specification number. The C.I. management stated to that the actual entries for welder I.D. and filler metal ~~are~~ were made by the craftsman, and the weld procedure specification entry ~~is~~ was made by the welding engineer prior to commencing the work activity. The form also identified the type of inspections (e.g., visual radiography, etc.) required to be performed. The form included signatures of both CI and CG&E QC inspectors.

The initial inspections (which identified the deficiencies) and the reinspections performed by the CG&E QC inspectors were documented on CG&E forms 19-QA-06, Attachment 1 (weld inspection reports). The CG&E forms indicated the location of the deficiency, the QC inspector signature and date, accept or reject, welder I.D., and remarks. The CG&E QCP personnel stated that the welder I.D. was copied from the mark made by the welder on the beam.

None ~~Neither~~ of the above forms (C.I. or CG&E), used for the four respective deficiencies~~, selected by the RIII inspector~~, identified or referenced the inspection (acceptance) criteria. The C.I. management and inspection personnel stated that the criteria used by the C.I. inspectors was defined in C.I. procedure EIW-1, which was directly referenced in cover pages to CWP 82-038. The RIII inspector verified that the reference to EIW-1 was made. A copy of the EIW-1 inspection criteria was also provided in the CWP. The CG&E QCP management and inspection personnel stated that the criteria used by the CG&E inspectors was defined in CG&E procedure 19-QA-28, revision 0. No documentation was provided to indicate (or reference) that procedure 19-QA-28 was the inspection criteria used by the CG&E QC inspectors. Failure to record the inspection procedure which was used as acceptance criteria by the CG&E inspectors is contrary to 10 CFR 50 Appendix B Criterion XVII and the CG&E QA Manual Section 17. This item is a repeat of an item of noncompliance identified in IE Report 81-13. (358/82-13-~~23~~15)

Discussions with the CG&E QCP personnel and C.I. management personnel, reviews of the QC inspection records of the four deficiencies addressed above, and a review of the EIW-1 and 19-QA-28 revision 0 inspection criteria revealed that no in-process inspections (i.e., verification of welder, weld procedure specification, and weld rod) had been required or performed by either CG&E or C.I. QC inspectors for any of the weld repairs made per CWP 82-038 (NR Q-QAD-82-2222, revision 1). Failure to establish a program to verify the in-process weld repair activities addressed in CWP 82-038 is contrary to 10 CFR 50 Appendix B Criterion X, the CG&E QA Manual Section 10, and the AWS D1.1-1972 Code, Section 6. This item is a repeat of an item of noncompliance identified in IE Report 82-13. (358/82-13-~~24~~06C)

The RIII inspector did not compare CG&E procedure 19-QA-28 revision 0 to C.I. procedure EIW-1, but did inquire as to why two different procedures were being used to evaluate the same activity. The management personnel responsible for CWP 82-038 indicated that procedure 19-QA-28 revision 0 was less stringent than EIW-1 because Sargent and Lundy had permitted certain deviations from the AWS D1.1-1972 code and those deviations were included in procedure 19-QA-28. This matter is unresolved pending review of procedure 19-QA-28 revision 0. (358/82-13-~~25~~16)

One of the generic deficiencies (condition E) covered by NR Q-QAD-82-2222 revision 1 was undersize welds. The disposition which was also generic, required additional weld metal to be deposited, assuring that the design leg and throat sizes of the weld were met. The disposition also referenced part of the AWS D1.1-72 code, which required additional weld metal to be deposited. For the specific deficiency identified on page 3 of the NR, beam 59, condition E, no specific design requirements (i.e., drawing details for the leg and throat sizes) were specified in the CWP including the NR, for the specific weld that was documented as deficient (undersized). This matter is unresolved pending further review to determine if other design controls were established and implemented for the above weld. The controls are required to assure that the design criterion for the above weld size was specified and used during the initial inspection, the weld activity, and the reinspection. (358/82-13-~~26~~17)

6. a. The RIII inspector reviewed audit report No. WHZ-1 dated March 31 to April 2, 1982, which was performed by Catalytic's corporate auditor. The indicated purpose of the audit was to evaluate the effectiveness of the site Catalytic QA program. The audit indicated that, since actual work had not started as of the dates of the audit, only cursory reviews were made of activities addressed in 23 site procedures. One deficiency (finding) was identified during the audit. The finding stated that the quality assurance engineer was not receiving the documents required to define the scope of (Catalytic's) work. As of September 17, 1982, no actions had been taken to correct the deficiency. Furthermore, this deficiency is very closely related to the problem concerning the designation of Catalytic's scope of work, which is addressed in subsection 1 of this report section. Failure to assure that the above audit finding was promptly corrected is contrary to 10 CFR 50, Appendix B, Criterion XVI and the C&GE QA Manual Section 16. (358/83-13-~~27~~08E)

b. No other audits of C.I. site activities ~~have~~ had been performed by any C.I. management as of September 17, 1982. C.I. has had approval to perform safety related work since March 30, 1982 (CWP 82-038). Therefore, since Audit WHZ-1 was only cursory, Catalytic had essentially not performed any audits to determine the effectiveness of the QA programmatic controls of work activities.

Letter No. QAA-CCW-341, dated August 30, 1982, from the C.I. Supervisor of QA Audits to the site C.I. management, stated that an audit was scheduled for the week of September 27, 1982, to evaluate the QA program pertaining to ASME work related activities. The letter also stated that the audit checklist, which would be used, would be sent to the site prior to the audit for use by the site QA manager to conduct a self-evaluation. The RIII inspector was shown the checklist at the site on September 17, 1982. The RIII inspector considers the practice of disclosing the attributes (checklist) of an audit, prior to performing that audit, a deviation from accepted industry practice and inconsistent with the regulatory requirement of determining the effectiveness of the QA program. (358/82-13-18)

7. On September 17, 1982, the RIII inspector reviewed CG&E schedule of audits concerning Catalytic activities. The schedule was based on the implementation of C.I.'s procedures, because all of C.I.'s procedures were reviewed and approved by CG&E prior to implementation. The list of approved C.I. procedures appeared to address all 10 CFR 50 Appendix B Criteria, including interfaces. As of September 17, 1982, only the following two audits (F.A. 388 and 412) had been performed by CG&E of C.I.

procedural implementation:

a. The RIII inspector reviewed CG&E audit #F.A. 388 dated March 1-11, 1982, of C.I. activities. The indicated scope of the audit included procurement, storage, training, qualification, and document control. Audit #F.A. 388 appeared to be extremely narrow in scope and depth. The CG&E Director of Quality Audits stated that Audit #F. A. 388 was limited in scope and depth because of the very limited scope of C.I. work activities at the time of the audit.

   Audit #F.A. 388 identified two findings and three "concerns". The licensee stated that procedurally, findings (Audit Finding Reports, AFR) required followup actions, and that "concerns" were those items which do not affect the quality of the plant and do not require followup audits to verify effective corrective action.

   The two findings appeared to be properly controlled and closed.

   One (Concern #2) of the three concerns appeared to be adequately characterized and controlled.

   The remaining two Concerns (#1 and #3) appeared to be mischaracterized, because they had potentially adverse affects on the quality of the plant.

Concern #1 stated that the C.I. site QA manager, SQAM, and QA engineer, QAE, did not have certifications per ANSI N45.2.6. The C.I. written response to the concern indicated that the lack of certifications had been resolved. As of September 17, 1982, no followup action had been taken by CG&E to verify the specific concern or the generic implications because concerns procedurally did not require followup. The CG&E auditor stated that the lack of certifications was designated as a "concern" because the SQAM and QAE were not performing any safety related activities at the time of the audit.

Concern #3 stated that controls had not been established to control "Limited Life Materials" (materials such as paint, which has a specified shelf life). The C.I. written response to the concern stated that a log was set up to identify shelf life materials and that the warehouse supervisor would verify that the shelf lives had not expired. As of September 17, 1982, no followup action had been taken by CG&E. On September 17, 1982, the RIII inspector observed approximately 10 gallons of paint (material order #1012-00, received December 13, 1981) which was locked in storage. The shelf life of four gallons of the paint expired on September 13, 1982.

The paint cans were tagged for a specific plant use. The warehouse supervisor stated that the specified use has since been cancelled. C.I. letter #I.O. 82-404 dated April 21, 1982 stated that prior to using any limited life materials, the warehouse supervisor shall verify that the shelf life has not expired. The letter also states QC shall verify the shelf life of materials during quarterly inspections. On September 17, 1982, the warehouse supervisor stated that the issuance of safety related materials was verified by C.I. QC inspectors, not the warehouse supervisor. No measures were established to require QC inspectors to verify the expiration dates of limited life materials prior to issuance. The following two problems still existed, relative to Concern #3:

(1) An uncontrolled letter (I.O. 82-404) was used to identify QA procedural requirements.

(2) The procedural requirements identified in the letter did not adequately establish controls for the issuance of limited life materials.

Note: For Concern #3, there appeared to be no specific adverse plant conditions which resulted.

Failure to require followup action of deficient areas, addressed in Concerns 1 and 3, is contrary to

10 CFR 50 Appendix B, Criterion XVIII and the CG&E QA Manual, Section 18. (358/82-13-~~29~~ 11B)

b. The RIII inspector made a cursory review of CG&E Audit #412 dated August 2-31, 1982, of C.I. activities. The indicated scope of the audit included the implementation of procedures which controlled (1) instructions, procedures, and drawings (2) special processes, (3) inspections, (4) nonconformances, (5) corrective action, and (6) audits. The audit appeared to be comprehensive and objective. The audit findings appeared to be adequately addressed. A few portions of the audit were not completed.

¶ Based on the audits activities addressed in subsections 6 and 7 of this NRC report, there appears to have been insufficient audits performed of Catalytic activities, ~~This deficiency~~ prior to 8/1/82. This deficiency is addressed in Section I, subsection 11, of this NRC report.

TORREY PINES TECHNOLOGY
PO Box 85608
[illegible]
Telephone [illegible]

A Division of GA Technologies Inc.

August 19, 1983
Project 2474
TPT:CG&E-022

50-358

Mr. W. H. Dickhoner
President and Chief Executive Officer
Cincinnati Gas and Electric Company
139 East Fourth Street
Cincinnati, Ohio 45202

Dear Mr. Dickhoner:

Enclosed are twenty-four (24) copies of TPT's final report No. GA-C17173 entitled "Independent Review of Zimmer Project Management" dated August, 1983.

The report is in two volumes:

Volume 1: The Executive Summary - presents a top level summary of the work done, results, observations, conclusions, and recommendations.

Volume 2: The Discussion Volume - presents a more detailed description of the review and evaluation tasks, the information obtained and analyzed, and detailed observations, conclusions and recommendations.

In accordance with NRC's protocol, copies of the report have been simultaneously mailed to NRC representatives identified by Mr. Keppler's staff.

In accordance with your request, twenty-two (22) additional copies for public distribution will be sent as soon as printing is completed.

We are available to discuss the contents of the report at your convenience. If you have any questions, please call.

Sincerely,

A. J. Neylan

A. J. Neylan
Project Manager

AUG 20 1983

Enclosure

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NRC

J. G. Keppler
J. Lieberman
J. E. Sniezek
J. C. Stone
W. J. Ward
Director, Office of Special Cases
Zimmer Project Inspector
Zimmer Section Chief
Zimmer Sr. Resident Inspector

CG&E

S. Frantz
J. Newman
W. Wegner
J. Williams, Jr.

GA-C17173

INDEPENDENT REVIEW OF ZIMMER PROJECT MANAGEMENT

FINAL REPORT

VOLUME 1 - EXECUTIVE SUMMARY

PREPARED FOR
CINCINNATI GAS AND ELECTRIC COMPANY

~~8312070225~~ GA PROJECT NO. 2474
(406) AUGUST 1983

TORREY PINES TECHNOLOGY
A Division of GA Technologies Inc.

FOREWORD

The final report on the Independent Review of Zimmer Project Management, done by Torrey Pines Technology under contract to the Cincinnati Gas & Electric Company, is presented in two volumes.

Volume 1, the Executive Summary, presents a top level summary of the work done, results, observations, conclusions, and recommendations.

Volume 2, the Discussion Volume, presents a more detailed description of the review and evaluation tasks, the information obtained and analyzed, and detailed observations, conclusions, and recommendations.

ACRONYMS AND ABBREVIATIONS

AE	-	Architect-Engineer
AEC	-	Atomic Energy Commission, later the Nuclear Regulatory Commission (NRC)
AE/C	-	Architect Engineer/Constructor
AFR	-	Audit Finding Report
ANI	-	Authorized Nuclear Inspector
ANSI	-	American National Standards Institute
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing Materials
AVL	-	Approved Vendor List
AWS	-	American Welding Society
BOP	-	Balance of Plant
B&PV	-	Boiler and Pressure Vessel
BPC	-	Bechtel Power Corporation
BWR	-	Boiling Water Reactor
C of C	-	Certificates of Compliance
CAR	-	Corrective Action Report
CASE	-	Coalition for Affordable Safe Energy
CEO	-	Chief Executive Officer
CER	-	Condition Evaluation Request
CG&E	-	Cincinnati Gas & Electric Company
CI	-	Catalytic, Incorporated
CM	-	Configuration Management
CMTR	-	Certified Material Test Report
CPM	-	Critical Path Method
CRD	-	Control Rod Drive
C&SO	-	Columbus and Southern Ohio Electric Company
CWAR	-	Construction Work Approval Request
DDC	-	Design Document Change
DP&L	-	Dayton Power and Light
ECR	-	Engineering Change Request
EOTD	-	Engineering Operating Test Department

EPD	-	Energy Production Department
FCP	-	Field Construction Procedure
FDDR	-	Field Deviation Disposition Request
FDI	-	Field Disposition Instruction
FSAR	-	Final Safety Analysis Report
FWO	-	Field Work order
GA	-	GA Technologies Inc.
GAP	-	Government Accountability Project
GCD	-	Generation Construction Department
GE	-	General Electric Company
GED	-	General Engineering Department
HJK	-	Henry J. Kaiser Company [formerly Kaiser Engineers Incorporated (KEI)]
IAL	-	Immediate Action Letter
I&C	-	Instrumentation and Control
I&E	-	NRC Inspection Report
IIDR	-	In-Process Inspection Deficiency Report
IR	-	Inspection Report
ISK	-	Isometric Piping Drawing
KEI	-	Kaiser Engineers Incorporated [later Henry J. Kaiser Company (HJK)]
LEAD	-	Licensing and Environmental Affairs Department
LOCA	-	Loss-of-Coolant Accident
MAA	-	Management Assessment Audits
MCAR	-	Management Corrective Action Request
MRB	-	Materials Review Board
MRP	-	Material Requirements Planning
NDE	-	Nondestructive Examination
NED	-	Nuclear Engineering Department
NPD	-	Nuclear Production Department
NPS	-	Nuclear Power Station
NR	-	Nonconformance Report
NRC	-	U.S. Nuclear Regulatory Commission
NSD	-	Nuclear Services Department
NSSS	-	Nuclear Steam Supply System

OPP	-	Owner's Project Procedures
PMS	-	Performance Measurement Systems
PO	-	Purchase Order
PR	-	Purchase Request
PSAR	-	Preliminary Safety Analysis Report
QA&S	-	Quality Assurance and Standards
QA	-	Quality Assurance
QAD	-	Quality Assurance Department
QAP	-	QA Procedure or QA Program
QC	-	Quality Control
QCP	-	Quality Confirmation Program
QCPP	-	Quality Confirmation Program Procedure
QVP	-	Quality Verification Program
RCI	-	Reactor Controls, Incorporated
RO	-	Reactor Operator
RPV	-	Reactor Pressure Vessel
S&L	-	Sargent & Lundy Engineers
SAI	-	Science Applications, Incorporated
S&W	-	Stone and Webster
SCO	-	Order to Show Cause [Order Immediately Suspending Construction (to CG&E from NRC), dated November 12, 1982]
SLC	-	Special Litigation Committee
SRO	-	Senior Reactor Operator
SWO	-	Stop Work Order
TPT	-	Torrey Pines Technology (A Division of GA Technologies Inc.)
WY&B	-	Wallinger-Young and Bertke
ZOC	-	Zimmer Oversight Committee
ZNP	-	Zimmer Nuclear Power (Station)
ZPM	-	Zimmer Project Manager or Zimmer Project Management
ZPOC	-	Zimmer Project Oversight Committee

VOLUME 1 - EXECUTIVE SUMMARY

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FIGURE

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VOLUME 1 - EXECUTIVE SUMMARY

1. INTRODUCTION

Torrey Pines Technology (TPT) was retained by the Cincinnati Gas and Electric Company (CG&E) in response to Section IV.B.1. of the Nuclear Regulatory Commission (NRC) Show Cause Order (SCO) dated November 1982, to conduct an independent review of CG&E's management of the W. H. Zimmer Unit 1 Nuclear Power Station (NPS) project, including its quality assurance program (QAP) and its quality confirmation program (QCP), to determine the organizational changes needed to ensure that construction of the Zimmer 1 plant can be completed in conformance with NRC regulations and the construction permit.

TPT reviewed the organizational structure, policies and procedures, and Quality Assurance (QA) activities of CG&E; including its interfaces with Sargent and Lundy (S&L), Henry J. Kaiser Company (HJK), General Electric Company (GE), Catalytic Incorporated (CI), and Reactor Controls, Inc. (RCI). The evaluation covered the management of the Zimmer project from its inception to the present. The review was divided into four periods: (1) project inception to the assumption of increased construction responsibilities by CG&E in 1976, (2) from 1976 to the Immediate Action Letter (IAL) in early 1981, (3) from the IAL to the Show Cause Order (SCO) in November 1982, and (4) since the SCO.

The basic approach used in the review was to separately examine key characteristics and aspects of the Zimmer project management and QA programs. As a cross-check, selected "case studies" were also examined to assess the collective role and behavior of management in response to specific problems and/or series of events.

Information was obtained by interviewing Zimmer project management staff (CG&E), representatives of subcontractor organizations (HJK, S&L, GE, CI, RCI,) and representatives of related organizations such as the NRC, National Board of Inspectors, and Intervenor Groups. The interviews included past and present management and other individuals having information pertinent to this review. Selected records and files were examined to obtain relevant documents/information to supplement and verify the information obtained in the interviews. The interviewees and the supplemental documents were selected on the basis of TPT's professional judgement.

Information received, in whatever form, was taken in good faith by TPT. TPT personnel involved in the research in support of the study were not expert in investigative techniques that might be used in cases of purposeful deception. Although TPT has no right of discovery in the legal sense, all records and files requested by TPT were made readily available. TPT personnel did not uncover anything that might lead credence to the possible suspicion that they were being provided with incorrect information or were intentionally deceived.

The total program effort was approximately 60 manmonths; over 3200 documents were reviewed; and approximately 100 people were interviewed, several more than once.

Evaluations were made of the advantages and disadvantages of: (1) the alternative organizational structures identified by NRC in the SCO, (2) organizational changes that have been implemented and/or proposed by CG&E since the SCO, (3) the organizational recommendation made by Bechtel Power Corporation (BPC), and (4) various alternative organizational structures conceived by TPT.

TPT's recommendations for an appropriate organization to satisfactorily complete the Zimmer project, in accordance with NRC regulations, were formulated independently based on the data obtained and an evaluation of the alternative organizations.

The investigation did not include any technical review or evaluation of the adequacy of the Zimmer plant design and construction. No physical inspection of the plant was performed.

2. GENERAL OBSERVATIONS

Construction of the Zimmer nuclear plant is approximately 97% complete. From external appearances, the plant appears to have been constructed in an efficient and workmanlike manner. However, a comprehensive verification program (QVP) is required to determine the true quality of the design and construction. It is TPT's opinion that the management shortcomings which resulted in the issuance of the SCO have been, or can be, corrected by CG&E and that, if the management changes recommended by TPT are made, future work at the Zimmer plant can be completed in conformance with the NRC regulations and construction permit.

In performing this investigation, TPT made the following additional observations regarding the background, external factors, and corporate management practices that contributed to the present situation at the Zimmer project.

2.1. CG&E'S PAST RECORD

CG&E's performance record for the construction of coal-fired plants has been very good. Construction schedules on fossil fuel plants were generally met, costs were kept under control, and results for consumers and stockholders were correspondingly satisfactory. This successful record was achieved using a management style that relied on a small, tightly knit group of individuals who communicated informally and who controlled performance by contractual and fiscal constraints on subcontractors. These methods were the essence of CG&E's style and were adopted by all levels of management.

When applied to Zimmer, this style of management resulted initially in significant accomplishments, in terms of schedule and construction completion dates, despite extensive design changes and backfits on the Mark II Boiling Water Reactor (BWR) containment (which were no fault of CG&E). In fact, until the late 1970's, CG&E was leading the nation in the construction of this type of plant and was at the forefront in paving the way in licensing and defining solutions to design problems. Even by November

1982, the date of the SCO, the Zimmer power station compared very favorably in terms of cost and schedule with contemporary nuclear plants of the same type.

2.2 LACK OF PRIOR NUCLEAR EXPERIENCE

CG&E, and to a large extent its constructor HJK, lacked prior experience in its assigned roles in this nuclear power plant project. Although in the early 1970's numerous other utilities also lacked prior nuclear experience, the constructor (HJK) of the Zimmer project was unique from the standpoint that it did not have, nor did it later obtain, any additional commercial nuclear power plant prime construction contracts. Consequently, it appears that neither CG&E nor HJK had sufficient experience or the external interactions necessary in order to respond in a timely and effective manner to the rapidly evolving, more stringent interpretations of NRC requirements. As a result, it was not recognized until very far along in the Zimmer project that a much more formalized, rigorous approach was needed to control and document the quality of the design and construction of a nuclear plant than that required for the design and construction of a fossil fuel plant. This was probably the single, most significant factor contributing to the present situation at the Zimmer plant.

2.3. FISCAL POLICY

CG&E had a corporate fiscal policy that minimized expenditures. Such a policy, taken in the proper perspective, benefits both the ratepayers and the stockholders of the Company. However, this emphasis completely dominated other important priorities such as quality and quality assurance. Cost reduction and schedule maintenance was encouraged to the extent that construction forces worked only to compliance with the minimum NRC standards and regulations. This approach, combined with the rapidly evolving and more stringent interpretation of these regulations over the years, contributed significantly to the current problems at the Zimmer project.

2.4. NRC ATTENTION

Quality problems existed during the early stages of construction which remained uncorrected during that period due, in part, to a lack of attention and follow-through on a corrective action course by the NRC. Although CG&E QA was generally responsive to NRC concerns, these concerns were neither extensively nor aggressively pursued by the NRC. Consequently, CG&E management failed to recognize the underlying message in the Inspection Reports (IRs) relating to the problems that existed at Zimmer. As a result, corrective action was not taken in an effective or timely manner. CG&E was allowed to continue construction while being lulled into a false sense of satisfactory performance until the late 1970's and early 1980's.

2.5. MARK II CONTAINMENT DESIGN

As previously mentioned, CG&E had to cope with major design changes and backfits affecting the Mark II containment of the GE Series 5 BWR when the original design was found to be deficient. As the leading plant under construction, design options and the flexibility for backfits were more limited at Zimmer than for plants in earlier stages of construction. The extensive changes and backfits that were required were not conducive to high morale on the construction project. In this environment the Zimmer project engineering staff, in addition to their normal construction duties, were also required to be active participants in the utility Owners' Group that was addressing the BWR problems. It is not evident that GE took a strong role in support of the Zimmer problems, as opposed to the generic problem of the BWR.

2.6. EFFECTS OF THREE MILE ISLAND

In the aftermath of the Three Mile Island incident, the NRC became increasingly more active and concerned about potential shortcomings at the Zimmer project. With a concurrently increasing public concern regarding nuclear power in general, and allegations about Zimmer in particular, CG&E was unsuccessful in its attempts to convince critics that the plant had not been constructed improperly. Even allowing for the fact it may have been difficult to distinguish between malcontents, antinuclear activists, and genuinely concerned individuals, CG&E reacted to particular issues in a symptomatic manner rather than trying to determine and correct the underlying causes. Although not all the criticism of CG&E appears justified, societal attitudes deteriorated to the point where CG&E is now presumed guilty until it can prove its innocence.

3. REVIEW RESULTS

The following is a summary of the main conclusions in each area of Zimmer project management investigated by TPT:

3.1. PROJECT MANAGEMENT ORGANIZATION

In this area, the objective was to evaluate the CG&E project management organization to determine whether deficiencies existing in its structure, staffing, policies, and/or procedures might have kept the project from meeting the high standards required for nuclear power plant design, procurement, and construction.

TPT concluded that:

CG&E attempted to use a project management approach at Zimmer that had been previously used successfully in the construction of fossil fuel plants. The approach, which was not unusual at that time, was to rely on a small, dedicated management team using relatively informal management systems and techniques. The emphasis was on getting the plant built on schedule, at the minimum cost. CG&E was not prepared for the complexity of the project requirements that evolved throughout the 1970's. Even so, based on their approach, the Zimmer project management functioned effectively (although generally informally), in attaining their cost and schedule goals. In retrospect, a number of deficiencies have existed (and some continue to exist) in the project management organization structure, staffing, policies, and/or procedures that are inappropriate in the management of a complex project such as Zimmer.

CG&E established an Owners Project Procedures (OPP) Manual for the Zimmer Project in 1972 which delineated the project organization, including reporting lines within CG&E, for the major subcontractors (HJK, S&L, GE); defined the responsibilities and authority of the various positions; and named the personnel who would act in those positions. These formal overall project policies concerning responsibility and authority over the functions at Zimmer Project appear to have been adequate, but they were not implemented adequately by project personnel.

CG&E did not have an integrated, comprehensive set of project management procedures documented and implemented to ensure that all elements of the project (e.g., Construction, Engineering, Quality Assurance, Licensing, Cost, Scheduling, etc.) were coordinated. This impaired communication between departments and, in some instances, resulted in conflicting requirements and/or a duplication of effort.

In comparison with other nuclear utility companies, staffing of both CG&E and the subcontractor organizations was inadequate throughout the 1970's. The CG&E management and professional staff was of inadequate size and had insufficient experience and training in the design and construction of nuclear power plants. After the IAL in April 1981, additional staff was recruited including a large proportion of temporary employees, some in management positions. A small number of CG&E personnel with prior nuclear experience has been added to the staff since the SCO, but it still remains understaffed and this situation needs to be corrected.

CG&E's project management and control systems, including performance measurement and document control, were inadequate. The systems utilized did not integrate the planning and scheduling of various project management activities such as construction; QA; engineering; and, subsequently, the transition to operations. Management reporting systems were also poor.

Key managers and professional staff were not dedicated solely to the Zimmer project. Several key managers had conflicting responsibilities that detracted from their management overview of Zimmer. Except for short periods of time, the CG&E manager responsible for the entire Zimmer project was not located at the site. These conditions, coupled with the lack of an integrated project management system, contributed to the creation of informal autonomous organizations within the project with lines of communication that were not always consistent with the published project organization charts. Also, there was a too-heavy reliance on contractors for project management and control. The CG&E policy of delegating the responsibility of major elements of the work to reputable experienced contractors is not inconsistent with the approach taken by other utilities in the construction of nuclear power plants. However, CG&E does not have the management system, implementing procedures, and staff required to control the work performed by its subcontractors. The net result was to impair the visibility of the project to CG&E top management.

3.2. MANAGEMENT POLICIES TOWARD QUALITY ASSURANCE

In this area, the objective was to evaluate the CG&E project management policies affecting QA, and to assess whether management's involvement and commitment towards quality was adequate to ensure an effective program.

TPT concluded that:

Management at Zimmer had not done an adequate job in highlighting the QA program as one of the key elements in the successful construction of a nuclear power plant, or in providing the appropriate level of support that would ensure effective program implementation.

The level and status of the CG&E QA organization through the years was generally inadequate to provide an effective nuclear QA program. The major shortcomings in this area are the small and inexperienced CG&E QA staff, cost and schedule pressures on the QA organizations, and failure to effectively correct and prevent recurrence of problems.

CG&E management generally did not establish definitive policies, verbal or written, concerning QA at Zimmer and no strong message by CG&E management in support of quality and quality assurance was evident. Instead, CG&E management policy insisted that all concerned (CG&E and subcontractors) minimize the time and money spent on QA programs.

CG&E top management appeared to lack an adequate degree of involvement in, and commitment toward, QA at Zimmer. Up until 1981, the President of CG&E appeared to be insulated from an accurate picture of the status and inadequacies of the Zimmer QA program. The CG&E project organization provided minimal executive summary information to management on overall quality problems, status, and QA program effectiveness. Executive reports generally addressed details and highlighted "brush-fires" rather than providing a management perspective.

The Zimmer project management, up to the Vice Presidential level appeared to have been sufficiently involved in the QA program to have had an awareness of the many shortcomings and problems at Zimmer throughout the years. However, corrective action to prevent recurrence of these problems was generally not taken. Problems continued to surface repetitively and eventually played a prominent role in the issuing of the IAL, the $200,000 fine, and the SCO.

While CG&E QA was involved in the Zimmer project activities over the years, there were several significant shortcomings in the management of this function which limited their perception and control of the status of the project. Their review and audits of subcontractor work for the adequacy, implementation, and effectiveness of related QA programs did not include sufficient depth, follow-up, or timely implementation of corrective action.

3.3. MANAGEMENT OF THE QUALITY ASSURANCE PROGRAM

In this area, the objective was to evaluate CG&E's management of the QA Program to determine if adequate systems, procedures, and techniques have been established and, if so, are being implemented effectively.

TPT concluded that:

Management did not establish adequate mechanisms to ensure that QA program commitments in the Preliminary Safety Analysis Reports (PSARs) and Final Safety Analysis Reports (FSARs) were implemented in CG&E (and subcontractor) quality procedures in a timely manner.

CG&E's control of the process of developing, maintaining, and implementing subtier procedures, instructions for work, and inspections that affect quality has been less than effective from the start of construction to the present. There are many instances of inadequate control over design documents, design document changes, welding forms, inspection methods/procedures, documentation of work accomplished, conformance to work procedures, and QA procedures.

It was generally found that the QA training program was a reactionary process, increasing in scope and depth as problems were identified. Little evidence of planning for training, or systematic appraisal of training requirements in advance of specific work commencement, was found.

Comprehensive qualification and certification of QA personnel, for the most part, was not accomplished until after the major construction was completed.

An apparent lack of a clear-cut delineation of the different CG&E and HJK responsibilities and authorities in the area of procurement control [coupled with ongoing differences of opinion between CG&E and HJK over the scheduling of surveys/audits/inspections, on vendor data requirements, and on the development of an Approved Vendor List (AVL)] have contributed to a number of procurement problems. Attempts at corrective action appear to have been ineffective.

Up to 1981, CG&E lacked effective control over the design function. More audit emphasis should have been placed by CG&E on field design control procedures. This could have helped to identify and correct, in a timely manner, the design control problems experienced at Zimmer. CG&E initiated an intensive effort after the SCO to get this system back on track.

CG&E did not provide sufficient direction and support for the establishment of a comprehensive audit program executed in accordance with the requirements and intent of 10CFR50, Appendix B. Consequently, the CG&E QA audit program appeared to be ineffective. Individual problems were attacked, but the magnitude and extent of problems apparently remained largely undetected. Many noncompliances detected by outside audit groups should have been found by the CG&E QA audit group.

There exists no effective assurance that documents to be maintained as records are complete, accurate, valid, or readily retrievable. It would also appear that management did not take effective action early enough in the construction project to ensure the validity and availability of these documents. A centralized records center was set up after the IAL, and the turnover of documents from other site locations is in progress. However, progress is slow and it is not being accomplished in a thorough manner.

From the beginning of construction until the present, the corrective action system was generally not effective in assuring that identified discrepancies in material/systems/procedures were investigated in a timely manner, analyzed to determine root causes, and corrected by priority actions to prevent recurrence. Standard management tools to collect relevant data, analyze the data relating to the problem, propose alternatives on the basis of analyzed data and the operating environment, and select solutions were available but were apparently not utilized or, at the least, were not effective. In addition there is little evidence to indicate that management established an effective system to track "open" items to assure their completion.

There were extremes in the degree and kinds of interaction between the QA Department and its subcontractor organizations. On one hand, the CG&E QA interface with S&L QA and GE QA has been minimal but sufficient in relation to contractual responsibilities. On the other hand, CG&E QA's interface with HJK QA increased over the years to the point that the association became less than amicable and developed into an adversarial relationship. The controls and interfaces which CG&E QA applied to the activities of RCI also appear to have been minimal even though information provided from CG&E Management Assessment Audits

(MAAs) indicated that problems existed. It appears that the obscurity of CI's work scope; the lack of CI/Zimmer interfacing procedures; and the CG&E QA audits which appear to have been programmatic, rather than technical, contributed to the concerns of the NRC.

3.4. QUALITY CONFIRMATION PROGRAM

In this area, the objective was to evaluate CG&E's management of the QCP to determine its adequacy and effectiveness in achieving the objectives and the commitments of the program.

TPT concluded that:

During the initial stages of TPT's management review of the QCP it became increasingly evident that the assignment to the program of the present Director signaled a significant turning point in the history of the QCP.

The present QCP appears to have a reasonable organizational structure including adequately defined responsibilities and authorities. A high degree of management skill particularly in the administrative area, as opposed to the technical area is displayed by QCP management.

However, in spite of improved management there is still an inadequate definition to the QCP itself. While some tasks show good progress, others appear to be bogged down for one reason or another. In particular, the treating of audits, audit findings, root cause identification, corrective action, and the overall management assessment of the QCP through audits have been generally ineffective.

CG&E recognizes that a Quality Verification Program (QVP) is required, which will be more comprehensive than the present QCP, and involve disciplines and skills not now required of the QCP. Although the QVP organization would require personnel with different levels of expertise than those presently involved in the QCP, TPT believes the present QCP management and organization have a role in QVP (i.e., individual personnel appear well-qualified to perform certain tasks). Such skills are not evident in several areas of the Zimmer project management. The overall magnitude of the QVP indicates the need not only for management with high administrative skills, but also with extensive technical and prior experience in setting up, implementing, and successfully completing nuclear programs at other plants. Additional experienced staff and/or the services of an experienced external organization will be required to satisfactorily complete the QVP. An independence from involvement in prior activities would provide greater credibility.

3.5. PROJECT MANAGEMENT INTERFACES WITH MAJOR SUBCONTRACTORS

In this area, the objective was to evaluate the adequacy of CG&E's project management methods for: (1) administration and control of the work of major subcontractors and suppliers and (2) managing changes to their work and contracts to ensure effective control of performance. The evaluation included CG&E interfaces with S&L, HJK, GE, CI, and RCI.

TPT found that:

CG&E's original philosophy regarding procedures for projects was to allow major subcontractors to develop and use their own procedures, with the OPP as an umbrella document. The concept was good, but the implementation and control are inadequate in the case of the Zimmer project. The original OPP, issued in 1972, was a very broad but brief document that covered only the outline of how CG&E was to interact with the major contractors. This OPP was inadequate as a basis for developing and recording engineering/ construction records and writing procedures, and for controlling software and design documents; especially design drawings and design document changes (DDCs).

The OPP has been rewritten since the IAL and now appears to be an adequate base upon which to establish final, detailed project procedures. A major effort is still required to prepare and maintain a comprehensive set of working-level project procedures.

The present Nuclear Engineering Department (NED), formerly the Mechanical Engineering Section of the General Engineering Department (GED), had a formal charter to perform project engineering tasks such as monitoring S&L and GE activities, development of cost accounting on purchase orders (POs), cash flow projections, engineering change request (ECR) reviews, DDC reviews, making design changes, keeping up with codes and standards, and providing licensing support. However, in actual practice, NED has had little or no influence on the activities of S&L and GE. Although NED was the receiver and reviewer of engineering information it has been understaffed, limiting its effectiveness as a monitor of S&L and GE. NED has been in a reactive rather than an anticipative mode of operation. Its time has been consumed in detail work, reviewing procedures and previously written DDCs, rather than in monitoring the engineering activities of others. Thus its oversight charter has not been made meaningful. In about 1981 or 1982, NED tried to become more actively involved but support by senior management is required before NED's influence can increase.

The relationship of GE to CG&E was that of a vendor providing nuclear equipment to a buyer. GE interacted with CG&E primarily through the GE Zimmer Project Manager (ZPM) stationed in San Jose, California. GE did no site construction or inspection. GE has had very little direct influence on CG&E in the technical decisions made at Zimmer as CG&E relied upon S&L to make decisions regarding GE equipment. GE's role has been one of assuring that changes made by S&L affecting GE equipment are reviewed, approved, and properly documented in the GE drawing system universally used on all of GE's BWR projects.

The relationship of trust between S&L and CG&E was well-established. It was based on past experiences in the construction of coal-fired plants (22 different projects) over a period of 75 years. It is conceivable that this trust enabled CG&E senior management to feel it was unnecessary to monitor and control S&L's activities and that merely holding them accountable, under their contractual obligation to perform all engineering at Zimmer, was adequate. When attempts were made to exercise greater control and influence over S&L activities, senior management would admonish the Zimmer project personnel to let S&L alone to do their job. In this way, the monitoring and auditing of S&L activities was minimized.

For the majority of the time spent on the Zimmer contract, S&L conducted their engineering functions (including the processing of engineering changes, the incorporation of DDCs into drawings and specifications, analyses, and report writing) from the Chicago offices. S&L had a minimal site representation at Zimmer until after the IAL, when they did assign a large staff to the site to try and deal more directly with field engineering problems. Engineering changes were not well-controlled until a unified procedure was established in 1981. An extensive backlog of DDCs remains to be incorporated into design documents.

CG&E did exercise significant control and overview of HJK. CG&E initially delegated construction and QA responsibilities to HJK, yet tightly controlled the purse strings, limiting the number of staff employed and dictating the scope of activity in selected areas. CG&E's confidence in HJK decreased and their relationship with HJK had apparently deteriorated significantly by about 1976. On that date, CG&E took over the project management responsibility for construction and began to exercise greater overview and control, resulting in increased adversarial relationships between CG&E and HJK personnel with HJK assuming a more defensive posture in later years. Management policies and procedures clearly defining the management roles of both

CG&E and HJK (including their chains of command, limits of authority on both sides, and supervision rights) were inadequate.

Catalytic, Inc. (CI), working primarily for the Nuclear Production Department (NPD), was hired in mid-1980 mainly to work on punchlist items. They also performed other work for the GCD such as: (1) upgrading of structural steel to accommodate seismic loads and (2) removal and replacement of fuel pool heat exchangers.

CG&E QA had direct contact with CI, and the CI QA Manager, through: (1) audits of CI's work, (2) review and approval of CI work procedures, (3) review and approval of CI controlled work packages, and (4) participation at periodic project review meetings. Due to the number of procedures that CI developed and routed through CG&E QA for review, CI work on hardware did not actually start until the summer of 1982.

In general, CI was found to perform well in the punchlist or systems-oriented phase of construction although the definition and control of their work sometimes appears questionable. Various concerns regarding CG&E's control of CI's work included such items as: (1) inadequate control of work assignments to CI, (2) incomplete work packages and weld inspection records, (3) lack of in-process CG&E inspection hold points, and (4) inadequate CG&E audits of CI.

Reactor Controls, Inc. (RCI) was contracted to provide design analysis, construction activities, and QA/QC to an S&L design specification. Since HJK was not part of the work effort, it was CG&E's QA responsibility to perform audits and surveillance of RCI. CG&E did not provide definitive directions to RCI regarding the criteria and procedures needed to conduct work at Zimmer.

CG&E QA reviewed and approved the RCI QA manual prior to start of work and also made subsequent revisions to the manual. Apparently, a survey of RCI was not performed to verify QA Program implementation. QA performed periodic audits of RCI work. However, CG&E did not audit RCI to all the criteria of 10CFR50, Appendix B, applicable to RCI work. Considering the major RCI problems that were revealed later, it appears that the CG&E audits were not only insufficient in number but also ineffective. Problems that were subsequently identified included welding workmanship deficiencies, questionable welder qualifications, and inaccurate drawings. These are typical examples of deficiencies that are ordinarily detected by QA audits. The audits were also ineffective because the non-QA participants (that is, the CG&E project engineering personnel) were inadequately trained in auditing procedures and requirements and did not have sufficient time to prepare and execute the audits.

CG&E has taken appropriate corrective action by hiring other subcontractors to inspect the reactor internals, define any deficiencies, and take the corrective actions needed.

In general, review of subcontractors' activities appears to have occurred aggressively only between CG&E and HJK. There is little evidence that S&L, RCI, or CI activities were effectively reviewed, monitored, audited, or critiqued by CG&E. This CG&E policy of delegating the responsibility for major elements of the work to reputable experienced contractors is not inconsistent with the approach taken by other utilities for the construction of nuclear power plants. However, CG&E does not have the management system, implementing procedures, and staff required to control the work performed by their subcontractors.

Project planning and scheduling programs, and management information systems, appear to be available. However, their development, integration, understanding, and utilization by CG&E and the major subcontractors have many shortcomings. HJK appears to have had minimal involvement in, input to, and use of these information systems. Schedules and planning documents are not used to establish priorities or work plans at monthly subcontractor meetings. Engineering, quality assurance, construction, and planned testing activities are inadequately integrated. TPT concludes that a centralized planning organization would be desirable in order to integrate the planning work of the operations group into a single reference source.

3.6. PLANNED TRANSITION FROM PLANT CONSTRUCTION TO OPERATIONS

In this area, the original objective was to review existing procedures and the methods by which these procedures are to be implemented in the transition of the plant from the construction phase to the operations phase.

From TPT's investigation, it is clear that the preoperational test program, as originally conceived and carried out, was unsatisfactory due to the significant design changes imposed during the program compounded by the decision to allow the release of systems prior to the completion of construction. The disorder evident in the original test program resulted, in part, from turnover of systems to NPD which were in no condition to be meaningfully tested due to incomplete construction, known system changes which had yet to be physically implemented, and the large number (about 11,000) of outstanding DDCs which had not been incorporated in the design documents. Added to this was the large number of outstanding ECRs awaiting resolution and the large number of NRs resulting from the QCP.

This shortcoming has been realized, and the corrective action provided is to return the program, in effect, to its beginning by returning all essential systems to GCD jurisdiction. The project would then be committed to completing all construction activities and repeating the entire preoperational test program. Judgments as to the adequacy of this approach must remain tentative at this time since details of how the transition from the construction phase to the operation phase will actually be implemented have not yet been finalized.

At the close of the original transition program, NPD had a staff of some 35 test engineers, two-thirds of whom were CG&E employees. It would be expected that this staff, experienced in the operating functions of the Zimmer plant, would be adequate to support the revised test program. The situation with NED is less clear. As of May 1983, the department had a total engineering staff of only nine engineers who were assigned responsibilities for the Nuclear Steam Supply System (NSSS) and/or Balance of Plant (BOP) systems. Considering the backlog of outstanding ECRs, and the undoubtedly large number of additional ECRs that will be generated in the course of renewed testing, it would be expected that the staff will have to be enlarged.

The proposed team concept, wherein representatives of all affected CG&E departments are assigned to a group having the responsibility for coordinating all needed work to successfully complete the preoperational testing of a specific system/subsystem, promises to supply the coordination of effort that appeared to be lacking in the initial program. As of this date, procedures have not been prepared to establish the number of teams, each team's responsibility and membership, and the amount of authority each team will have to set work priorities for the various CG&E departments and subcontractors involved in construction rework, QA documentation, and resolution of the deficiencies uncovered in testing. Thus, the efficiency of the team concept could not be evaluated by TPT. However, TPT believes that, when properly covered by the appropriate procedures, this will be an effective program.

3.7. CASE STUDIES

In this area, the objective was to assess the role and behavior of CG&E management in response to selected specific problems and/or series of events, using the case study approach as a cross-check on the observations and conclusions reached separately in each of the other tasks in this independent review project.

TPT found that:

In each of the case studies, similar management deficiencies existed which were consistent with problems found in the other tasks in this report. For example, the other tasks in this review cited examples of CG&E management's lack of experience in nuclear construction, lack of emphasis on quality commitment, lack of procedures and records control, and, fundamentally, lack of understanding of the importance of the thorough documentation required in the construction of a nuclear plant.

In each case study, the particular problems or deficiencies identified are presently being adequately addressed by CG&E.

The overall conclusion common to all case studies, which was also corroborated by observations in all other tasks, was that (since the SCO) there has been a significant change in approach toward project management and, in particular, the attitude toward quality. As CG&E strengthens the Zimmer project organization by hiring experienced external personnel, this improvement in management attitude is expected to continue.

4. OVERALL CONSIDERATIONS

In TPT'S opinion, the future major goals of the Zimmer Project must be to establish corporate credibility with the public and with regulatory authorities, to verify the quality of the design and construction to date, to rectify any deficiencies, and then to complete construction and start-up fully in accordance with regulatory requirements.

It is with this background, and based on the investigation of CG&E management (including its QA Program), that TPT recommends the management organizational changes discussed in Section 6 of this report.

Before specific organizational arrangements and responsibilities are discussed, some overall considerations deemed appropriate to the anticipated continuation of the Zimmer project are presented.

4.1. WORK SCOPE

In order to recommend an appropriate organization, the major tasks that need to be performed must first be identified.

Key among these tasks are:

1. Defining and completing a comprehensive QVP to verify the quality of the design and construction of the Zimmer Plant from start of construction to the present date. The QVP should include: (1) an independent design review to determine if the design for Zimmer has been properly executed and documented, (2) a construction walkdown, and selected nondestructive testing to confirm compliance between the actual construction and the design documents, and (3) a comprehensive records collation and review to ensure compliance with QA documentation requirements.

2. Rectifying any deficiencies found in the QVP, including any needed modification of hardware in order to ensure compliance with design requirements and the reworking or replacement of areas where the quality is inadequate or indeterminate.

3. Completion of remaining construction including: (1) outstanding design modifications, (2) final construction checkout, (3) preoperational testing and start-up testing performed fully in

accordance with NRC regulations and, finally, after start-up, (4) the ongoing operation of the plant.

4. Confirmation of operator selection, training, and qualifications in preparation for plant start-up and operation.

5. The development of a comprehensive and integrated program plan schedule and management information system to effectively plan and control the work.

6. The establishment of an effective QA and audit program to ensure that all activities are performed in accordance with the appropriate regulatory requirements and standards. This program should include not only the audits but the actions to be taken in a timely manner in order to identify and correct problems and their root causes.

4.2. POLICY TOWARD QUALITY ASSURANCE

A key consideration in completing the Zimmer project is the policy and attitude of management towards QA. Quality assurance must start with the top executive of the company and permeate the actions and responses of everyone and everything that is done. This across-the-board commitment to quality and QA should not be made under duress or because CG&E is forced to do so. The commitment should be made because it is good business and good management.

As will be noted in the following section, part of TPT's recommendation is to centralize and elevate the status of the QA management. However, all management functions must accept the responsibility and commitment to perform work of fully acceptable quality. The QA group should not (as perhaps has been the situation in the past at Zimmer) be regarded as the organization controlling the work and assuring that it is right. The commitment to quality, and the basic control of and responsibility for the work, is fairly and squarely in the hands of the construction, operations and engineering groups. QA must be independent and provide assurance through the inspection, surveillance, and audit functions that quality is built into the product; but the a priori responsibility for quality is with the performing organization. In addition to holding the performing organization responsible and accountable for the quality of the work done, upper management must get timely feedback on how well the work is done from a QA standpoint.

4.3. THE QUALITY VERIFICATION PROGRAM

The QVP is seen as the next project phase for the Zimmer plant. This QVP is seen as considerably broader in scope than the existing QCP. It affords CG&E the opportunity to make its QA objectives evident. The immediate effort should include the planning and scheduling of activities, staffing, procedures preparation, organizing of related documentation, and the execution of inspection activities (including walkdowns) to check compliance between actual construction and design document requirements. An independent design review should be initiated immediately. Implementation of hardware changes during this project phase would be initiated only as required to satisfy the QVP and would be completed prior to commencing the additional work necessary to complete construction, plant checkout, and preoperational testing.

From the initial definition of its scope to its eventual successful completion, he QVP will require the support of every organization involved in the Zimmer project. The day-to-day leadership of QVP activity must be clearly defined as the responsibility of a single organization but the overall responsibility for the QVP is placed squarely with the senior executive having overall management responsibility for the Zimmer plant, as it is with any other project phase. In this context, various elements of the QVP may have conflicting demands on available CG&E resources. A strong commitment on the part of CG&E management is required to coordinate, schedule, and monitor QVP activities (and to maintain staff morale) in order to achieve the successful completion of this program.

4.4. STAFF AVAILABILITY AND ROLE OF AN ARCHITECT-ENGINEER/CONSTRUCTOR

Another overall consideration must be the practicality of quickly obtaining the right type, quality, and quantity of management and support staff considered necessary to complete Zimmer in accordance with regulatory requirements. To mitigate this problem, TPT recommends that the most realistic approach is to retain the services of a fully qualified and experienced architect-engineer/constructor (A-E/C) type of company to provide the quality and quantity of temporary staff required to manage construction and provide an overview of the QVP.

5. EVALUATION OF ALTERNATIVE ORGANIZATIONS

Various alternative organizations to accomplish the tasks identified above were evaluated by TPT. In all alternatives sufficient authority, resources, management experience, and capability at all levels must be available to perform the activities required to complete Zimmer in accordance with design requirements and the NRC regulations.

5.1. ALTERNATIVES EVALUATED

Sixteen alternative project management organizations, as listed below, were evaluated.

Alternatives specified by the NRC for evaluation were:

1. Strengthening the present CG&E organization.

2. An organizational structure in which the construction management of the project is conducted by an experienced outside organization reporting to the Chief Executive Officer (CEO) of CG&E.

3. An organizational structure in which the Quality Assurance program is conducted by an experienced outside organization reporting to the CEO of CG&E.

4. An organizational structure in which both Quality Assurance and construction management of the project are conducted by an experienced outside organization reporting to the CEO of CG&E.

Each of these first four alternatives could be effected in conjunction with the CG&E organization that was in place at the date of the SCO, or with the CG&E organization as revised since the SCO. The latter case provides four additional alternatives (1A, 2A, 3A, 4A) for evaluation.

Alternatives suggested by TPT

5. Creation of a new company organized and owned by the present owners [CG&E, Dayton Power and Light Co. (DP&L), and Columbus and Southern Ohio Electric Co. (C&SO)], which would function virtually autonomously to complete and subsequently operate the Zimmer plant.

6. Strenthening and reorganizing the Zimmer project organization within CG&E, whereby all aspects related to the Zimmer project are directed by an experienced senior officer of the company [effectively, the Zimmer Project Manager (ZPM)], who had no involvement with Zimmer prior to the SCO. In addition, construction management, and management of the QAP, are performed by an experienced outside organization reporting to the senior officer responsible for the Zimmer project.

7. Creation of an organizational structure whereby an experienced outside organization co-manages the project with CG&E and assigns personnel to all key management positions. The initial responsibility for Zimmer activities would rest with the outside organization, with a gradual transition to CG&E of the prime responsibility as progress was made and CG&E staff became more capable.

8. Delegation of all activities on the Zimmer project to an experienced outside organization on a turnkey basis.

9. Establishment of a Zimmer Project Oversight Committee (ZPOC) with a majority of the members having no prior Zimmer line management involvement. The ZPOC would report to the Board of directors. The organizational structure discussed in Alternative 6, including the ZPM, would report directly to the ZPOC. The ZPM would have a line of communication directly to the CEO of CG&E in reporting progress and status.

10. Establishment of a ZPOC reporting to the Board of Directors of CG&E as in Alternative 9. The organizational structure discussed in Alternative 6, including the ZPM, would report to the CEO of CG&E and have a line of communication to the ZPOC to report progress and status (i.e., the reverse relationship to Alternative 9).

Alternative proposed by CG&E:

11. Strengthening and reorganizing the CG&E Zimmer project organization, whereby all aspects related to Zimmer are the responsibility of the Senior Vice President, Nuclear Operations (who had no involvement with Zimmer prior to the SCO). Bechtel Power Corp. (BPC) as an experienced external organiztion, will be responsible for management of the QVP and construction. BPC's

proposed scope of activity and responsibility is not yet finalized. BPL will report to a CG&E Vice President under the Senior Vice President. CG&E co-managers are planned for all BPC project management positions. (Note that this is similar to TPT's Alternative 6, except for some differences in detail at the lower levels of the organization.)

Alternative proposed by Bechtel Power Corporation (BPC):

12. BPC proposed a fifth alternative to the four concepts suggested by the NRC. The fifth alternative, proposed by BPC, was substantially the same as TPT's Alternative 8. However, BPC interpreted NRC's Alternative 1, "Strengthening the present CG&E organization" differently than TPT. Their interpretation is, in fact, co-management by an experienced outside organization and is similar to TPT's Alternative 7.

5.2. METHODOLOGY

The organizational alternatives were evaluated using a modified Kepner-Tregoe type of analysis with criteria developed by TPT. This decision making methodology involves defining primary (or MUST) criteria and secondary (or WANT) criteria against which the alternatives are evaluated. The MUST criteria selected were: (1) all legal requirements and relationships to the PUC and nuclear licenses with NRC must maintained, (2) the organization must overcome all prior deficiencies in order to facilitate completion of construction in accordance with all NRC regulations and requirements, and (3) the organization must provide a credible basis for a comprehensive quality verification of all prior construction.

All alternatives which meet the MUST criteria are further evaluated against the secondary or WANT criteria. The alternatives are ranked using weighted figures of merit against the WANT criteria. The WANT criteria selected were: (1) external credibility, (2) soundness of organizational characteristics, (3) practicality of implementation, (4) ease of transition from construction to operations, and (5) project continuity.

5.3. RESULTS

The results indicate that strengthening CG&E management, combined with involving an experienced external organization, is the basic element of the three front-running candidates. Combining this basis with an independent Zimmer Project Oversight Committee (ZPOC) provides a considerable increase in the perceived credibility of the organization. The practicality and credibility of having this ZPOC act in an advisory committee to the Board, rather than a controlling mode, is favored. Consequently, Alternative 10 is the organization preferred by TPT.

A summary of the evaluation, including a brief discussion of the relative merits of various alternatives, is provided below. A more extensive discussion of Alternative 10, the recommended organization, is provided in Section 6.

The evaluation of the MUST criteria is presented in Table 1. A number of alternatives met all the MUST criteria only weakly, particularly in the area of correcting prior deficiencies. However, the benefit of the doubt was accorded to all alternatives on the basis that, provided the overall project organization was fundamentally improved, additional strengthening in selected areas could be effected to correct prior project deficiencies in that area. The alternatives which met the MUST criteria (with qualifications) are noted in parentheses in Table 1.

The evaluations in Table 2 of the WANT attributes for each alternative reflect relative judgments, not absolute ones, using a scale of from one to ten. Each criterion was taken separately and evaluated based on experience and careful reflection of the best data available. The weighted figure of

TABLE 1
MUST CRITERIA*

	Strengthen CG&E	Const. Mgt. by EEO**	QA Mgt. by EEO	Const. and QA by EEO	New Company	Strengthen CG&E and Const. and QVP Mgt. by EEO	Co-management by EEO	Turnkey by EEO	As in Alternative 6, Report to Oversight Comm.	As in Alternative 6, Report to CG&E CEO add Oversight Comm.	CG&E Proposal	BPC Proposal
Objective	1	2	3	4	5	6	7	8	9	10	11	12
Meets all legal requirements and relationships to PUC and licenses with NRC	GO	GO	GO	GO	(GO)	GO	GO	GO	GO	GO	GO	GO
Must facilitate completion of construction in accordance with NRC regulations	(GO)	(GO)	(GO)	(GO)	GO	GO	GO	GO	GO	GO	GO	GO
Provides credible basis for Quality Verification Program	(GO)	(GO)	(GO)	(GO)	GO	GO	GO	GO	GO	GO	GO	GO

*GO = acceptable; (GO) = marginal, additional qualifications must be met.
**EEO = experienced external organization.

TABLE 2
WANT CRITERIA

		Strengthen CG&E	Const. Mgt. by EEO*	QA Mgt. by EEO	Const. and QA by EEO	New Company	Strengthen CG&E and Const. and QVP Mgt. by EEO	Co-management by EEO	Turnkey by EEO	As in Alternative 6, Report to Oversight Comm.	As in Alternative 6, Report to GC&E CEO add Oversight Comm.	CG&E Proposal	BPC Proposal
Attribute	Wt.	1	2	3	4	5	6	7	8	9	10	11	12
External Credibility	10	2/20**	3/30	4/40	5/50	9/90	5/50	6/60	7/70	9/90	10/100	5/50	6/60
Organizational Characteristics	9	2/18	6/54	6/54	8/72	10/90	10/90	6/54	8/72	10/90	10/90	10/90	6/54
Practicality	9	10/90	7/63	7/63	6/54	2/18	9/81	5/45	3/27	6/54	8/72	9/81	5/45
Transition to Operations	8	7/56	5/40	6/48	4/32	10/80	10/80	8/64	3/24	10/80	10/80	10/80	8/64
Resource Availability	7	6/42	8/56	8/56	9/63	6/42	6/42	9/63	10/70	6/42	6/42	6/42	9/63
Project Continuity	6	9/54	6/36	6/36	5/30	7/42	8/48	10/60	2/12	8/48	8/48	8/48	10/60
Total		280	279	297	301	362	391	346	275	404	432	391	346
Relative Preference		8	9	7	6	4	3	5	10	2	1	3	5

*EEO = experienced external organization.

**Rating/Score.

NOTE: Some increase in rating would be realized for the 1A, 2A, 3A, and 4A cases relative to the corresponding 1, 2, 3, and 4 value listed. The increase is judged not to be sufficiently significant to affect relative rankings.

merit for each alternative indicates its the relative preference, in TPT's opinion. Additional consideration was then given to developing the structure of the front-running alternative (10) to address and correct the deficiencies observed in prior Zimmer project management.

Some of the key reasons for differentiating between the alternatives are summarized below:

At the operational level, the recommended Alternative 10 is quite similar to alternatives 5, 6, 9, 10, and 11. Each, if properly structured at the lower levels, should rectify the prior deficiencies noted in the Zimmer project management. The key difference between Alternatives 9 and 10 and Alternatives 5, 6, and 11 is the appointment of the ZPOC (at the Board of Directors level) to provide an independent advisory body. The senior executive officer responsible for Zimmer must convince this committee that the policies and progress at Zimmer are satisfactory, consistent with NRC regulations, and in the best interests of the stockholders of CG&E. Using this committee in an operational mode, as in Alternative 9, is considered impractical. Establishing an autonomous new company, as in Alternative 5, would provide greater independence and even more external credibility but it is judged to be the most difficult, potentially expensive, and time-consuming to set up. Legal issues on the transfer of NRC permits and licenses would require considerable further time and evaluation, the benefits of which are not consistent with the expense that would be incurred.

Alternatives 1, 2, 3, and 4 all suffer the same type of shortcomings. Each would correct deficiencies in particular areas of the Zimmer project management but, in TPT's opinion, the deficiencies extend across all functions within the complete project and also involve senior management. Clearly, Alternatives 1A thru 4A are variants which are better than their counterparts 1 through 4, but still suffer shortcomings in respect to the correction of functional deficiencies.

TPT doubts whether simply strengthening the CG&E organization (Alternative 1), interpreted to mean the replacement of or the hiring of additional staff, is satisfactory. Involving an experienced external organization clearly enhances CG&E's credibility and provides an important resource to the project.

Alternatives 7 and 8 overcame the functional deficiencies perceived by TPT, in that they apply across the complete project. However, Alternative 7, the establishment of co-managers at all key management positions is perceived as highly impractical (involving a difficult division of responsibility and authority). At the working level, this choice would foster a persistent question as to who was in charge and whose orders were to be followed.

The major shortcoming in Alternative 8 is the lack of involvement of CG&E management and staff, who must be prepared to take over and operate the plant. In addition, the relationship of all alternatives to CG&E top management must be carefully viewed to ensure sufficient external credibility. Only Alternatives 5, 9, and 10 provide this characteristic to a satisfactory degree in TPT's opinion. As noted above, in TPT's view, Alternative 10 is superior in that it is the most practical and credible of the three.

6. RECOMMENDED ORGANIZATION

The following summary of TPT's recommendation for an organizational structure is an expansion of Alternative 10. It is presented (by group function) in the context of completing the work scope, particularly the QVP discussed in Section 4, Overall Considerations.

The organizational structure is depicted in Figure 1.

The foundation of any public-held stock company is the Board of Directors. These directors represent the stockholders and their interests. TPT

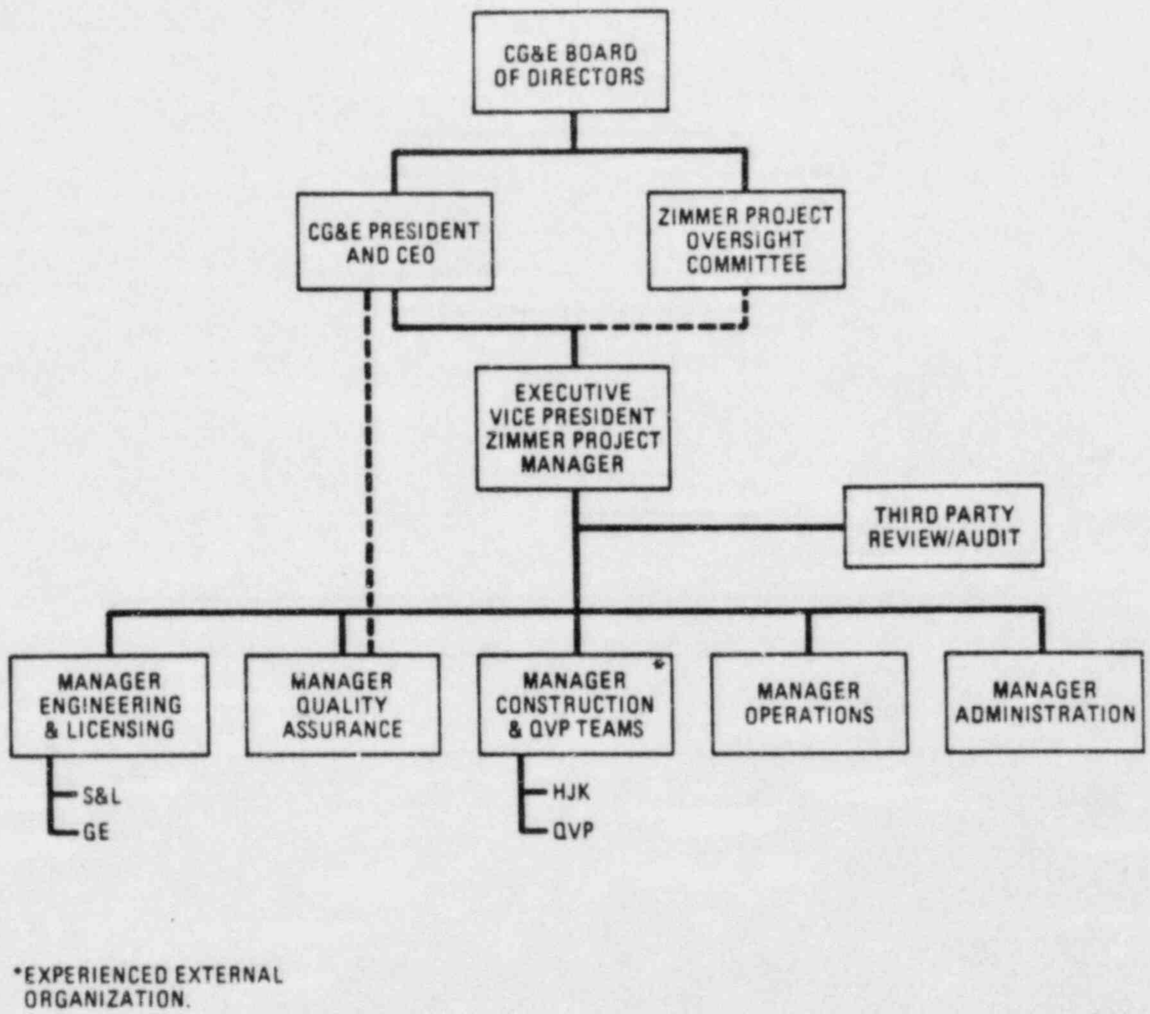

Fig. 1. Recommended Zimmer project management organization

believes that (for a smooth functioning, efficient organization) the directors must retain full responsibility and that it should not be diluted in any fashion. TPT believes that the Cincinnati Gas & Electric Board of Directors should become more involved and knowledgeable regarding key policy decisions and the key results of those policies. The Board, as a whole, should be perceptive enough to identify flaws and undesirable overall results from key management policies. These directors should bring business expertise and technical expertise applicable to, if not directly related to, the nuclear industry and community concerns. To assist in the fulfillment of this responsibility, TPT recommends the election of a director by the stockholders who is, and has been, independent of the Zimmer project and who has broad experience in the nuclear industry from a business viewpoint, a project management viewpoint, and from a QA viewpoint.

TPT further recommends that the board, recognizing its responsibilities, carefully evaluate the capabilities and credentials of all CG&E officers having direct line management responsibilities for Zimmer, and, on the basis of the evaluation, if appropriate, issue endorsement of those officers.

To further assist the Board in fulfilling its responsibilities to the stockholders, in order for the Board of Directors to demonstrate its commitment to integrity in all activities related to Zimmer and, at the same time, achieve the maximum credibility in the eyes of its critics a Zimmer Project Oversight Committee (ZPOC) should be appointed. This committee should be constituted from existing CG&E directors (supplemented by new members, if required) so that the majority of members have had no prior involvement in Zimmer line management. These directors should have business and technical expertise applicable to, if not directly related with, the nuclear industry, and community awareness. The ZPOC would be similar in constitution and independence to the recently formed Special Litigation Committee (SLC) formed by the CG&E Board to address the Bell Efros Derivative Action Complaint.

The capabilities of the ZPOC should be supplemented by a permanent, though not necessarily full-time, staff of advisors. These advisors should provide technical and business expertise, and community awareness. Included should be technical expertise in all phases of a nuclear project including engineering, construction, and quality assurance. A member who belongs to such organizations as The American Nuclear Society, The American Society of Mechanical Engineers, or The American Society for Quality Control would be appropriate. Also included should be a respected leader from the Cincinnati community. Representatives of the two partners in the Zimmer project should also be included.

The ZPOC would provide an overview and source of information and analysis of Zimmer operations, for the Board of Directors that would be independent from the views of the line management. This strategy would ensure the highest corporate visibility for Zimmer. The ZPOC should have full access to any documents and records of the Zimmer project. The senior executive responsible for Zimmer would report periodically to this committee regarding progress and status. The ZPOC would not make policy decisions but would act as an Advisory Group to the Board of Directors on policy matters, providing insights into the results of policy decisions.

The Chief Executive Officer (CEO) and President of Cincinnati Gas & Electric has the full responsibility for the management of Zimmer, as well as all aspects of CG&E business, and also for the implementation of policy decisions from the Board of Directors. Any other organizational structure that might weaken the CEO's position would be counterproductive and would increase the cost of operation of CG&E, including Zimmer, to the stockholders and therefore, ultimately, also increase the cost of electricity to the ratepayers without any counterbalancing benefit. Therefore, in this recommended organization, the CEO is left with the full responsibility for Zimmer. As such, he must be involved in all policy decisions including the relative priority of quality, quality assurance, cost, and schedule; basic approach to regulatory requirements; and the organizational reaction to whistle-blowers. He must also be knowledgeable regarding the results of these policies and the continuing general direction of the project. Obviously, he should not be involved in the day-to-day operation of the project but he must be sensitive to, and perceptive of, the basic direction of the project and its major problems.

Furthermore, TPT has concluded that the President of CG&E is capable of completing the job, notwithstanding the errors of the past and the widespread criticism of CG&E and its management. This conclusion applies specifically with respect to the current President, Mr. W. H. Dickhoner.

In this reorganization, all activities related to Zimmer should be concentrated exclusively in a single senior executive who has had no direct association or involvement in the project prior to the SCO. This senior executive would report to the President and CEO of CG&E. He should have the authority and resources necessary to implement all measures needed to complete the Zimmer project successfully and in accordance with the NRC regulations. He will also be responsible for providing complete, timely reports to the ZPOC concerning progress, policies, and any major problems at the Zimmer project. He will also provide information to the ZPOC that is requested by the Committee itself or by its group of advisors.

This senior executive should have a proven track record in the successful management of major nuclear projects. He should have demonstrable knowledge of all phases of the completion of a nuclear project including engineering, construction, quality assurance, and regulatory relations. For the purposes of this discussion, he is referred to on the organization chart (Fig. 1) as the Executive Vice President, Zimmer Project Manager (ZPM), but numerous other titles would be appropriate.

TPT recognizes that CG&E has hired Mr. J. Williams, Jr. as Senior Vice President, Nuclear Operations, since the SCO, and that his sole responsibility is to manage the Zimmer project. In TPT's view, Mr. Williams is an appropriate selection to manage current activities at the Zimmer plant.

His background and experience meet the requirements specified by TPT. His words and actions since being in office have underscored his commitment to quality and his intention to do whatever is necessary to perform a comprehensive QVP and to complete the Zimmer station fully in accordance with NRC regulations and the construction permit.

TPT also notes that Mr. Williams has hired three well-qualified persons to head various functions at the Zimmer plant. TPT has had no contact with these individuals as they have recently joined the project. Therefore, TPT can observe only that their qualifications and experience fully meet, in TPT's judgment, the requirements of these positions.

The major activities identified in the previous section of this report should be addressed collectively by organizational units elevated in status to report directly to the Executive Vice President, Zimmer Project Manager, as indicated in Fig. 1. Each organizational function should be headed by an individual of proven ability, having the qualifications and prior experience commensurate with the position.

An experienced, external A-E/C organization would be hired to perform necessary construction management and to manage the leadership of the day-to-day activities of the QVP in the context of the overall project commitments discussed previously.

It is recommended that HJK be retained to perform all construction activities under the management of the new A-E/C. Existing CG&E construction staff would be utilized to the extent required in the QVP; specifically, to provide continuity to prior activities and records.

It is important to preserve the A-E/C's corporate identity, responsibility, and commitment while still maintaining CG&E's management involvement due to the advanced state of completion at Zimmer; the extensive documentation still outstanding from prior work (particularly in the area of ASME Code reports); the knowledge, experience and records of existing staff; and the prospect of the transition from construction to operations (which will ultimately be the licensee's responsibility). In these circumstances it is inappropriate to fully delegate accountability to a new A-E/C. CG&E, appropriately reorganized and strengthened in the senior management functions, should remain actively involved in Zimmer project management and quality assurance in order to properly discharge corporate responsibilities. In this organizational concept, the A-E/C would have a clearly-defined corporate role and scope under CG&E's overall management. The A-E/C would provide necessary program management resources primarily in construction activities and in leadership of the QVP teams mentioned previously. The new A-E/C would manage HJK site activities in the completion of the QVP and, subsequently, in the completion of construction. In addition, depending upon CG&E's ability to recruit appropriate people, the A-E/C may also provide temporary staff to be integrated (under CG&E's direction) in areas other than construction; for example, in engineering and/or the operations area. As noted above, the A-E/C's project manager would report to, and receive directions from, the Executive Vice President, ZPM.

The scope and function of each major organizational unit and the relationship to major subcontractors is described below.

6.1. CONSTRUCTION

The A-E/C would replace the present CG&E construction management group. The responsibility of the A-E/C would be to direct and manage all construction activities, including the remedial work resulting from the QVP and the subsequent completion of construction at the Zimmer site. All work is essentially hardware related, but includes all required and related documentation.

Also as noted above, it is further recommended that the QVP should report organizationally through the Construction Group to the Executive Vice President, ZPM. A team approach is proposed for the implementation of the QVP. Each QVP Team would be assigned to a system, a subsystem, or other logical and existing subdivision of the plant. These teams would consist of personnel from each Zimmer organization, representing all disciplines and functions necessary for that team's assignment except QA/QC*. The number of active people on a team would vary from time to time depending on the status of completion and the particular requirements. The experienced external organization is perceived to have the technical and management capability, and the prior experience, to assume this duty and to provide the necessary qualified staff as team leaders. In addition, as the membership of each the team comprises representation from all other groups, all organizational units must contribute resources to the extent required.

The A-E/C's activities and responsibilities are concluded when the QVP, the subsequent completion of construction, the construction checkout tests, and the rework identified during the preoperational and start-up tests are completed, and the level of effort can be handled by the permanent station maintenance crew. At this point, the A-E/C, as such, is terminated and responsibility is fully transferred to the Operations Group. Thereafter, ongoing hardware-related functional activities such as materials receiving, warehousing, and key craft capabilities are retained as a maintenance support function for future operations. Qualified staff are reassigned to operations and engineering to provide an essential carry-over of experience into those areas.

6.2. ENGINEERING

The responsibility of the Engineering Group is to direct and manage all engineering activities related to the Zimmer project. All work is essentially software- and engineering-related.

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*QA/QC would be independently performing its normal project function while reporting through an independent chain of command to Zimmer's top management.

During the QVP phase of the project, the Group's primary activities will be to:

1. Participate strongly and actively in the QVP Team activities providing the necessary technical input and guidance.

2. Provide the liaison to a third party's independent design review which is seen as an essential requirement during the QVP.

3. Continue to be the primary technical interface between the Zimmer project organizaton, the original plant designer (S&L), and the NSSS supplier (GE), and

4. Implement design control procedures to bring the technical documentation of the plant to the standard required.

The Group would provide a technical overview and needed resources to other organizations, as required. The status and requirements to complete the ASME Code N Stamp Reports on earlier HJK work is one area requiring such technical evaluation. Other areas would be power system performance and safety system performance.

The Group would also be responsible for all Nuclear Safety, Licensing, and Environmental Affairs.

The Group would not, as in the past, provide the administrative service for the purchase of components and services. That function would be administered separately under the Administrative Group, with technical review as required by Engineering.

The Head of the Engineering Group, and the majority of his key assistants, should be permanent CG&E professional staff who, after the completion of the QVP and the construction will provide complete technical services (or conduits of services from external sources) to the Operations Group.

The Head of the Engineering Group should hold an appropriate engineering degree from an accredited national university and have extensive experience in the nuclear industry. He should have held an engineering management position with a nationally-recognized company actively involved in the design and construction of nuclear power plants. Prior experience with BWR reactors would be desirable.

It is clear that the existing CG&E staff must be supplemented by additional qualified staff. Also in the near-term, the number of staff will be greater than when the plant is operational. It would, therefore, be appropriate to contract for some supplemental staff temporarily from qualified external organizations.

6.3. QUALITY ASSURANCE

The Quality Assurance Group is responsible for establishing and implementing a Quality Assurance Program that covers all activities on the Zimmer project. The program must be structured to ensure that all Zimmer-related activities comply with current regulatory requirements.

All Zimmer-related QA activities will be centralized under this Group including those related to the QVP, construction completion, preoperational testing, start-up and operations. The Group is expected to function in the conventionally-accepted role, verifying the quality of the work accomplished by the performing organization.

The Group's responsibilities would include all of CG&E's Zimmer-related QA/QC activities, including the effective auditing of subcontractor performance, and also the prime responsibility for all external relationships with Federal, State, and Regulatory Code Authorities regarding QA matters.

The Head of the Group should have the same status as all other Group Heads and report directly to the Executive Vice President, ZPM. Group staff should have equality in level, status, and compensation with other functional groups. The QA Group should have a clearly designated information-reporting line to the CG&E President.

The Head of the Quality Group, and his key assistants, should be permanent CG&E employees who, after the QVP and the construction completion phase, will have similar responsibilities for the continuing operation of Zimmer.

The qualifications of the Head of Quality Assurance must predominantly reflect a strong QA management background and experience in civilian nuclear power plant construction and operation. The existing CG&E QA organization is understaffed and staff must be supplemented by additional qualified personnel. Particularly during the QVP, additional subcontractor support will be required.

As part of their QA activities, the Quality Assurance Group must provide particular attention to the determination of actions which must be taken to identify and correct any existing shortcomings in the quality of the Zimmer plant. Accordingly, it is important that the group perform trending analyses of quality problems, keep track of commitments, and make timely determinations of the root causes of problems and measures to prevent their recurrence. Another key duty of the Quality Assurance Group is to verify that adequate documentation is being produced and properly retained for all Zimmer safety-related QVP, construction, engineering, start-up, and operations activities.

Although individual groups may retain copies of their own records, a central file for all safety related documents, maintained by the Administrative Group, under QA's technical overview and direction is considered essential.

6.4. OPERATIONS

The Operations Group is responsible for all activities related to pre-operational testing, start-up tests and subsequent Nuclear Power Plant operations to ensure safe and efficient operation of the facilities in accordance with all federal, state, and local regulations.

The Group's responsibilities include plant maintenance (after takeover from Construction); the retention of a proper inventory of spare parts; plant security; and the procurement, management, and efficient utilization of nuclear fuel supplies. The Group's responsibilities also include the training and requalifiying as required, of nuclear plant operators.

During the QVP and the construction completion phases of the Zimmer project, the Group would assign staff to the varius QVP Teams primarily to obtain exposure to the design and construction phases of the facility and to maximize the opportunity for experience carry-over. Also during these phases, the plans and procedures for the effective transition from construction to operations will be finalized. The currently proposed 'team' approach being developed by NED should be utilized. Leadership of its start-up teams should be the responsibility of the Operations Group. Plans will also be formulated for operator training and qualification and the subsequent maintenance of these qualifications.

Clearly, the Head of the Operations Group must be a permanent CG&E employee reporting to the Executive Vice President, ZPM, whose continuing responsibility is to provide the necessary management capability to direct the future safe and efficient operation of the facilities. His responsibilities will entail the establishment and implementation of policies and procedures relating to all aspects of operating the nuclear facility. He should have a demonstrated record of success in the professional management of nuclear power-generating facilities and have played a significant role in the start-up of nuclear plant(s). CG&E currently has some capable support staff in the plant operations and operator training areas. This capability should be enhanced by their involvement in the QVP and continuing involvement in other reactor programs.

6.5. ADMINISTRATION

TPT recommends that administrative activities be centralized and standardized under a single manager to relieve the burden on the Executive Vice President, ZPM created by multiple, independently reporting organizations.

Presumably, corporate CG&E resources would continue to be utilized for standard administrative functions such as Finance, Accounting, Legal, Contracts, Purchasing, and Personnel. In these areas, specific individuals at CG&E's main office should be clearly designated as having Zimmer duties as their first priority. They should be available, as required, by the Executive Vice President, ZPM and should, in any event, be coordinated through a single senior individual manager (independent of other Groups) on the Zimmer project staff, reporting to the Executive Vice President, ZPM. In the case of Contracts and Purchasing, although standard administrative head office resources may be utilized, serious consideration should be given to locating the designated individual(s) at the Zimmer site depending on the level of activity.

Three functions that require special emphasis [and that should be centralized, standardized, and specific to (and located at) the Zimmer site] are the areas of Program Planning and Scheduling, Management Information Systems, and Document Control. Major shortcomings of the Zimmer project in the past have been the lack of effective integrated planning of construction, QA and the transition to operations, the absence of comprehensive management information systems, and an inadequate documentation/records control system.

There is a major and urgent need to establish such capability. In the areas of Program Planning and Management Information Systems some progress has been initiated by CG&E, particularly in operations. A powerful computer code, and related software systems, have been purchased but are not yet fully operational nor effectively utilized. It is strongly recommended that this capability be established and applied to all future activities, commencing with planning for the QVP, and also applied for all activities thereafter.

As noted previously some progress is being made in the area of documentation to identify and compile records at the central facility at Zimmer. However, progress is slow and this task is not being accomplished in a thorough manner. This activity should be elevated in priority and focused under a relatively senior manager.

7 THIRD PARTY REVIEW

TPT recommends that a qualified external organization(s), independent from the A-E/C referred to previously, be retained to perform review/audits in three specific areas in conjunction with the following organizational recommendation. These are:

1. An Independent Design Review.

2. An independent Audit of the implementation of the QVP.

3. A Records Management Review.

These reviews and audits should be performed by a qualified outside organization, which did not perform the activity initially nor will be involved in performing the activity subsequent to the recommended reorganization.

The primary incentive to perform independent third party reviews is to provide increased assurance to CG&E management that the resumption of activities at Zimmer will proceed properly. It is in the best interest of management, the stockholders and the ratepayers that everything reasonably possible be done to assure satisfactory completion of the project. A secondary incentive is the increased credibility that will be achieved with Congress, the NRC and the General Public.

The purpose of the Independent Design Review is to determine that the design for Zimmer has been properly executed and documented. Selected critical safety systems should be examined to ensure that original design configuration and calculations (including field modifications) are adequate, comply with the design bases, and meet Regulatory requirements.

The purpose of the Independent Audit of the QVP is to provide expert independent assurance that in addition the audit would include an independent review to verify that the construction and repair activities at Zimmer are being performed in an adequate and effective manner consistent with Regulatory requirements. The depth and scope of the proposed QVP activities including the related planning of the program are adequate. Selected critical safety systems would be examined to confirm compliance between actual construction and the original design document and that this compliance can be demonstrated.

The purpose of the Records Management Review would be to ensure that the appropriate records retention and retrieval systems are being assembled, as recommended, at Zimmer. In addition to examining the overall records management system, the review would test the effectiveness of the system by tracing selected documentation from design through construction to operations, ensuring that all prerequisite identifications and controls have been applied and that such documentation is readily retrievable.

ERRATUM

GA-C17173, INDEPENDENT REVIEW OF ZIMMER PROJECT

MANAGEMENT, FINAL REPORT

VOLUME 1, EXECUTIVE SUMMARY

AUGUST 22, 1983

The following erratum should be noted in GA Technologies Inc. Report GA-C17173:

Page 47, third paragraph, should read:

> The purpose of the Independent Audit of the QVP is to provide expert independent assurance that "the depth and scope of the proposed QVP activities including the related planning of the program are adequate. Selected critical safety systems would be examined to confirm compliance between actual construction and the original design document and that this compliance can be demonstrated. In addition, the audit would include an independent review to verify that the construction and repair activities at Zimmer are being performed in an adequate and effective manner consistent with Regulatory requirements."

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GA-C17173

INDEPENDENT REVIEW OF ZIMMER PROJECT MANAGEMENT

FINAL REPORT

VOLUME 2 - DISCUSSION

PREPARED FOR
CINCINNATI GAS AND ELECTRIC COMPANY

GA PROJECT NO. 2474
AUGUST 1983

TORREY PINES TECHNOLOGY
A Division of GA Technologies Inc.

FOREWORD

The final report on the Independent Review of Zimmer Project Management, done by Torrey Pines Technology under contract to the Cincinnati Gas & Electric Company, is presented in two volumes.

Volume 1, the Executive Summary, presents a top level summary of the work done, results, observations, conclusions, and recommendations.

Volume 2, the Discussion Volume, presents a more detailed description of the review and evaluation tasks, the information obtained and analyzed, and detailed observations, conclusions, and recommendations.

ACRONYMS AND ABBREVIATIONS

AE	-	Architect-Engineer
AEC	-	Atomic Energy Commission, later the Nuclear Regulatory Commission (NRC)
AE/C	-	Architect Engineer/Constructor
AFR	-	Audit Finding Report
ANI	-	Authorized Nuclear Inspector
ANSI	-	American National Standards Institute
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing Materials
AVL	-	Approved Vendor List
AWS	-	American Welding Society
BOP	-	Balance of Plant
B&PV	-	Boiler and Pressure Vessel
BPC	-	Bechtel Power Corporation
BWR	-	Boiling Water Reactor
C of C	-	Certificates of Compliance
CAR	-	Corrective Action Report
CASE	-	Coalition for Affordable Safe Energy
CEO	-	Chief Executive Officer
CER	-	Condition Evaluation Request
CG&E	-	Cincinnati Gas & Electric Company
CI	-	Catalytic, Incorporated
CM	-	Configuration Management
CMTR	-	Certified Material Test Report
CPM	-	Critical Path Method
CRD	-	Control Rod Drive
C&SO	-	Columbus and Southern Ohio Electric Company
CWAR	-	Construction Work Approval Request
DDC	-	Design Document Change
DP&L	-	Dayton Power and Light
ECR	-	Engineering Change Request
EOTD	-	Engineering Operating Test Department

EPD	-	Energy Production Department
FCP	-	Field Construction Procedure
FDDR	-	Field Deviation Disposition Request
FDI	-	Field Disposition Instruction
FSAR	-	Final Safety Analysis Report
FWO	-	Field Work order
GA	-	GA Technologies Inc.
GAP	-	Government Accountability Project
GCD	-	Generation Construction Department
GE	-	General Electric Company
GED	-	General Engineering Department
HJK	-	Henry J. Kaiser Company [formerly Kaiser Engineers Incorporated (KEI)]
IAL	-	Immediate Action Letter
I&C	-	Instrumentation and Control
I&E	-	NRC Inspection Report
IIDR	-	In-Process Inspection Deficiency Report
IR	-	Inspection Report
ISK	-	Isometric Piping Drawing
KEI	-	Kaiser Engineers Incorporated [later Henry J. Kaiser Company (HJK)]
LEAD	-	Licensing and Environmental Affairs Department
LOCA	-	Loss-of-Coolant Accident
MAA	-	Management Assessment Audits
MCAR	-	Management Corrective Action Request
MRB	-	Materials Review Board
MRP	-	Material Requirements Planning
NDE	-	Nondestructive Examination
NED	-	Nuclear Engineering Department
NPD	-	Nuclear Production Department
NPS	-	Nuclear Power Station
NR	-	Nonconformance Report
NRC	-	U.S. Nuclear Regulatory Commission
NSD	-	Nuclear Services Department
NSSS	-	Nuclear Steam Supply System

OPP - Owner's Project Procedures
PMS - Performance Measurement Systems
PO - Purchase Order
PR - Purchase Request
PSAR - Preliminary Safety Analysis Report
QA&S - Quality Assurance and Standards
QA - Quality Assurance
QAD - Quality Assurance Department
QAP - QA Procedure or QA Program
QC - Quality Control
QCP - Quality Confirmation Program
QCPP - Quality Confirmation Program Procedure
QVP - Quality Verification Program
RCI - Reactor Controls, Incorporated
RO - Reactor Operator
RPV - Reactor Pressure Vessel
S&L - Sargent & Lundy Engineers
SAI - Science Applications, Incorporated
S&W - Stone and Webster
SCO - Order to Show Cause [Order Immediately Suspending Construction (to CG&E from NRC), dated November 12, 1982]
SLC - Special Litigation Committee
SRO - Senior Reactor Operator
SWO - Stop Work Order
TPT - Torrey Pines Technology (A Division of GA Technologies Inc.)
WY&B - Wallinger-Young and Bertke
ZOC - Zimmer Oversight Committee
ZNP - Zimmer Nuclear Power (Station)
ZPM - Zimmer Project Manager or Zimmer Project Management
ZPOC - Zimmer Project Oversight Committee

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1. INTRODUCTION

1.1. BACKGROUND

Torrey Pines Technology (TPT), a division of GA Technologies Inc. (GA), was contracted by Cincinnati Gas & Electric Company (CG&E) to perform an independent review of the project management of the William H. Zimmer Nuclear Power Station (Zimmer). This review was required by an order of the U.S. Nuclear Regulatory Commission (NRC) in November 1982, which stopped all safety-related work at Zimmer pending the satisfactory completion of certain specified actions, including this review.

Almost 60 man-months of effort were expended in this review by TPT. Over 3200 documents were reviewed and approximately 100 people were interviewed, some more than once.

Tentative approval of TPT's independence and capability to perform the review was given by the NRC at the conclusion of a public hearing in Cincinnati on March 25, 1983 pending a review of the proposed program plan. The initial draft of the program plan was reviewed by the NRC in a public meeting on April 25. Following this meeting, TPT was authorized to meet with CG&E and its contractors and to perform an initial survey at the Zimmer site. The conduct of this independent review was subject to the rules of the "Protocol Governing Communications Between CG&E and Independent Organizations Conducting Reviews or Audits Under the Commission's Order," as defined in a March 2, 1983 letter to Mr. William H. Dickhoner from Mr. James G. Keppler. The NRC requested another public meeting to review any proposed changes to the program plan as a result of the initial review by TPT, and the comments offered at the April 25 meeting.

After the initial review by TPT during the first week of May, the program plan was revised, with the concurrence of the NRC and CG&E, to place greater emphasis on evaluating CG&E's management of the Zimmer project and less on a detailed review of procedures, specifications, etc. the plan was also revised to include the evaluation of the zimmer project management from its inception to the present. The review was divided into four time periods: (1) project inception to the assumption of construction management responsibility by CG&E in 1976, (2) from 1976 to the Immediate Action Letter (IAL) in April 1981, (3) from the IAL to the Stop Cause Order (SCO) in November 1982, and (4) since the SCO. Finally, a new task was added; namely, the inclusion of four case studies for comparison with the results of the other tasks:

1. CG&E management attitude toward "whistle blowers."
2. Structural steel in the control room.
3. 2400 feet of small bore piping.
4. Welder qualifications.

The revised program plan was approved by the NRC in a public meeting with TPT on May 26, 1983 with a proviso that TPT include an evaluation of the relationship between CG&E and Reactor Controls, Incorporated (RCI).

The majority of the information was gathered in June and in the first part of July 1983.

1.2. OBJECTIVE

The objective of this effort by TPT was to conduct an independent review of the CG&E management of the Zimmer project, including its Quality Assurance (QA) program and Quality Confirmation Program (QCP) to determine the measures needed to ensure that construction of the Zimmer plant can be completed in conformance with the NRC regulations and construction permit.

As required in the SCO this review was to evaluate, at a minimum, the four organizational alternatives identified in the SCO. TPT identified and evaluated ten additional alternative organizations. After completing the investigation and an initial evaluation of CG&E's management of the Zimmer project, including its QA program and QCP, and after having selected a preferred organizational alternative from the list of sixteen alternatives, TPT was given information of tentative organizational plans by Admiral J. Williams (Alternative 11) and was allowed to review a draft report by the Bechtel Power Corporation (Bechtel) on the same subject as this independent review. Bechtel had evaluated one alternative organization (Alternative 12) in addition to the four required by the NRC.

1.3. PROGRAM STRUCTURE

This review program was organized into ten tasks, A through K (not using I), which are described in detail in the program plan and listed below:

Task	Title	Percentage of Effort Expended
Task A	TPT Program Management and Integration	10
Task B	Evaluation of CG&E Project Management Organization	15
Task C	Evaluation of CG&E Management Policies Toward Quality Assurance	10
Task D	Evaluation of CG&E Management of the Quality Assurance Program	12
Task E	Evaluation of CG&E Quality Configuration Program	8
Task F	Evaluation of CG&E Project Management Interfaces with Major Subcontractors	8
Task G	Evaluation of Planned Transition from Plant Construction to Operations	5
Task H	Evaluation of CG&E Management of Zimmer through the Case Study Approach	10
Task J	Evaluation of Alternate Project Management Organizations	12
Task K	Reports and Recommendations	10

Tasks A and K are administrative in nature covering the organization, planning, directing, and documentation of this review project and, as such, are not specifically reported here.

For Tasks B through J, the work typically included a review of reference documents for requirements (10CFR50, Appendix B; ANSI Standard N45.2; the Zimmer PSAR and FSAR; INPO Performance Objectives and Criteria for Construction Project Evaluations and Construction Project Evaluation Methods, etc.); a file search for pertinent documents, document review and evaluation; interviews with current and past Zimmer personnel (both CG&E and contractor employees); interviews with other individuals having information pertinent to this review; and analyses and documentation of the information obtained.

The review program covered the organizational structure, policies and procedures, QA and QCP activities of CG&E [including its interfaces with Sargent and Lundy Engineers (S&L); Henry J. Kaiser Company (HJK); General Electric Company (GE); RCI; and Catalytic, Incorporated (CI)] for the four periods of time, as applicable, listed under Section 1.1.

The program did not include any technical review or evaluation of the adequacy of the Zimmer plant design and construction. No physical inspection of the plant was performed.

1.4. EVALUATION PROCESS

In analyzing the information obtained, each reviewer evaluated what he found at Zimmer in comparison with requirements gleaned from the reference documents, as well as with his own judgment based on education, training and experience. Procedures were written to guide the reviewer in each task and checklists were used as needed, particularly for interviews.

There were no predetermined conclusions or recommendations for any part of this program. Each reviewer was free to perform his task in accordance with the program plan and procedures, subject only to review and comment by the task leaders and the Project Manager.

Individuals assigned to this program were required to file statements of independence, under oath or affirmation, attesting to their freedom from conflict of interest on the Zimmer project with CG&E, Columbus & Southern Ohio Electric Company, Dayton Power & Light, S&L, HJK (formerly Kaiser Engineers, Incorporated), GE, and Bechtel.

The basic approach used in the review was to examine separately key characteristics and aspects of the Zimmer project management, and management of the QA program and the QCP. As a cross-check, selected case studies were examined to assess the collective role and behavior of CG&E management in response to certain specific problems and/or series of events, as identified under Section 1.1 above.

1.5. COMPREHENSIVENESS OF THE REVIEW

It is important to recognize that this review was not performed as a standard management evaluation study using conventional techniques and procedures. Because of public influence, and the allegations concerning the Zimmer project, the normal give-and-take found in a consultant/client relationship in a study of this type was not permitted as outlined in NRC protocol referenced earlier. Consequently, some pieces of information may have been misunderstood or misinterpreted.

In addition, due to the broad scope of the review and the relatively short period of time available in which to perform the evaluation, it was impossible for TPT to examine each document generated at Zimmer during its thirteen year history, and to interview every individual knowledgeable of Zimmer project management activities. Therefore, some important documents may not have been examined, and some individuals not interviewed.

TPT did not attempt to address any of the issues raised in the various legal suits involving the Zimmer plant and the parties involved therein. No opinion on the validity, or otherwise, of the claims in such suits should be drawn or inferred from statements in the TPT report.

Information received, in whatever form, was taken in good faith by TPT. TPT personnel involved in the research in support of the study were not expert in investigative techniques that might be used in cases of purposeful deception. Although TPT had no right of discovery in the legal sense, all records and files requested by TPT were made readily available. TPT personnel did not uncover anything that might lend credence to the possible suspicion that they were being provided with incorrect information or were intentionally deceived.

Therefore, it is the opinion of TPT that the information gathered is representative, on the whole, of the conditions that have existed at the Zimmer Nuclear Power Station (NPS) and that any deficiency of information does not significantly affect the conclusions drawn or the recommendations made.

1.6. ZIMMER HISTORY

For the convenience of the reader, a brief history of significant events at the Zimmer NPS is presented in Table 1-1. The major contractors are Sargent and Lundy Engineers (S&L) for architect/engineering; Henry J. Kaiser Company (HJK) for construction; and General Electric Company (GE) as NSSS vendor. Additional contractors for particular on site work are Catalytic, Incorporated (CI), a constructor; and Reactor Controls, Incorporated (RCI), an engineer/constructor.

TABLE 1-1
HISTORY OF ZIMMER NUCLEAR POWER STATION

Time	Event
January 1968	S&L contract signed to be Zimmer A&E.
February 1969	Based on "Economic Evaluations of Alternatives," S&L recommended a GE boiling water reactor NSSS be build on existing CG&E property in Moscow, Ohio.
August 1969	A GE BWR contracted.
September 1969	Project announced.
April 1970	PSAR filed.
September 1970	Kaiser Engineers, Inc. contracted as constructor.
January 1971	Environmental Report filed.
June 1971	Calvert Cliffs decision (15-month Project delay).
October 1972	Construction permit received from NRC.
Winter 1973	Backfill compacted around the circulating water pipes and the primary containment tendon tunnel in preparation for the building slabs.
February 1973	First Class 1 concrete placement made.
April 1973	Main buildings all laid out and many subfloor pipes installed.
September 1973	Reactor building base slab completed.
October 1973	Reactor Pressure Vessel arrived on site.
December 1973	Four large rad waste tanks set in place.
January 1974	Work began on reactor pedestal.
February 1974	Project estimated to be 13% complete.
April 1974	Service Water Pumphouse started.
May 1974	Base slab for the circulating water structure completed.
June 1974	Work stop due to concrete truckers strike.
August 1974	Strike ended and work resumed.
December 1974	Project estimated to 21% complete.

TABLE 1-1 (Continued)

Time	Event
April 1975	NRC issued standard letter - concerning suppression pool dynamic loads under postulated LOCA conditions.
May 1975	MARK II Owners Group formed.
May 1975	Submitted Application for Operating License.
July 1975	Reactor sacrificial shield fabrication started.
December 1975	Reactor Pressure Vessel set in place.
May 1976	Project estimated to be 50% complete.
June 1976	CG&E takes over construction management.
December 1976	97% of concrete placed, including all of the cooling tower concrete.
July 1978	Reactor Vessel Hydro test completed.
October 1978	NRC issued new containment acceptance criteria.
November 1978	Reactor Pressure Vessel internals installation began.
December 1978	Core Standby Cooling System functional testing started.
January 1979	Final Safety Evaluation Report issued by NRC.
March 1979	Three Mile Island event occurs.
August 1979	Nuclear fuel received from GE and placed in dry storage in the spent fuel pool.
January 1981	NRC initiates extensive investigation at Zimmer.
April 1981	NRC issues Immediate Action Letter.
November 1982	NRC issues Show Cause Order; all safety-related constructions stopped.

1.7. ZIMMER COST AND SCHEDULE

As of November 1982, the date of the NRC's SCO, the Zimmer plant construction was estimated to be 97% complete. As indicated in Table 1-2, as of that date the Zimmer plant compared very favorably, in terms of cost and schedule, with contemporary nuclear plants of the same type.

TABLE 1-2

COMPARISON OF COST AND SCHEDULE FOR CONTEMPORARY BWR POWER PLANTS

Plant/Utility	Net MWE	AE	Constructor	Into Comml Ops. Orig. Sched.	Into Comml Ops. Actual or Expected	% Compl @ 12/31/82	Total Cost $M Orig. Est.	Total Cost $M Actual @ 12/31/82	$/kwe
Fermi 2/Detroit Ediso	1100	Utility	Daniel	1/74	11/83	92	221	2350	2150
Hope Creek 1/Public Service Electric & Ga	1170	BPC	BPC	3/75	12/86	50	NA	3795	3556
LaSalle 1/Commonwealt Edison	1078	S&L	Utility	10/75	10/82	100	360	1367	1268
LaSalle 2/Commonwealt Edison	1078	S&L	Utility	10/76	10/83	92	300	1018	944
Limerick 1/Philadelph a Electric	1055	BPC	BPC	8/78	4/85	80	1000	2350	2227
Nine Mile Point 2/Niagara Mohawk Power	1099	S&W	S&W	7/78	10/86	57	370	4174	3798
Perry 1/Cleveland Electric	1205	Gilbert	Utility	7/79	5/84	88	75	1983	1645
Shoreham/Long Island Lighting	820	S&W	Utility	1/75	9/83	96	506	3000	3658
Susquehanna/Pennsylvania Power & Light	1050	BPC	BPC	5/79	5/83	98	NA	2252	2145
WNP-2/Washington Public Power Supply	1100	B&R	BPC	9/77	2/84	93	398	2964	2694
W. H. Zimmer 1/ Cincinnati Gas & Electric	810	S&L	HJK	1/76	NA	97	410	1027	1267

2. TASK B - EVALUATION OF CG&E PROJECT MANAGEMENT ORGANIZATION

2.1. OBJECTIVE AND SCOPE

The objective of Task B was to evaluate the CG&E Zimmer project management organization to determine whether deficiencies have existed in its structure, staffing, policies, and/or procedures that have kept the project from meeting the high standards required for nuclear power plant design, procurement, and construction.

The scope of Task B included the following review subtasks:

1. Evaluate the project management organizational characteristics; i.e., visibility, staffing adequacy and qualifications, clarity of position descriptions, interorganizational relationships, scope, communications, document control, performance measurement systems, and informal organizational structure. (B2)*

2. Determine if CG&E project policies clearly and adequately defined project management responsibilities and authority for all activities on the Zimmer project. (B3)

3. Evaluate the CG&E project management system to determine if procedures are available which clearly define how policies and responsibilities are to be implemented. (B4)

4. Evaluate CG&E project management systems and procedures to determine if they adequately and effectively control all interfaces between internal organizations. (B5)

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*Corresponds to the review subtasks in the Program Plan.

2.2. INVESTIGATION

Information obtained through interviews of CG&E and contractor personnel involved with Zimmer, and from a review of the documents found in CG&E and contractor files, was analyzed and evaluated in relation to the following characteristics which would be expected to be found in a well-managed nuclear power plant project:

1. A reasonable, well-defined set of objectives and requirements.

2. Work broken down into manageable tasks.

3. An overall plan or integrated set of plans for the achievement of project objectives and requirements.

4. A reasonable, accurate estimate of the resources required to perform the planned effort, followed by the allocation of those resources to the tasks that make up the project.

5. Assignment of responsibility for the performance of the work and control of the resources required to perform the work.

6. Financial accountability for all resources used.

7. Measurement of work performance, including quality and resource usage against plan.

8. Ability to identify significant deviations from plans and to determine the overall effect on the project.

9. Control of changes to plans to maintain consistency with objectives and resources and to coordinate related elements of the project work.

10. Timely feedback of the information necessary to take prompt action to avoid or minimize cost increases and/or schedule delays.

11. Receipt of the information necessary to determine and justify any additional resource requirements well in advance of actual need.

2.3. SUMMARY OF OBSERVATIONS

A summary of the observations based on information gathered and evaluated in Task B is presented by subtask:

2.3.1. Evaluation of Project Management Organizational Characteristics (B2)

The following topics were examined as part of this subtask:

1. Management Visibility
2. Staffing Adequacy
3. Staff Qualifications
4. Position Descriptions
5. Interorganizational Relationships
6. Scope of Responsibilities
7. Communications
8. Document Control
9. Performance Measurement Systems
10. Informal Organization Structures.

2.3.1.1. Management Visibility. CG&E established an Owners Project Procedures (OPP) Manual for the Zimmer project in 1972, which was essentially a modified version of a document originally prepared for the Beckjord (fossil) Power Plant. This manual delineated the project organization, including reporting lines within CG&E and for the major subcontractors (HJK, S&L, GE); defined the responsibilities and authority of the various positions; and named the personnel that would act in those positions. The

General Engineering Department (GED) Manager was assigned full responsibility for the Zimmer project. However, CG&E did not establish an internal organization solely dedicated to the design and construction of this plant. In fact, all of the key CG&E managers had significant responsibilities other than the Zimmer project.

Numerous changes in organizational structure and incumbents have occurred during the life of the project.

A history of the Zimmer project management staff is shown in Table 2-1. Figures 2-1 through 2-4 show the organization as it was in 1972, 1977, 1981, and 1982, respectively. In 1977, a major change in the organization came about when the CG&E Senior Field Engineer, who was previously shown communicating with (but not organizationally responsible to) the HJK Project Manager, became the CG&E Principal Construction Engineer (Project Manager), and the HJK Project Manager then reported to him. The CG&E Principal Construction Engineer also had the title of Project Manager. His responsibilities were limited to all field work, as defined in the November 1977 OPP. In 1981, the CG&E position of Vice President, Nuclear Operations was created with four department managers (including QA) reporting to that position. The position of Vice President, Nuclear Operations was filled in September 1981 by a new hire who had considerable prior nuclear experience. In 1982, the number of organizations reporting to the Vice President of Nuclear Operations was expanded from four to six and the Manager of QA returned to reporting to the Senior Vice President (now also titled Project Manager). These changes altered the management level to which the QA function reported, and this improved the visibility to CG&E management of QA in the construction area. This subject is discussed further in Task C, Section 3.

CG&E's initial company policy for the construction of the Zimmer project was to employ reputable contractors; delegate full responsibility to design, construct, inspect, and test the facility; and hold the contractors

TABLE 2-1
HISTORY OF ZIMMER PROJECT MANAGEMENT

Date	President	Vice President	Construction Manager	QA Manager	No. of CG&E Construction Personnel*	No. of CG&E QA Personnel*
9/69	W. H. Zimmer	B. J. Yeager	—	—	—	—
9/70	B. J. Yeager	W. H. Dickhoner	—	—	—	—
9/72	B. J. Yeager	W. H. Dickhoner	W. B. Murray	E. C. Pandorf	5	5
9/72	W. H. Dickhoner	E. A. Borgmann	W. B. Murray	E. C. Pandorf	5	5
7/75	W. H. Dickhoner	E. A. Borgmann	W. Schwiers	E. C. Pandorf	5	5
6/76	W. H. Dickhoner	E. A. Borgmann	H. Gear	E. C. Pandorf	7	5
9/76	W. H. Dickhoner	E. A. Borgmann	H. Gear	W. Schwiers	7	5
4/77	W. H. Dickhoner	E. A. Borgmann	B. K. Culver	W. Schwiers	20	5
7/80	W. H. Dickhoner	E. A. Borgmann	S. Swain	W. Schwiers	38	7
6/81	W. H. Dickhoner	E. A. Borgmann**	S. Swain	H. R. Sager	59	15
11/81	W. H. Dickhoner	E. A. Borgmann	B. K. Culver	H. R. Sager	68	163
At 12/82	W. H. Dickhoner	E. A. Borgmann	B. K. Culver	H. R. Sager	93	188

*Includes technical, clerical, and contract personnel.
**R. Sylvia was a Vice President, Nuclear Operation reporting to E. A. Borgmann from 8/81 to 1/83.

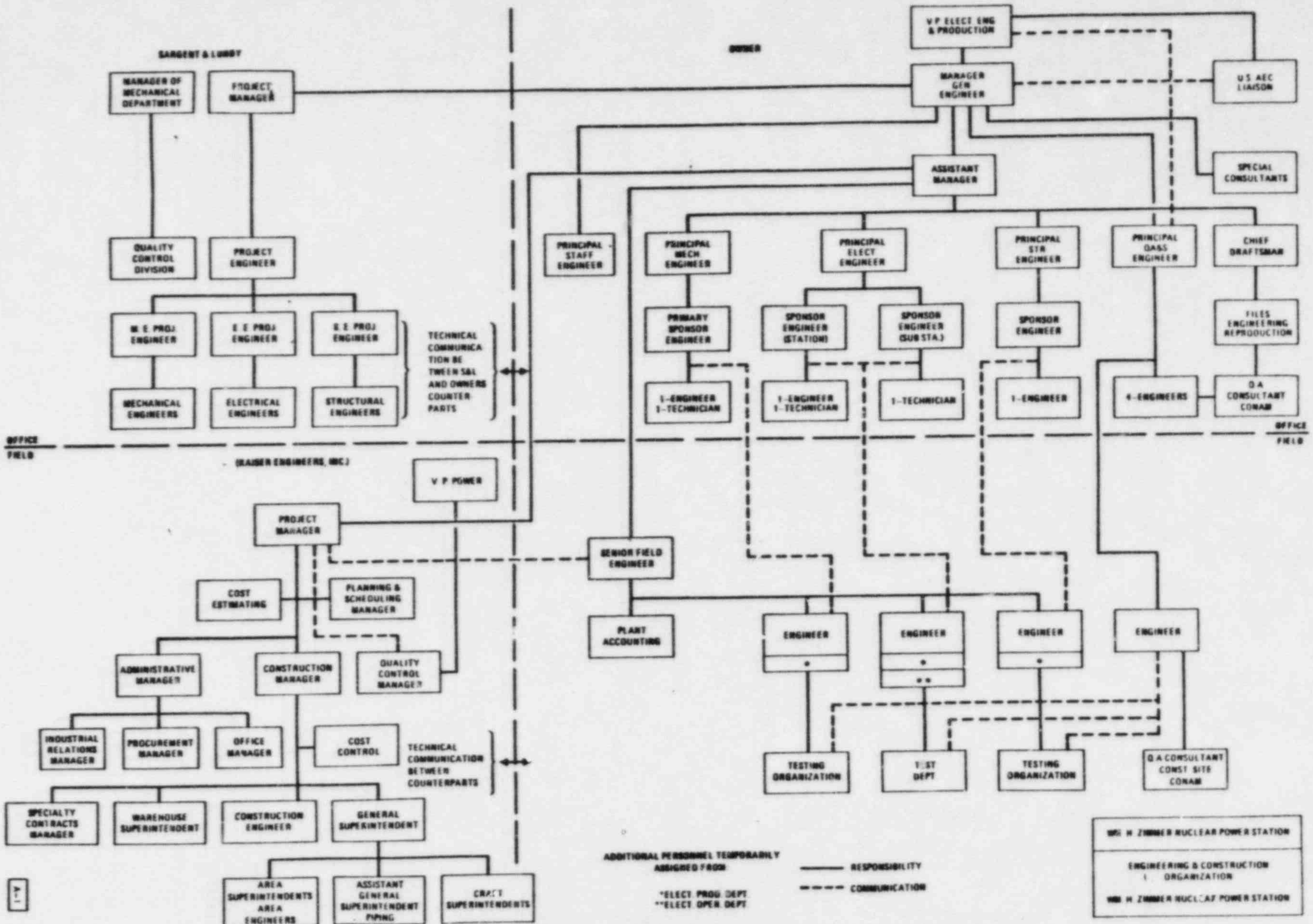

Fig. 2-1. Zimmer engineering and construction organization - 1972

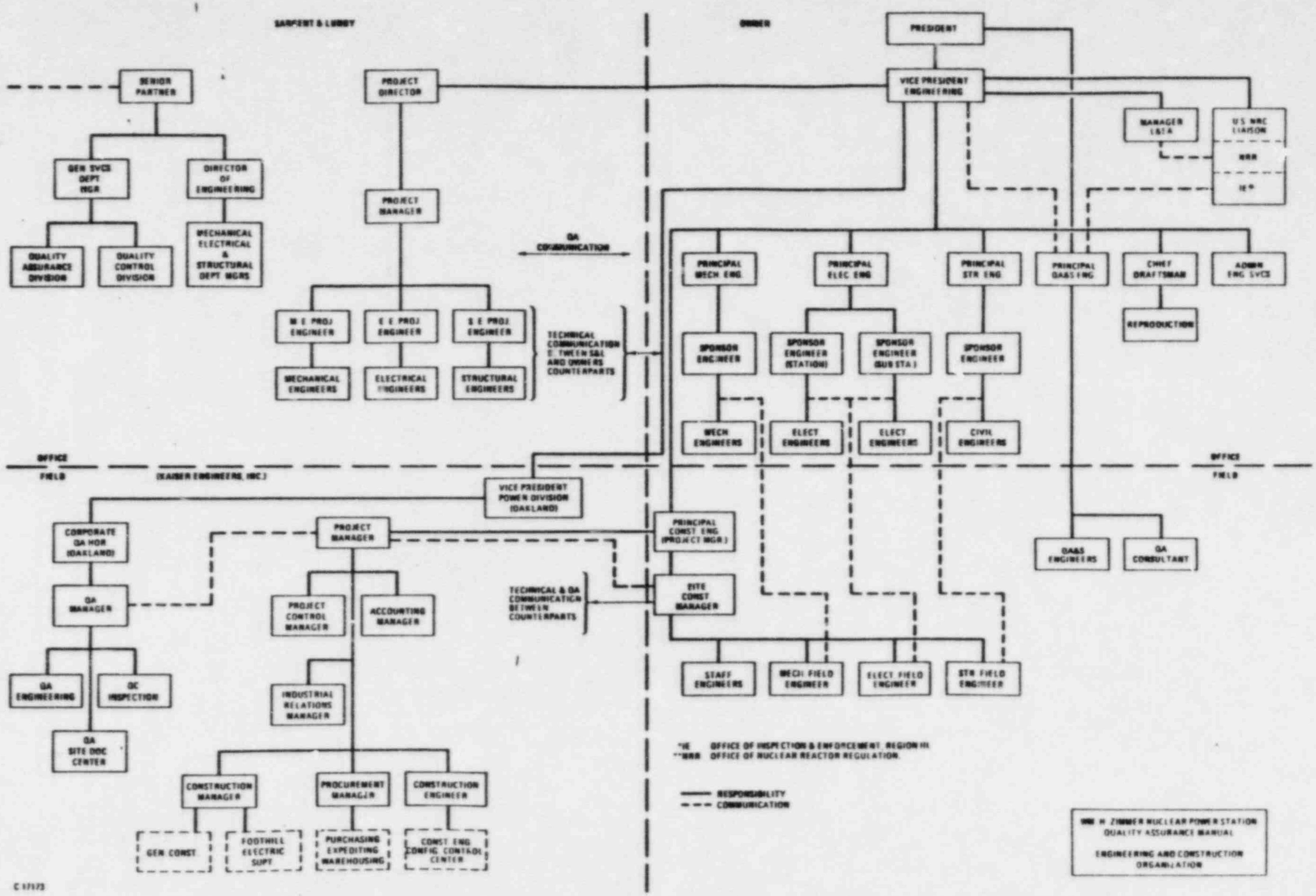

Fig. 2-2. Zimmer engineering and construction organization - 1977

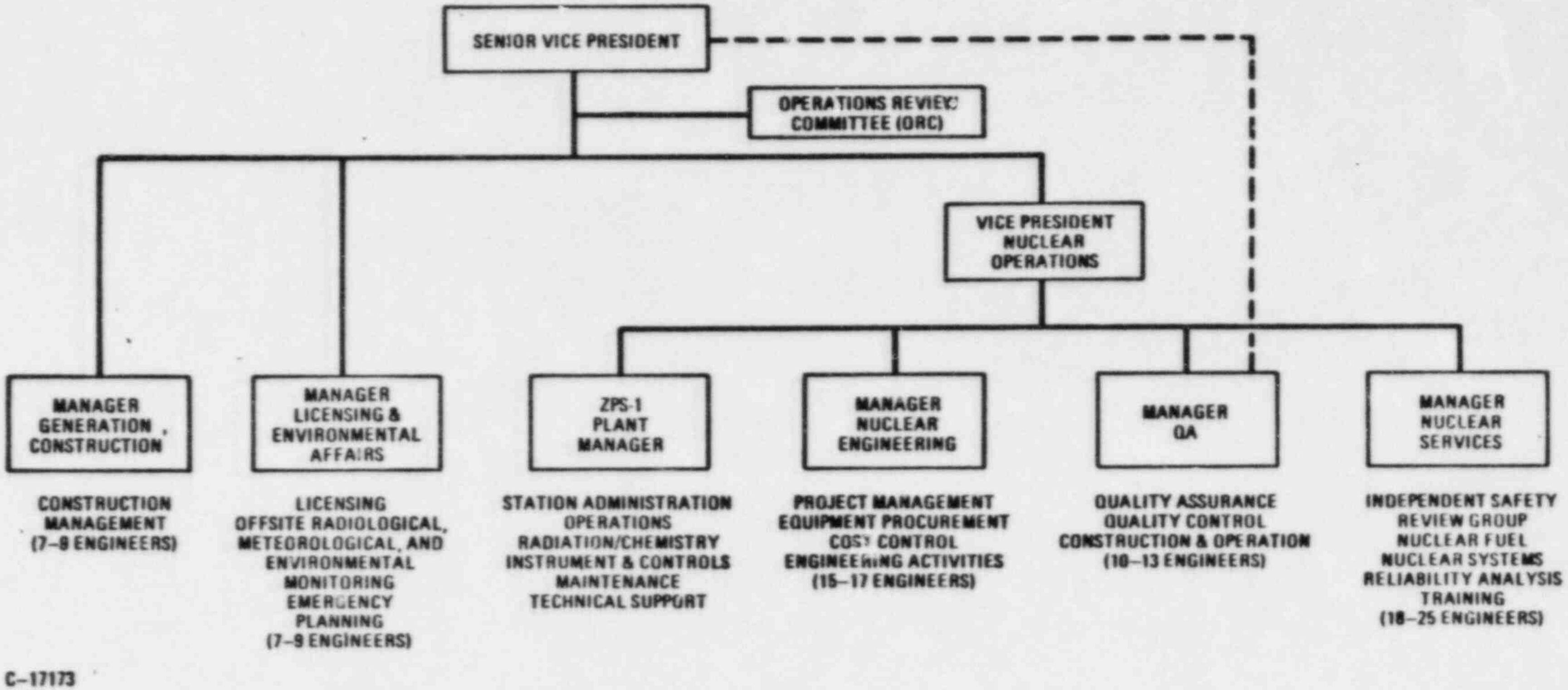

Fig. 2-3. CC&E organizational chart - 1981

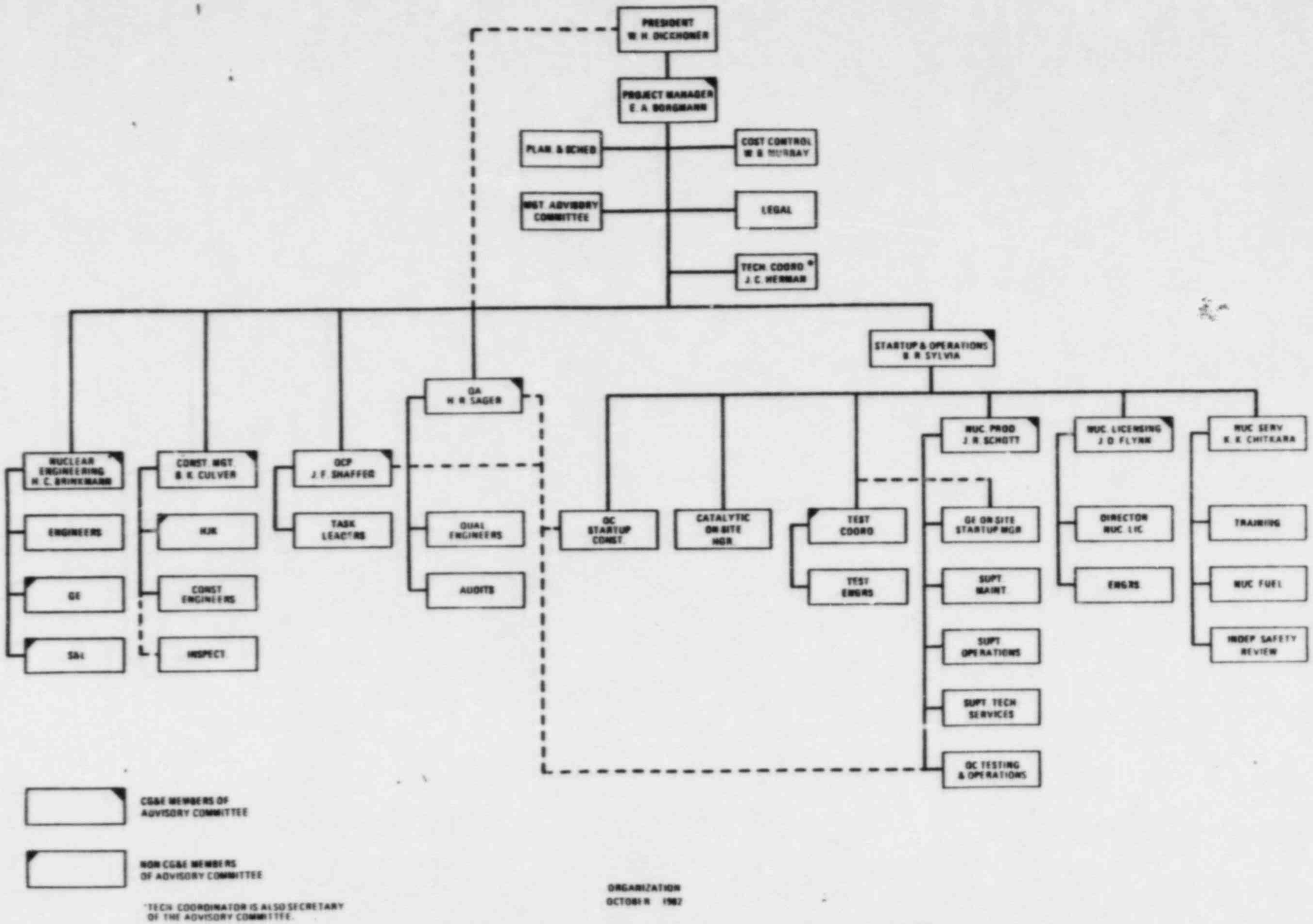

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Fig. 2-4. Zimmer organizational chart - 1982 accountable for furnishing an acceptable facility. This method of utilizing contractors to engineer and construct major facilities is consistant with the way most utilities have built nuclear power plants. However, in the case of CG&E, they did not have an adequately experienced staff nor an adequately comprehensive, integrated management system (planning, scheduling, cost control, document control, etc.) to monitor and control the work of the contractors. These deficiencies severely limited the visibility of the Zimmer project to the President of CG&E.

Contemporary utility companies constructing nuclear power plants employ staffs significantly larger than the staff CG&E utilized prior to the IAL (April 1981). Also, these utilities do not delegate responsibilities to contractors without specifying extensive requirements for the contractor's project performance measurement and reporting system criteria.

2.3.1.2. Staffing Adequacy. CG&E initially had only one or two people at the construction site. The site QA and project engineering function remained at this low level until September 1976.

The Mechanical Sponsor* Engineer had a staff of four engineers in 1975. In 1979, the staff was increased to six. This group became the Nuclear Engineering Department (NED) in 1980. This group was heavily involved in the Mark II containment redesign effort that, as noted in Section 6, was crucial in the design and construction of the Zimmer Plant. Unfortunately, the size of the staff was so small that proper concentration on this priority issue limited their ability to perform normal project duties, which were to procure mechanical equipment and to oversee and review S&L design work.

Contractually, CG&E had the authority to approve all staff additions proposed by HJK. Documents reviewed and interviews revealed that, in many instances, HJK requests for additional staff were either refused or the

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*The title "Sponsor" was used by CG&E to identify the Senior individual responsible for a particular discipline; e.g., Mechanical Engineering Department.

additional number requested was revised downward. This impacted the ability of the subcontractor to perform his work. In limited instances, CG&E also directed HJK to reduce the number of craft labor personnel on site.

The project had one CG&E Licensing Engineer from 1973 through 1979. This position was held by the same person for the entire period. He managed the licensing function by drawing on the talents of the other departments and contractors (i.e., S&L) in order to accomplish each licensing task that arose. The Licensing Engineer also had other assignments. For example, from 1970 through 1978 he spends about 25% of his time on other projects and, as of June 1983, he spents about 33% of his time on other projects. In January 1977, this function was retitled the Licensing and Environmental Affairs Department (LEAD) which consisted of a Licensing Section and an Environmental Section, each headed by a Principal Engineer.

Since receipt of the IAL in April 1981, CG&E has revised their hiring policy and has permitted their managers to significantly increase their permanent staffs and utilize temporary help, as required. All CG&E managers interviewed indicated that, in their opinion, they now have (or have approval for) sufficient personnel (including significant numbers of temporary people) to perform the necessary duties. A portion of the added staff is temporary help in order to obtain qualified people in a timely manner.

2.3.1.3. <u>Staff Qualifications</u>. An outline of the qualifications of the managers in the project organizations was obtained by interviews and from resumes provided by CG&E. This information revealed a general lack of prior experience in nuclear power plant design, construction, and operation. CG&E hired their engineering staff primarily out of local colleges, upon graduation. CG&E had a good training program to provide these graduates with exposure to the various functions within CG&E before placing them in a permanent assignment but no nuclear or corporate QA organizations to which graduates could be sent. The engineering disciplines are largely involved in the design of small, in-house projects or in monitoring the design of major facilities. Their duties included processing purchase orders, reviewing bids, ordering material, and preparing cash flow projections for the construction of fossil plants and gas distribution systems. As the staff matured and progressed through the organization they became proficient in the CG&E way of conducting business, which involved primarily project monitoring and procurement engineering support activities.

Interviews also revealed that when the QA and Construction Departments needed to augment their staff, additional personnel were provided from the GED. The General Engineering Department appears to function as a resource pool from which other departments can draw. For example, the following key managers were all originally members of GED:

1. E. A. Borgmann, Senior Vice President in charge of Zimmer until April 1983.

2. H. Brinkmann, Manager, Nuclear Engineering Department (NED) (1981-Present).

3. B. Culver, Manager, General Construction Department (GCD) (1977-Present).

4. E. C. Pandorf, Principal Quality Assurance and Standards (QA&S) Engineer (1970-76).

5. J. Schott, Manager, Nuclear Production Department (NPD) (1981-Present).

6. W. Schweirs, Manager, QA (1977-81).

This method of staffing filled positions with personnel who were usually good performers, adequately trained, well-versed in company policies, and potentially good managers. Unfortunately, due to the absence of nuclear programs at CG&E, these same personnel frequently lacked the needed or required experience, particularly for a major nuclear plant. No training programs in the nuclear field were generally available. The NPD is an exception in that it has taken proper action to expand the capabilities and skills of its staff by sending personnel to other nuclear plant sites (e.g., Peach Bottom, La Salle, Hatch) to receive training and experience in preparation for start-up testing and operation of the Zimmer plant.

2.3.1.4. Position Descriptions. Position descriptions for key CG&E management positions in the project organization were reviewed. Responsibilities, authority, and accountability are clearly defined. The descriptions reviewed were published in the Preliminary Safety Analysis Report (PSAR) in 1970, revised in the Final Safety Analysis Report (FSAR) in 1975, and again revised after the 1976 project reorganization when CG&E took over responsibility for construction management. Similar descriptions were published in the OPP Manual in 1972.

The published position descriptions defined the management positions of department manager and above. In addition, the duties of the Principal Engineer, Primary Sponsor Engineer, and Sponsor Engineer were also specified. Since receipt of the IAL in April 1981, CG&E has initiated a task to rewrite their existing position descriptions and to expand the scope of these descriptions to include descriptions for the majority of those personnel assigned to the Zimmer project.

2.3.1.5. Interorganizational Relationships. The lines of accountability that were originally defined in the OPP, and the organization charts published in the PSAR, appeared to have ensured a proper relationship between the various functions within CG&E. Initially, the project was essentially a suborganization within the GED. Working relationships appeared adequate because all functions were located at the CG&E main offices and the project staff was small.

As the project proceeded and staff and functions gradually moved to the site in 1975 to 1976, relationships became dependent on the individual manager's direction and approach to interacting with his peers. The project lacked comprehensive working-level procedures to assure coordination and consistency. When CG&E took responsibility for all construction in 1976, they established the Generation Construction Department (GCD) at the site to manage the effort of the major subcontractors. Engineering remained located at the main office. GCD appears to have become the dominant organization in the project because of its responsibility to manage HJK's site activites.

Interview comments indicated long-standing friction between the NPD and GCD, caused by the fact that construction priorities assigned to punchlist items were not necessarily in agreement with the priorities required for preoperational and start-up testing. There was also friction between the NED and the GCD due to design changes made by S&L and GCD, and implemented by GCD without informing NED or obtaining review and concurrence. In addition to the fact that NED was not given the opportunity to review these changes, they also had to work with engineering documentation that did not reflect the actual design that was installed. This situation apparently evolved as a result of organizational confusion over who was, in fact, the "acting" project manager. In the November 1, 1977 and January 30, 1978 revisions to the OPP, the Principal Construction Engineer was also designated as the Project Manager (see Fig. 2-2). However, these same documents show all functions except construction reporting to the CG&E Vice President of Engineering. Sargent and Lundy Engineers also reported to this Vice President. As a result, there seemed to be confusion as to the responsibilities and authority of the Principal Construction Engineer (a position later titled Generation Construction Department Manager) relative to S&L.

The departments tended to function autonomously at the site. This situation was exacerbated by having the Vice President of Engineering Services and Electrical Production located at CG&E's main office and the department managers, who reported to him, located at the construction site about 30 miles away. The day-to-day awareness of managing and coordinating the project, assigning priorities, resolving conflicts, and sensing and solving problems between departments was impaired. The problem did not seem to improve as a result of the 1981 reorganization. In 1981, the position of Vice President, Operations was created with three departments [the Nuclear Services Department (NSD), NED, and QA] reporting to this position. The Generation Construction Department and the LEAD continued to report to the Vice President, Engineering Services as did the newly-created Vice President, Nuclear Services. Although the Vice President, Nuclear Services was located at the site, the focal point of the five major departments remained in CG&E's main office.

2.3.1.6. Scope of Responsibilities. Some of the key managers and one department within the CG&E project organization had duties and responsibilities in additional to the Zimmer project, as indicated below:

1. The Vice President, Engineering Services and Electricity Generation has been, and remained (until April 1983), responsible for other projects in addition to Zimmer.

2. The GCD Manager has, at various times, been responsible for fossil plant construction at Miami Fort and East Bend as well as at Zimmer. In 1976 and early 1977, he spent approximately 50% of his time on fossil plants. The latter half of 1977 was spent approximately 75% on Zimmer and 25% on fossil plants. During 1980 through 1981, he spent approximately 25% of his time on Zimmer and 75% on fossil plants but had delegated site construction management to another individual.

3. The LEAD is not dedicated exclusively to the Zimmer project, but represents all projects within CG&E in communicating with the various local, state, and federal regulatory agencies in addition to handling licensing activities for Zimmer. As previously

stated, until recently there was only one Licensing Engineer working on the Zimmer project.

2.3.1.7. Communications. Communications between the major contractors and CG&E management should have been adequate if the OPP had been followed. Minutes of the monthly status and construction meetings were generally taken and distributed in accordance with the OPP. The OPP published in 1972 prescribed in complete detail how to plan for meetings, the documentation (minutes) required, and those who should be included on the distribution list for the minutes. The OPP (August 1972) prescribed the conduct of: (1) S&L Monthly Engineering Meetings, (2) HJK Monthly Construction Coordinating Meetings, (3) HJK weekly field construction meetings, and (4) the distribution of the minutes of all the meetings. Comparable procedures are contained in the latest issue of the OPP.

The OPP does not, however, provide direction for internal communications within CG&E, including the conduct of meetings or the providing of status reports. Such provisions were possibly unnecessary during the early construction phase when staffs were small, CG&E involvement was minimal, and all departments were in the downtown offices.

Although the OPP does not require it, departments provide monthly status reports, employ the "Interdepartment Correspondence" form for internally typed correspondence, and use the handwritten "Speedy Memo" to document other internal communications. Formal letters are used to communicate contractural matters to the contractors. Other than the correspondence to the contractors, the bulk of internal written communication is not retained in a central records management file. Although the typed internal correspondence is nominally logged and controlled by the originating department's secretary, it is subject to the high risks of actual or effective loss resulting from the lack of records management, particularly for long-term retention. Such retrieval has already proven a problem for Zimmer. Typically, the "Speedy Memo," was not permanently retained.

The lack of adequate project procedures for an overall information system including centralized planning and scheduling, cost control and variance analysis, document control, licensing commitment tracking, etc. created a situation of nonstructured communication within the project unless a problem occurred. Executive summaries provided to management did not appear to adequately summarize problems, their analysis, and the corrective action status.

2.3.1.8. Document Control. The review of the CG&E document control function determined that there is not a centralized project document system. Each department has its own system for generating, issuing, and controlling documents. The responsibility for managing the project design and construction documents was assigned to HJK in the initial contract. In April 1981, CG&E (GCD) took over the responsibility for managing the construction documents from HJK. There are nine individual document centers (not counting the CG&E warehouse where many records are currently stored) within the various project organizations (CG&E and contractors) with no central repository for all project documents. A list of these centers is as follows:

1. CG&E General File, Downtown Office
2. CG&E QAD File, Construction Building
3. CG&E GCD File, Construction Building
4. CG&E Document Control, Service Building
5. CG&E Vault, Construction Records, Construction Building
6. CG&E Site Document Control Center, Construction Building
7. HJK QA File, Construction Building
8. HJK Construction, Construction Building
9. CG&E Project Controls Group (Cost and Budget Information), Construction Building.

2.3.1.9. Performance Measurement System. The evaluation of the CG&E performance measurement system is discussed in Section 2.3.4.

2.3.1.10. Informal Organization Structures. Observations and interviews regarding the day-to-day operation and interfaces between the various organizations indicates they sometimes did not function according to the structure depicted on the organization charts. The following are instances of these exceptions:

1. Due to the autonomy of each department, and (as previously discussed) the fact that the Vice President, Engineering Services was located at the CG&E main offices, an informal organization functioned at the site. The GCD became the focal point and lead regarding site operations, acting as the "project manager" in a broader sense than that depicted on the organization charts.

2. The contractors (HJK and S&L) did not always report to CG&E as shown on the organization charts. Interviews identified numerous occasions when the proper CG&E organization was bypassed, with the contractors going directly to the Vice President, Engineering Services for resolution of a problem. These actions resulted in a breakdown of CG&E's formal organization structure.

2.3.2. Determination if CG&E Project Policies Clearly and Adequately Defined Project Management Responsibilities and Authority (B3)

The CG&E OPP for the Zimmer project clearly defined some of the responsibilities and authorities of the CG&E project functions as well as those of the contractors (the CG&E quality policy however, as discussed in Tasks C and D, did not appear to be adequately defined). These responsibilities and authorities were published in the March 1972 and November 1977 issues of the OPP and are paraphased below by issue date.

2.3.2.1. March 8, 1972 OPP Responsibilities and Authorities.

1. The Zimmer project is under the direct supervision of the Chief Engineer and the Manager of the GED, who have overall responsibility for engineering, construction, and quality assurance.

2. The Assistant Manager of GED will be the Assistant Manager for this project. He will exercise line authority over the Owner's office and field engineering forces (with the exception of the Principal Staff Engineer and QA&S personnel), and in acting as the principal contact with the Kaiser Engineers, Incorporated (KEI) Project Manager.

3. The CG&E QA&S Section has been assigned sufficient authority and organizational freedom to identify quality problems; to initiate, recommend, or provide solutions; and to verify implementation of solutions.

4. The Owner's Acting Primary Sponsor Engineer, will have a general coordinating role with engineering and administrative personnel who have office engineering assignments on the project (with the exception of those responsible for elements of QA and the staff engineers).

5. Matters of an engineering design nature concerning fabricators, manufacturers, contractors, consultants, governmental agencies, KEI, or S&L shall be handled through the Owner's Sponsor Engineers, who will be responsible for making the necessary decisions or contacts to clarify the condition in question.

2.3.2.2. November 1977 OPP Responsibilities and Authorities.

1. This project is under the direct supervision of the Vice President, Engineering who has the overall responsibility for engineering, construction, and quality assurance. Licensing is under the direct supervision of the Manager of Licensing and Environmental Affairs.

   The CG&E QA&S Section, under the supervision of the Principal QA&S Engineer, has been assigned sufficient authority and organizational freedom to identify quality problems; to initiate, recommend, or provide solutions; and to verify the implementation of solutions.

2. Matters of an engineering design nature concerning fabricators, manufacturers, contractors, governmental agencies, KEI, or S&L shall be handled through, or with the knowledge of the Owner's Sponsor Engineers, who will be responsible for making the necessary decisions or contacts to clarify the condition in question. The Mechanical Sponsor Engineer is designated as the primary sponsor and is responsible for cash forecasts, work order estimates, and similar responsibilities which require interface between engineering disciplines.

Contractor procedures for implementing these responsibilities are beyond the scope of this task and are reported under Task F, Section 6.

The OPP manual was revised periodically and reissued according to a defined distribution list. Interview comments from some of the department managers indicated that they were aware of the OPP manual although it was not readily available nor was it used as a working document.

2.3.3. Evaluate CG&E Project Management System to Determine if Procedures Are Available Which Clearly Define How Policies and Responsibilities Are To Be Implemented (B4)

From the beginning of the project in 1970 to the receipt of the IAL (April 1981), CG&E did not have a centralized system for the control, preparation, and revision of project procedures. Few procedures were prepared specific to the Zimmer project that defined and implemented the CG&E policies in the OPP applicable to the project. Interviews confirmed that few procedures existed. Procedures that were in effect in CG&E were prepared by individual departments and were generally narrow in scope. They did not appear to contain the breadth and detail required to clearly implement policy for the entire project. In instances they were vague and subject to interpretation by the user, leading to nonuniform application of the requirements. This was considered adequate by CG&E based on their approach to fossil projects where they assigned small staffs, delegated the bulk of the work to contractors, and took on a minimal monitor/overview posture.

Since 1981, CG&E has assigned additional manpower to the preparation of project related procedures and a considerable amount of work has been done. However, this new, increased effort is still being performed by individual departments without a central organization to monitor and control the effort in order to ensure consistency, completeness, and avoidance of duplication. A review of new procedures prepared to date indicates that a significant amount of work remains to be done. For this reason, it was not possible to conduct an in-depth evaluation of the implementation of the new procedures.

In addition to the above procedural problems, the present CG&E system does not have procedures that adequately address the functions below that are considered essential in the management of the construction and operation of a nuclear power plant. However, these functions were performed to some extent, as noted:

1. Centralized, Integrated Project Planning and Scheduling. Prior to the SCO, S&L did the planning and scheduling for the construction with HJK and others providing input to S&L. S&L used OPTIMA, a computerized critical path method (CPM) of planning and scheduling. The program identified a critical path for the completion of construction, but did not adequately include the preoperational and start-up testing, licensing, engineering, or QA activities. The project staff do not appear to be using these planning tools in their day-to-day activities.

   Since the SCO, CG&E has purchased the PREMIS code for planning and scheduling. This new tool is not yet being used to develop an integrated project schedule. The construction group is still relying on the S&L OPTIMA. The NPD is using PREMIS for preoperational and start-up tests planning and scheduling. Each code creates its own data base, but they are not integrated.

2. Budgeting and Cost Control. Existing CG&E cost reports consist of listings of estimated cost at completion [budgeted cost or purchase order (PO) cost estimate] versus actual costs from inception-to-date, indicating expenditures for the current month. Samples from the two CG&E cost reports, titled Project Cost Report and Construction Item Cost Report, are shown in Figs. 2-5 and 2-6, respectively. TPT observed the following deficiencies in these reports:

   (a) Estimated costs are not time-phased in accordance with an overall project schedule.

   (b) No trend analysis of estimated versus actual costs.

WM. H. ZIMMER NUCLEAR POWER STATION
BUDGET NO. __________
PROJECT COST REPORT FOR MONTH OF________________

PAGE NO.

CONTRACTOR – VENDOR	PO OR ITEM	DESCRIPTION	BUDGET AMOUNT	PCT PO	PURCHASE ORDER AMOUNT	CURRENT MONTH AMOUNT	LAST CHARGE	TO DATE AMOUNT

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Fig. 2-5. Project cost report

ITEM	DESCRIPTION	ESTIMATED AMOUNT	CHARGES		VARIANCE FROM ESTIMATED AMOUNT
			CURRENT	TO DATE	

CONSTRUCTION ITEM COST REPORT

PERIOD ENDING PAGE

C-17173

Fig. 2-6. Construction item cost report

(c) No variance analysis which identifies the causes of significant cost variances or the corrective action to be taken.

(d) Estimated and actual cost data are not sorted by CG&E departmental responsibility. This makes control of costs at the department level very difficult.

NOTE: HJK does provide reports that partially fulfill these needs in their area.

3. Configuration Management. S&L has performed configuration management for the Zimmer project since its inception. S&L forwards revised engineering documents to GCD which maintains the project files of current engineering documents. Control of design changes in various phases of Zimmer project activities are implemented by CG&E. The procedures for design change control are documented in OPP procedures "Engineering Change Requests" (ECR) and "Design Document Change" (DDC).

These documents are defined in the current OPPs as follows:

Design Document Change (DDC): A form utilized to identify and authorize recommended changes to the existing design documents applicable to system, structures or components. DDCs are intended to be used to resolve interferences or deficiencies resulting from field conditions or to expedite the performance of physical work on appropriately approved ECRs. DDCs are considered Design Documents.

The DDC procedure was established in November 1977 so that "...field work can proceed expediently prior to revisions of the affected design documents." This was revised to the above DDC definition in 1981.

Engineering Change Request (ECR): A form utilized to alert the necessary personnel of required CG&E and/or consultant action. Any change to a system or piece of equipment requiring the addition of a new piece of equipment, or affecting system functional logic, or manner of operation and maintenance, shall require the preparation of an ECR. An ECR is not a design document.

The ECR procedure was documented in the OPP in September 1981 with the definition given above. This was revised in September 1982 to require approval by NED. Interviews revealed that ECR's now require approval of the Vice President, Nuclear Operations and that approval will be given only provided the change is mandatory; that is, meets the requirements of the ECR procedure viz. the ECR (1) necessary for licensing, (2) necessary to make the system work, (3) necessary for nuclear safety, and (4) necessary for personnel safety.

However, NED personnel stated NED was frequently bypassed in the approval cycle of DDCs with and without ECRs. In TPT's opinion this further weakens CG&E's control over plant configuration.

4. Material Control. The Henry J. Kaiser Company (HJK) established the initial material control system used on the project. This is a construction-phase-oriented system. The HJK material control (warehouse) system is a manual system which relies on CARDEX files. This system does not provide effective sorting, management summarization, and reporting capabilities.

5. Document Control and Records Management. CG&E does not have a centralized, integrated document control and records management system, as noted in the previous section. A centralized records

storage location designated "the vault" was constructed after the IAL. The turnover of construction documents to the vault is in progress but it is not being accomplished in a thorough manner. The document control at other noncentral facilities is also inadequate. For example, during the course of the review, TPT attempted to find a series of management audits. Although not specifically searching for problems with records management, TPT staff found there was considerable difficulty in locating files in the Audit Group, the QAD files, and the CG&E vault. Although the requested records were found, some reports were missing and/or misfiled, and some files were not complete or contained material other than that designated.

Also in the CG&E warehouse, there was no index or retrieval system to locate records stored in tote boxes. In certain areas of the warehouse, it appears that records had been searched through and had not been carefully refiled or properly stored.

6. Reports to Management. CG&E does not have a formal procedure for defining reporting requirements to management. The following observations were made regarding the informal system currently in place:

   (a) Reports are not integrated and summarized for management visibility.

   (b) Reports are not prepared to a uniform format to facilitate review, integration, and summarization for management.

   (c) Reports do not integrate cost, schedule, and technical accomplishment.

(d) Reports do not clearly explain the causes of cost and schedule variances. In the case of variances, they do not provide a corrective action plan or follow-up.

(e) There is little feedback from management regarding the adequacy of the reports, problems identified, etc.

7. Construction Punchlists. CG&E has a computerized construction punchlist that has been in use at the site since January 1979. This system appears to be adequate; however, it lacks data and prioritization by expected and required start and completion dates.

2.3.4. Evaluate CG&E Project Management Systems and Procedures to Determine if They Adequately and Effectively Control All Interfaces Between Internal Organizations (B5)

As noted previously, CG&E, based on their prior successful experience on fossil plants, initially attempted to use relatively simple project management systems and procedures to control interfaces between internal organizations. This approach relied on regular face-to-face contact between managers, and simple, usually manual techniques for control purposes. As noted in Section 2.3.3, overall construction planning and scheduling was delegated to S&L, using the OPTIMA code, and detailed construction/work package planning was left to HJK.

As the size and complexity of the project grew, CG&E found an increasing need to improve the effectiveness of their management control systems. In an effort to respond to this need, particularly with respect to the transition from contruction to start-up testing, NED acquired the PREMIS/PICOM code to facilitate planning. At this date, the code is operational but not fully utilized within NED, nor applied at all outside NEDs.

The weaknesses of the CG&E project management systems and procedures, discussed in Section 2.3.3, and the limitations on the use of the above management systems adversely affected interfaces between the various CG&E organizations. Specifically:

1. The lack of a centralized function controlling procedures allowed individual organizations to prepare their own procedures that did not consider all affected groups and interfaces. This led to duplication of effort, conflicting or competing requirements between organizations, and a lack of consistency in implementing overall project policy.

2. The planning and scheduling of the construction effort using OPTIMA, and the start-up effort using PREMIS, are not integrated into one common data base. Although both indicate the overall project activities, changes to either schedule requires input to the other in order to evaluate the effect of the change. Engineering, QA, and licensing activities are not effectively scheduled in either system.

3. The current practice of assigning S&L the responsibility of configuration management does not enable CG&E to have an overview of the status of the project. Interview comments indicated that S&L design changes are not immediately sent to NED or NPD, thus creating a vacuum regarding the current design status. This situation, in turn, effects the ability of NED and NPD to interface properly with GCD. There is no assurance that all departments have the most recent issue of documents.

4. The decentralized document control and records management system was not effective in ensuring proper interfacing between organizations within CG&E. This led to functions working with a different issue/revision of project documents during the construction of the plant. The current practice in which each organization functions independently regarding procedures, document

control, and configuration management severely limits proper interfacing between these organizations.

2.4. CONCLUSIONS FOR TASK B

It is evident that CG&E attempted to use the project management approach at the Zimmer project that had previously been used successfully in the construction of fossil plants. Their approach, which was not unusual at that time, was to rely on a small, dedicated management team using relatively informal management systems and techniques. The emphasis was on getting the plant built on schedule at minimum cost. CG&E was not prepared for the complexity of the project requirements that evolved through the 1970's. Even so, based on their approach the Zimmer project management functioned effectively, although generally informally, in attaining their cost and schedule goals.

In retrospect, a number of deficiencies have existed (and some continue to exist) in the project management organization structure, staffing, policies, and/or procedures that are inappropriate in a complex project such as Zimmer. These deficiencies, discussed below by subtasks should be rectified as noted below in the organizational structure recommended to complete the Zimmer project.

2.4.1. Organizational Characteristics (B2)

1. Management Visibility. In the past, the CG&E project organization structure, including the responsibilities and authorities of major CG&E functions and the contractors, has been clearly defined in the OPP. Nevertheless, there has been some confusion over the title of Project Manager and the relative responsibilities of GCD to other departments and contractors. CG&E relies too heavily on contractors for project management and control, resulting in loss of visibility to CG&E's project management.

2. Staffing Adequacy. The CG&E management and professional staff was of minimal size and experience to be able to undertake the design and construction of nuclear power plants throughout the 1970's. Since then the IAL additional staff has been added, but it includes a large proportion of temporary employees, some in management positions. Use of temporary staff may solve the immediate problem, but the long-range problem of the transfer of experience to operations must be addressed. A small number of CG&E personnel with prior nulcear experience have been added to the staff since the SCO but overall the project remains understaffed and this needs to be rectified.

3. Staff Qualifications. The GED was used as a resource pool to provide additional staff, when required by the needs of the project, without sufficient regard for the nuclear requirements of the position(s) being filled. This resulted in the assignment of personnel to positions for which they lacked the required education/training or experience in the nuclear field. The NPD appears to be an exception as they did take proper action to expand the capabilities and skills of their staff by sending personnel to other nuclear plant sites for training. The recent practice of recruiting staff with the appropriate experience and qualifications from external sources should be continued, especially for the key senior positions.

4. Position Descriptions. The position descriptions published in the PSAR and FSAR were found to be adequate, but they were limited to management positions and generic engineering positions and did not address certain functions such as QA and licensing. The recently initiated activity to develop position descriptions for the majority of personnel at Zimmer should be continued.

5. Interorganizational Relationships. Interorganizational relationships were not adequate because the departments tended to function autonomously with minimal interfacing, integration, and coordination of the project activities. Long-standing friction existed between departments caused by conflicting priorities in assigned work items, deficiencies in coordinated planning, and inconsistencies in dealing with various external organizations.

6. Scope of Responsibilities. Although clearly stated in contract documents and organization charts, key managers and professional staff, in practice, had conflicting responsibilities that detracted from their management efforts (especially in terms of availability) at Zimmer. This deficiency appears to have now been resolved as all key managers and personnel are dedicated solely to the Zimmer project.

7. Communications. Communication within the various departments should have been good if the OPPs had been followed. However, several things prevented this. Some of these items were:

   (a) Departments that functioned in an autonomous manner which tended to limit communication (this is being improved);

   (b) Lack of professional records control personnel throughout the project;

   (c) The lack of adequate project procedures for an overall project management information system, which created a situation of nonstructured communication with mangement unless a problem occurred; and

   (d) The executive summaries provided to management did not appear to adequately summarize problems or discuss root causes and corrective action.

8. Document Control. there was no single central repository for all Zimmer project documents and there have been inadequate numbers of professional document control personnel for the Zimmer project. This has led to duplication of effort and less than efficient document control. Since the IAL, CG&E initiated a central filing vault. However, there are still nine independent records control centers, excluding the CG&E warehouse, where records are retained. Procedures to transfer records to the vault are tardy and ineffective.

9. Informal Organization Structure. Except for short periods of time, the CG&E manager responsible for the entire Zimmer project was not located at the site. In addition to having responsibilities other than the Zimmer project, he was located away from the site at CG&E's main offices. These conditions, coupled with the lack of an integrated project management system, contributed to the creation of informal organizations within the project organization charts. This condition impaired the visibility of the project to CG&E top management because of blurred lines of communication and authority. It also resulted in priority work items not always being necessarily in agreement.

These prior concerns about inappropriate autonomy and interorganizational friction are apparently being rectified by the improved leadership and increased project team work interjected by the new Executive Vice President responsible for the Zimmer project.

2.4.2. Project Policies (B3)

CG&E's formal project policies, concerning responsibility and authority over the Zimmer Project's functions (excluding quality, which is addressed in the QA Manual, which is separately reviewed in Sections 3 and 4 of this report), appear to be adequate but they were not readily available or properly implemented by project personnel. Personnel should be better trained in their knowledge and use of policies and procedures.

2.4.3. Project Procedures (B4)

CG&E does not have an integrated, comprehensive project management system of procedures at the working level that are documented and integrated to ensure that all elements of the project (e.g., Construction, Engineering, Quality Assurance, Licensing, Cost, Scheduling, etc.) are coordinated and directed toward the single goal of the completion and operation of Zimmer).

Specifically:

1. CG&E does not have a centralized system for the control, preparation, revision, and distribution of project procedures.

2. The few procedures that are in existence have been prepared by individual departments and are generally narrow in scope. They do not appear to contain the breadth and detail required to clearly implement policy for the entire project. This, in turn, impaired communication between departments and, in some instances, resulted in conflicting requirements and/or a duplication of effort.

A limited effort has been initiated to correct the deficiencies in preparing, controlling, and integrating policies and procedures. A central organization should be set up to complete this assignment.

2.4.4. Management Control Systems (B5)

The CG&E policy of delegating the responsibility of major elements of the work to reputable experienced contractors is not inconsistent with the approach taken by some utilities for the construction of nuclear power plants. However, CG&E does not have the management system, implementing procedures, and sufficient staff required to implement and control the work performed by their contractors.

CG&E's project management and control systems, including performance measurement and document control, were inadequate prior to the IAL (April 1981) partly due to CG&E's policy of relying on contractors. They remain inadequate due to failure to initiate an integrated effort to develop centralized project management and control systems.

The present system does not include all of the elements necessary to manage a project of the complexity of Zimmer. Specifically, the current CG&E system does not adequately address the following elements:

1. Integrated project planning and scheduling.
2. Budgeting and cost control.
3. Configuration management.
4. Material control.
5. Document control and records management.

Effective, computerized management information systems are available to the Zimmer project staff but they are not being utilized.

3. TASK C - EVALUATION OF CG&E MANAGEMENT POLICIES TOWARD QUALITY ASSURANCE

3.1. OBJECTIVE AND SCOPE

The objective of Task C is to review and evaluate those CG&E management policies that affect quality assurance and to assess whether the degree of management involvement and commitment towards quality is adequate to ensure an effective QA Program.

The scope of Task C included the following review subtasks:

1. Evaluation of the organizational level and the status of the CG&E QA Department in order to determine if the are consistent with the requirements of an effective QA program. (C2)*

2. Evaluation of the CG&E QA Department's access to upper management in order to determine if the QA program status and the QA problems can be, and have been, brought to the attention of upper management and acted upon, as appropriate, in a timely manner. (C3)

3. Evaluation of the CG&E QA Department's involvement in project activities in order to determine if this involvement is sufficient to help ensure adequate control and cognizance over the project. (C5)

4. Evaluation of CG&E management's involvement in quality assurance activities in order to determine if this involvement is sufficient to provide an appropriate level of support and status to the QA program. (C6)

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*Corresponds to the subtasks in the Program Plan.

5. Evaluation of the attitude and commitment of CG&E management toward quality assurance, in order to assess the impact (with respect to resulting effectiveness) of the QA Department, the quality program, quality-related implementing procedures, management's quality assurance responsibilities, and the role of quality assurance in achieving a facility of adequate quality. (C7)

3.2. INVESTIGATION

Information obtained through interviews of CG&E and contractor personnel involved with Zimmer, and from a review of documents found in CG&E and contractor files, was analyzed and evaluated in relation to characteristics (as noted in each subtask) that would be expected to be found in a well-managed nuclear power plant project.

3.3. SUMMARY OF OBSERVATIONS

A summary of observations based on information gathered and evaluated in Task C is presented below:

3.3.1. Evaluation of the Level and the Status of the CG&E QA Organization*

This subtask consisted of an evaluation of the organizational level and the status of the CG&E QA organization in order to determine if the level and status are consistent with that required for an effective QA program. The following topics were examined as part of the evaluation:

1. QA staffing level.

2. QA budget.

*In the context used here, the terms QA organization, QA Department, and QA&S Section are interchangeable.

3. Reporting level of QA Manager/QA Department.

4. QA Manager position descriptions and qualifications.

5. QA personnel position descriptions and qualifications.

6. Freedom of the QA manager and his staff from cost and schedule pressures.

7. QA salary levels versus those of counterparts.

8. Freedom of the QA manager and his staff from non-QA/non-Zimmer responsibilities.

3.3.1.1. QA Staffing Level. The CG&E QA staff in 1970 consisted of a principal engineer and four supporting engineers (two mechanical QA engineers, one civil/structural QA engineer, and one electrical QA engineer) organized in a Quality Assurance and Standards (QA&S) Section of the General Engineering Department (GED). These individuals were, by and large, drawn from elsewhere within GED and appeared to have had little previous experience in developing and implementing a nuclear quality assurance program.

The staffing of the QA&S Section remained at four engineers and a manager from 1970 until 1977, when two contract personnel joined the organization for about one year. A subcontractor also provided some vendor auditing for CG&E along with assistance in performing management audits and, in 1978, began providing nondestructive examination (NDE) services. This CG&E QA staff size remained approximately constant until the 1981 IAL, after which the number of personnel in CG&E QA grew to more than 200 by November 1982.

Considering the limited number of personnel and their lack of previous nuclear QA experience, a review of the available documentation indicates that the QA&S Section did provide considerable coverage of the activities regarding Zimmer. However, as shown by the nature and number of inadequacies in the CG&E QA program, the QA staffing level from the beginning of the project until 1981 was not sufficient to carry out a fully adequate job of planning and implementing an effective QA program at Zimmer. This lack of experienced and qualified nuclear QA personnel on the CG&E staff also appear to be a factor in their failure to recognize the seriousness and magnitude of problems that were occurring and to resolve them in a timely manner. For example, as brought out in Task D, the cause of the ineffective controls over such activities as the procurement program can be traced to the lack of personel necessary to oversee the procurement function.

The AEC pointed out QA staffing inadequacies to CG&E as early as 1971. However, effective steps addressing the problem of inadequate CG&E QA staffing were not taken by CG&E management and only one CG&E QA representative was on site until late 1976.

Although the CG&E QA staff was small and inexperienced in nuclear QA matters, a review of the documentation did reveal that the CG&E QA staff was aware of a number of problems throughout the years. For example, in October 1976, CG&E QA staff identified generic HJK QA/QC and construction problems including:

1. Lack of procedures ensuring that installation and inspections were complete in accordance with design documents.

2. Lack of adequate scheduling of inspections; i.e., in process, final, etc.

3. No verification that inspection records at the time of turnover are to the latest design document.

4. Missing inspection requirements, or Code requirements not identified until ready for turnover, resulting in numerous Nonconformance Reports (NRs).

5. Lack of reponse to audits.

6. Inspection records kept in many different locations on the project site.

7. Socket weld problems.

8. Delays in producing American Society of Mechanical Engineers (ASME) N5 forms, Data Report for Installation.

9. Personnel from superintendents to area foremen were not quality-oriented, lacked training, and completed the job without QC.

10. NR trend analysis showed lack of craft direction, inadequate supervision, and repeated deficiencies.

11. Supervision was not inspecting the work for completeness and adherence to design documents prior to requesting QC inspection.

12. Craft depended on QC to tell them what was wrong with their work when inspected.

Thus, in spite of being small and inexperienced, the CG&E QA staff did indeed detect a number of basic problems resulting from HJK's implementation of the QA program. However, corrective action was not taken and the problems continued to recur.

3.3.1.2. <u>QA Budget</u>. Quality Assurance should have its own budget from the inception of a project, so that it is not adversely influenced by restrictions and pressures from other departments and can therefore achieve sufficient independence from cost and schedule constraints, as required by Appendix B, 10CFR50. Instead, at Zimmer, the budget for the QA&S Section was not a separately identifiable part of the GED budget from 1970 until the QA&S Section became the Quality Assurance Department in 1980 and, consequently, lacked the necessary visibility and independence it should have had.

3.3.1.3. Reporting Level. The CG&E QA organization has not always reported directly to the responsible corporate manager or been on the same organizational level as Construction. During the early years of construction, the QA&S Section reported through the Principal QA&S Engineer to the Manager of the GED. A consultant's report to CG&E management in October 1979 concluded that QA needed to be independent of GED in order to meet NRC requirements. A major reorganization was made in January 1980. Afterwards, the QA&S Principal Engineer assumed the title of Manager, Quality Assurance and reported directly to the Senior Vice President. This change allowed the quality assurance function the necessary independence from the GED and freedom to communicate directly with the corporate officer who had authority over the QA Program. However, a review of subsequent organization charts indicates that the QA organization did not continue on an equal reporting level with Construction. During 1981 and 1982, the Manager, Generation Construction reported directly to the Senior Vice President, while the Manager, Quality Assurance reported to the Vice President of Nuclear Operations who, in turn, reported to the Senior Vice President.

3.3.1.4. Position Descriptions. The Position Description for the Manager of QA was not drafted until midway through 1980. Position Descriptions providing minimum requirements for education and years of experience in quality assurance for the other four engineers in the QA&S Section were not developed until after the IAL.

3.3.1.5. Freedom from Cost and Schedule Pressures. From all the evidence available, it appears that CG&E's major priority was to complete the Zimmer project at the least cost and as close to schedule as possible. In this environment, QA was viewed as a requirement to be met at the minimum permissible level. Consequently, the size of the CG&E QA staff was maintained at a very low level, which in retrospect has proven to be inadequate throughout most of the project's lifetime.

Other indicators of the effect of cost and schedule pressures on the QA organization were CG&E management's reluctance to allow HJK to hire additional inspection staff, even though their case was supported by CG&E's own staff; the strict oversight of HJK travel expenses in the QA area; limitations on HJK's review of vendor qualifications for inclusion on the Approved Vendors List (AVL) despite HJK's strong protests in certain instances; and the permission granted to vendors, on occasion, to delete hold points and lower notification points for scheduling reasons.

Individually, such actions might each be argued, with merit, as being a conscientious decision of a hard-line, cost-conscious manager. However, collectively they created an environment which tended to downplay quality priorities and practices to an undue extent.

3.3.1.6. Salary Levels. CG&E employees within the QA Department have a variety of titles. In some cases the classification is a generic one (for example, Senior Engineer). In these cases, the salary range for an individual is identical to that for another similarly classified engineer elsewhere within the company. However, in addition to the generic classification, several of the CG&E QA people have quality-related titles (for example, Senior Quality Engineer). In these cases, the salary range is lower than that of a counterpart engineer with a title that does not have the quality designation (i.e., Senior Quality Engineer versus Senior Engineer).

The salary ranges of QA personnel were also evaluated from the standpoint of competitiveness with other companies. In general, it was felt that the CG&E salary ranges for experienced quality personnel were not competitive with other companies from whom personnel might have been drawn to meet CG&E's permanent staffing needs. This was verified by the difficulty experienced in trying to attract experienced people from other companies. Consequently, certain positions remained open for long periods of time (for example, the QA Manager has attempted, without success, to fill a Civil/Structural Quality Engineer position since April of 1981).

3.3.1.7. Freedom from Non-QA/Non-Zimmer Activities. Based on the review of correspondence, the QA&S/QA manager and his staff were free from non-QA and non-Zimmer responsibilities. From an early date in the project to the present, the individuals assigned to the QA&S Section/QA Department were involved in quality-related activities for the Zimmer plant and not required to function in other capacities.

3.3.2. Evaluation of QA Department Access to Management (C3)

This subtask evaluated the CG&E QA organization's access to upper management to determine if QA program status and problems can be, and have been, brought to the attention of upper management and acted upon in a timely and appropriate manner. The following topics were addressed during the evaluation:

1. Methods used by the QA manager to report on QA program adequacy and effectiveness to CG&E management, such as:

    (a) The vehicles for informing CG&E management of quality status/problems/trends.

    (b) The distribution of QA progress and activities reports, audit finding reports (AFRs), and NRC inspection reports to CG&E management.

(c) The QA manager's access to management through Corrective Action Reports (CARs), AFRs, Nonconformance Reports (NRs), etc.

(d) The contractor's reporting of problems to CG&E management.

(e) The attendance by QA at upper management meetings.

2. Management response to reports and QA program status/problems information received.

3. The accuracy of information on problems as reports proceeded up the management chain.

3.3.2.1. QA Reporting Methods to CG&E Management. A formal vehicle for informing CG&E's President of the quality program status, problems, and trends on a periodic basis does not exist. The few letters sent to the President were in reaction to specific concerns from the NRC or outside organizations. The reports of the semiannual Management Assessment Audits (MAAs) performed to evaluate the effectiveness of the QA organization were formally submitted to top management on only three of twenty-one occasions. There was no record that the President was informed of the deficiencies from the other management audits, even though some significant problems had been identified in the reports. In a similar manner, it appears that significant deficiencies identified in NRC inspections, such as failure to follow procedures and identify and correct infractions, were generally not communicated to the President before 1981.

Zimmer Project management at the vice presidential level was appraised of the quality problems and activities of the QA organization on a routine basis. The information vehicles used throughout the project included the management audits and NRC inspections, with corresponding post-audit briefings, memos, and letters; selected CG&E/HJK QA meeting agendas and minutes; CARs, AFRs; Stop Work Orders (SWOs); 10CFR50.55(e) reports; field and vendor (S&L, GE, HJK) audit reports; and monthly project meeting agendas and action item reports. Quality Assurance attended various management meetings, such as the Construction Coordination and Monthly Project Meetings. Correspondence to and from the NRC was normally addressed to the Vice President.

The QA Department's section of the Monthly Activities Report has been submitted to the President and Vice President since August 1981, but contained little executive summary information on quality problems, trends, or program effectiveness. The current reports provide detailed numerical summaries of quality control and assurance activities, such as the number of inspections and audits performed, the number of findings and NRs written, and the manhours expended in the Materials Review Board (MRB), but few executive summary-style highlights, conclusions, or trends.

It is not apparent whether AFRs were distributed above the Vice Presidential level during the early years but, in August 1977, a policy was implemented in response to an NRC concern which directed that all significant findings be brought to the attention of the President of CG&E.

Some filtering of information on quality program problems apparently took place in 1977, resulting from an MAA that proceeded up the management chain to the President. The MAA at that time indicated the QA Program did not have adequate detailed procedures to implement the 18 QA Program criteria and that QA&S audit followup was not being implemented. However, a memo to the President stated there had been "no significant findings" in the audit. The audit report itself was apparently not sent to the President.

3.3.2.2. Management Response to Information Received. Past management responses to the information received from sources other than the NRC on quality problems and QA program effectiveness appeared to be weak, based upon the recurrence of problems identified early in the project. For example, the CG&E Principal QA&S Engineer recognized inadequate corrective action commitments by HJK as early as 1973 and continued to identify similar poor corrective action statements by HJK on audit findings and NRs in subsequent years. However, in spite of the extensive ongoing identification of problems and the corresponding requests for corrective action, little was apparently done by CG&E management to bring about an effective approach for the timely treatment and the prevention of recurrence of these problems.

The discrepancies in the CG&E QA program reported to the Vice President, Management Audits were also not being effectively corrected in a timely manner. After 1976, the corrective actions for several audit findings had not been accomplished, or were ineffective, when reexamined in following MAAs. Furthermore, some findings did not receive adequate attention on a timely basis. For example, shortages in the CG&E QA staff were identified in 1977 and 1979, but real growth in the staff did not occur until 1981. Also, HJK had reported potential problem areas in the QA program concerning document control and staffing early in the project. Management response to provide suitable corrective action was weak, so that similar or related problems were repeatedly identified later in the project.

There were some indications that, after the IAL, upper management's response to the quality-related information it received was improved and was more supportive of an effective QA Program. For example, in December 1981, the Vice President of Nuclear Operations expressed concern that there were still basic programmatic problems in the HJK QA program. Examples cited by the CG&E Vice President, Nuclear Operation were: (1) inspections were made using procedures which were not approved, (2) inspectors performed inspections for which they were not qualified/trained, (3) dual inspection requirements were not met by HJK QA, and (4) work was performed and inspected without approved design documents. Improved reporting to categorize and trend findings to identify generic and programmatic problems was then requested by the CG&E Vice President of Nuclear Operations.

3.3.3. Evaluation of QA Department Involvement in Project Activities (C5)

This subtask consisted of an evaluation of the involvement of the CG&E QA Department in project activities to determine if the QA Department has been sufficiently involved to help ensure adequate control and cognizance over the project. The following topics were addressed during the evaluation:

1. CG&E QA Department reviews and audits of contractors for adequacy, implementation, and effectiveness of their QA program.

2. CG&E QA Department review of contractor inspection planning.

3. Interface of CG&E QA Department with the NRC on matters of quality (e.g., reporting of significant deficiencies).

4. CG&E QA Department review of contractor QA/QC personnel qualifications.

5. CG&E review of contractor documentation.

6. CG&E QA department involvement in scheduling and status meetings.

7. CG&E QA Department concurrence on quality-related procedures including engineering and construction procedures.

8. CG&E QA Department identification of witness/hold points.

3.3.3.1. CG&E QA Audits of Contractors. The CG&E QA Department did review and perform audits of contractors for adequacy and implementation, but it does not appear that they covered the effectiveness of the contractor's QA program. Also, CG&E delegated some of their audit responsibility to HJK and hired a third party to perform other audits. In many cases, the audits appeared to be superficial in nature and conducted late. Invariably, the "corrective action" commitments to those discrepancies identified did not determine the root cause and timely action to prevent recurrences was generally not taken.

3.3.3.2. CG&E QA Department Review of Contractor Inspection Planning. The CG&E QA Department reviewed contractor inspection planning although, at least in the early stages of construction, the review was limited to looking at generic inspection plans (i.e., a typical inspection plan would be developed and CG&E would review it). The evidence indicates that this level of review of contractor inspection plans continues at this date.

3.3.3.3. CG&E Interface with NRC. CG&E was generally responsive to the requirements, concerns, and opinions of the AEC/NRC. Internally, CG&E stressed the need to be responsive. For example, in a memo to CG&E project management in 1980, the Senior Vice President reprimanded his staff regarding a somewhat casual attitude toward meeting commitments to the NRC promptly. CG&E gave specific instructions to its contractors on what was expected of them and their procedures. Later in the project, when the use of 50.55(e)s and 10CFR21 reports were required, CG&E took measures to notify everyone involved as to their obligation concerning the reporting of significant deficiencies.

While the CG&E/NRC interface appeared adequate, it seems that CG&E failed to recognize an underlying message in the NRC Inspection Reports (IRs) concerning problems at Zimmer. As evidenced by a summary of NRC IR results prepared by CG&E in November 1977, and interviews with the Vice President and the President conducted by TPT, CG&E management apparently believed that the NRC IRs were painting a favorable picture at Zimmer. This belief was reinforced by the positive impressions given in a summary CG&E memo which stated that: (1) there had not been a violation issued against the QA Program for the Zimmer Project; (2) the responses supplied by CG&E to the individual noncompliances were acceptable to the NRC and, on subsequent inspections, it was determined that the corrective action was satisfactory; (3) this indicates knowledge of the requirements of an effective QA Program; and (4) repetitive-type noncompliances were at a minimum, which also indicates an effective corrective action program.

Contrary to the above, an analysis by TPT of the NRC Inspection Reports on Zimmer over the years indicates a number of repetitive noncompliances. For instance, failure to follow written instructions, procedures, and drawings was noted in 30% of the NRC noncompliances. Also in 1975, the NRC reported two infractions, one concerning failure to follow procedures and one due to the failure of the QA program to identify the infractions and to correct them. The NRC stated they were concerned about CG&E's system for the management control of NRC-licensed activities that had permitted these items to occur.

In 1976, the NRC reported that measures had not been established in the site QA manual to provide formal indoctrination and training of personnel.

National Regulatory Commission IRs also show that certain problems were reported repetitively. For example, inadequate control of welding material was reported by the NRC on 16 different occasions between October 1975 and September 1980.

Furthermore, in 1980, the NRC expressed concern that CG&E was not keeping the NRC informed of changes in CG&E procedures and had placed misleading information in response to NRC audits. Thus, it appears that CG&E failed to: (1) recognize the underlying message in the NRC Inspection Reports that there were problems at Zimmer and/or (2) correct these problems to prevent their recurrence. The discrepancies identified (taken collectively), plus such things as NRC-initiated management meetings, should have alerted CG&E management that problems existed.

3.3.3.4. <u>CG&E Review of Contractor's Personnel Qualifications</u>. The CG&E QA Department did review the contractor's QA/QC personnel qualifications.

As early as 1973, CG&E requested HJK to submit charts of its organization, responsibilities, and functions and resumes of its personnel including qualifications, experience, and education. Also, in November 1980, CG&E QA Management was reviewing and providing assurance that QA personnel working on Zimmer were qualified. However, as noted elsewhere within this task, as well as within Task D and Task H, in spite of these assurances, a number of personnel through the years were not appropriately qualified to perform their assigned quality assurance/quality control function. It is felt that the review performed by CG&E QA of personnel qualifications was not performed in a vigorous manner, nor done to a depth that would ensure that only appropriately qualified QA/QC people were used.

3.3.3.5. CG&E Review of Contractor Documentation. Generally, CG&E did not perform an adequate review of contractor documentation. From early in the project, there were documentation problems such as CG&E requesting the wrong documents, receiving incorrect or incomplete documents, or late document submittals. The correspondence reviewed indicated that CG&E QA was aware that documentation problems existed and tried to get corrective action for the problems. However, regardless of their attempts or the extent of their involvement, corrective actions were neither effective nor timely.

As a case in point, an agenda for an October 1976 CG&E/HJK meeting listed a number of problems including: (1) lack of a procedure to assemble inspection records and QA documentation at the time of system turnover, (2) no verification that inspection records at the time of turnover are to the latest design documents, (3) no identification of missing inspection or code requirements until ready for turnover, and (4) inspection records were being kept in many different locations on the pro ect site.

However even in December 1979, more than three years later, CG&E was still pursuing the same concerns. Again, though involved, CG&E QA has been unable to bring the problem to a successful conclusion. Furthermore, although the QA Principal Engineer/QA Manager included the Vice President on the distribution for correspondence regarding quality problems, there is little evidence of involvement or assistance by the Vice President or President in resolving ongoing problems by interfacing with HJK management at a higher level.

3.3.3.6. CG&E QA Department's Involvement in Project Construction Meetings. For the most part, the QA Department was involved in scheduling and status meetings. CG&E's QA Department was involved in the monthly project meetings and in joint QA meetings between CG&E and Kaiser. As indicated in the QA meeting agendas and minutes, CG&E QA was attempting to correct some problems identified in the HJK QA program, but with limited success.

3.3.3.7. CG&E QA Department Concurrence on Procedures. The CG&E QA&S/QA Department was involved with the development of, and concurrence on, quality-related procedures including engineering and construction procedures. CG&E reviewed HJK QA procedures as early as 1971. In addition, CG&E approved Kaiser's construction procedures, reviewed RCI design control procedures and reviewed and approved Catalytic work procedures and Catalytic Work Packages. In some cases, CG&E let the contractors review and approve their own or each others procedures (e.g., HJK welding procedures were required to be approved by S&L). After the 1981 IAL, CG&E QA has become more involved in the reviewing of procedures and the initiation of new procedures.

3.3.3.8. Identification of Witness/Hold Points. There is some evidence that CG&E QA used hold points to a limited extent in order to ensure the planned coverage of the construction effort regarding CG&E's surveillance. However, a thorough planned approach to CG&E QA involvement in the surveillance of the Zimmer effort through witness and hold points did not appear to be extensively or universally applied beyond a few cases.

3.3.4. Evaluation of Management Involvement in QA Activities

This subtask consisted of the evaluation of the involvement of CG&E top and upper management in QA activities in order to determine if top and upper management: (1) provided an appropriate level of support to the QA program and (2) obtained an adequate awareness of the status of the QA Program. The following topics were addressed during the evaluation:

1. Management awareness of problems.

2. Management support and the action that was taken to determine and correct the root causes of problems.

3. Management review of quality status reports and QA program status.

4. Management's delegation of quality-related matters involving contractors.

5. Management response to quality-related requests for support.

6. Management effectiveness in reducing quality-related problems.

3.3.4.1. Management's Awareness of Problems. The Vice President of CG&E was generally aware of problems relating to quality, but it does not appear that the President was. Examples of problems of which the Vice President was aware are as follows:

1. In discussions with the AEC in 1971, the AEC took the position that a single CG&E QA field engineer could not provide satisfactory QA coverage. CG&E management recognized that hiring restrictions might not permit hiring permanent people and therefore they considered the possibility of using a consultant.

2. In 1974, CG&E management was informed that no clear cut independence existed between the QA organization and the construction organization of HJK.

3. Also in 1974, management was notified by HJK that it was virtually impossible to continue working in all areas with the present staff.

4. In 1975, management was made aware of the questionable areas of in-depth auditing by HJK.

5. In 1975, CG&E management was made aware that the HJK QA/QC organization could not provide for optimum utilization of the engineers and inspectors in the organization.

6. In 1977, CG&E management was aware of electrical installation concerns and problem areas.

7. In 1979, CG&E management was aware of communication problems, inspection scheduling, and manpower needs.

3.3.4.2. <u>Determination of Root Causes.</u> While CG&E QA up to the vice presidential level may have known that problems existed, CG&E's management support and the actions taken to determine and correct root causes of problems were minimal. Generally, corrective action did not identify the cause of the problem, nor the extent to which it occurred. Action to prevent recurrence was often insufficient in depth, or not related to the specific cause of the problem. Followup and close-out of problems were typically slow and incomplete. Present corrective action requests still do not adequately pursue the identification of the cause of the problem, nor do they purge the system of the problem. The timeliness of response and followup to the point of effective preventive measures still appears to be inadequate.

3.3.4.3. Review of Program Status. As mentioned elsewhere in this task, feedback to the President appeared to be limited to occasional, cursory statements resulting from the periodic management assessments performed b, or for CG&E and AEC/NRC Inspection Reports. The latter, when taken separately, resulted in a false sense of security as the number and nature of the deficiencies did not appear to indicate that severe control problems existed. However when examined collectively, the AEC/NRC findings revealed repetitive problems, the root causes of which were not addressed by CG&E.

It was not until mid-1981 that quality status reports were being generated and sent to CG&E's President. Prior to that time, there is little evidence that the CG&E President was actively involved in Zimmer QA activities.

The Vice President of CG&E was generally aware of QA activities and program status. General correspondence, periodic management assessments, audit reports, NRC inspections, and attendance at monthly construction project meetings were the types of information vehicles used by the Vice President to keep abreast of QA-related activities. It appears that CG&E line managers determined generally what should or should not be sent to the President, with no set criteria established concerning keeping the President informed. Also at one point, line management evidently gave the Vice President the impression that quality-related activities at the site were under control when they were not. As a result, CG&E's Vice President informed CG&E line managers he was tired of receiving accusations from the NRC that CG&E could not refute, implying they were supplying inadequate and misleading information.

3.3.4.4. Delegation of Quality-Related Matters to Contractors. Management's involvement in quality-related matters versus their delegation to contractors appears to have been adequate. CG&E management generally delegated many of their own quality-related responsibilities to others and it was CG&E management's basic intent at the start of the project to assign the responsibility for quality control to contractors and to have CG&E, as the owner, be responsible for the required surveillance and auditing. However, CG&E recognized later in the project they possibly had delegated too much of their QA responsibilities to others. They also realized they did not have sufficient control over their contractors and later reassumed some of their QA responsibilities.

3.3.4.5. Response to Requests for Support. Management's response to requests for support on quality-related matters was generally negative. The reasons given by CG&E management varied, although it appears that CG&E management's real concerns were cost and meeting the schedule. At one point, HJK's request for staff support was sufficiently desperate for them to state it was becoming virtually impossible to continue working in all these areas with the present staff. On another occasion, HJK assured CG&E that only personnel that were needed would be hired, and that additional personnel would still be within the QA budget, both from a manpower and cost standpoint. However, in spite of HJK's request for additional inspection personnel, CG&E would generally fail to provide HJK with approval for the requested staffing.

3.3.4.6. Effectiveness in Reducing Problems. Even though the Vice President was involved in quality-related activities at Zimmer, it does not appear he was committed to the concept of QA to the extent of providing the required support needed to eliminate recurring quality-related problems. Failure to determine the root causes, and obtain effective corrective action commitments in a timely manner, was a major contributing factor to the recurring quality-related problems. It appears the primary concern was to resolve immediate problems, as opposed to establishing problem evaluation and prevention techniques.

3.3.5. Evaluation of Management Attitude Toward QA (C7)

This subtask evaluated CG&E management's attitude and commitment toward quality assurance. The impact of management's attitude and commitment was assessed with respect to the resulting effectiveness of the QA

Department, quality program, quality-related implementing procedures, management's quality assurance responsibilities, and the role of quality assurance in achieving a facility of adequate quality.

From the beginning of the project until 1979, there is little evidence, either written or verbal, that CG&E management established and supported definitive policies committed to quality or quality assurance at Zimmer.

Management statements expressing an opinion on QA in letters and memos generally tended to limit the scope or applicability of the QA program to the minimum, legally required effort. Specific examples included:

1. Use of minimum CG&E QA and HJK QA/QC staffing levels.

2. Repeated emphasis that "QA shall be limited to essential and Class I systems only," without consideration of a partial QA effort to reduce overall cost and schedule on non-essential and Class II systems.

3. Preference for fewer, general procedures rather than for more specific, detailed work instructions and procedures.

4. Minimum use of vendor surveys and surveillance.

5. Vendor documentation submittal requirements kept to a minimum and system documentation acceptance less important than system turn-over schedule.

6. Request for a reduction in QA program rather than an increase in staff when CG&E recognized that HJK QA engineering staff was overloaded with work.

7. Minimum procedure, drawing review, and approval cycle.

8. Replacement of vendor-recommended hold points with fewer notification points to meet schedule.

9. Preference for 100% inspection "only when absolutely necessary."

Taken alone, any one of these examples could be an acceptable practice but, taken collectively, the impression is given that the concern for quality was not in balance with the concern for cost and schedule. Although clear, objective, and quantitative methods are limited for determining the extent of QA coverage best suited for a nuclear construction project, coverage was, in TPT's opinion, often inadequate.

Few audits or special evaluations were requested by upper management. Rather, on one occasion, the audit frequency requirements were relaxed after an audit revealed that the audit schedule had not been met. After the IAL, however, audit personnel were hired to increase audit activity.

From the inception of the project, it does not appear that the importance of quality in construction was emphasized; such as a "quality is everyone's business" or a "do it right the first time" theme. There was not a published commitment to a quality theme before 1979. Management generally focused on working to minimum standards and regulations and applying the CG&E and HJK QA program only where required and only to the minimum extent necessary. Specific examples are given above.

Also, CG&E management, including previous QA management, appeared to lack an understanding of QA principles in some areas, such as independence of construction and inspection, the use and disposition of NRs, delegation of stop-work authority to inspectors, and the importance of training and QA experience. This lack of understanding could have resulted in the lack of appreciation for the need and value of an effective quality assurance program as discussed above.

The correspondence and interviews, taken collectively, also indicate that employees did not perceive a management commitment to quality. For example, in response to the CG&E QA manager's 1981 request for documentation which refutes HJK's claim that CG&E repeatedly denied HJK's requests for additional resources, one CG&E QA Director, who had worked on the project from the beginning, wrote "This correspondence speaks for itself. I can add little information that is not already discussed in the letters. It is not a nice history, but very true." It also does not appear that the importance of quality in construction was emphasized. Rather, construction workers were generally not quality-oriented but felt they could get the job done without QC.

3.4. CONCLUSIONS FOR TASK C

3.4.1. Level and Status of QA Department (C2)

The level and status of the CG&E QA organization through the years was generally not adequate to provide for an effective QA program. The major shortcoming in this area was the small and inexperienced CG&E QA staff.

The QA budget was not independently identified prior to 1980, but it is now. The total number of QA staff (including contractors and job shoppers), which significantly increased after the IAL, is, in TPT's judgment, about adequate. However, the CG&E permanent QA staff level should be increased. In this regard, salary levels are not competitive and should be reviewed to facilitate hiring experienced staff.

The QA staff has always been, and is now, free from non-Zimmer and non-QA duties. However, the QA reporting level was at various times in the past one step below its counterpart departments. This has now been corrected.

The over-emphasis on cost and schedule priorities relative to quality did impact the QA department. Even so, it appeared that the CG&E QA

Department, and its predecessor the QA&S Section, genuinely tried to do a good job of controlling the Zimmer QA program through the years. However, the small size of the group, and their lack of nuclear QA experience, did not provide adequate QA coverage of the Zimmer quality-related activities. The CG&E QA staffing problem was compounded by the limits which CG&E management placed on: (1) HJK QA/QC staffing, and (2) the amount of QA/QC work delegated to HJK (e.g., vendor surveys).

3.4.2. QA Department Access to Management (C3)

Until 1981, CG&E's President appeared to be insulated from a clear picture of the Zimmer activities, quality problems, and effectiveness of the QA program. On the other hand, the Vice President was, by and large, routinely involved in construction activities and quality problems.

The CG&E QA organization provided little executive summary information on quality problems, status, and program effectiveness to management. Reports generally provided details and highlighted "brushfires" rather than providing a management perspective.

Management response to reports of QA program ineffectiveness and problems it received was generally weak. Although significant problems with the quality program were identified early in the project, the followup action to prevent their recurrence appeared ineffective or was not accomplished in a timely manner. Improvements occurred after the IAL but were insufficient at the time of the SCO. Further improvement is required.

3.4.3. QA Department Involvement in Project Activities (C5)

While CG&E QA appeared to be adequately involved in the Zimmer project activities over the years, there were several significant shortcomings in its effectiveness in ensuring adequate control and cognizance over the project. Specifically, CG&E QA Department reviews and audits of contractors for adequacy, implementation, and effectiveness of their QA programs did not contain sufficient depth, followup, or implementation of timely corrective action.

3.4.4. Management Involvement in QA Activities (C6)

As noted in Section 3.4.2, the Vice President generally had an adequate awareness of the status of the QA program, but the President was insulated from quality-related problems and did not become involved in the Zimmer QA program until after the IAL. The majority of problems brought to management's attention were generally not investigated in depth in order to determine and correct the root causes.

Management's review of the QA program status and effectiveness was inadequate. Too much responsibility was delegated to contractors and CG&E did not exercise sufficient control and overview of the responsibilities delegated until after 1981. Even then, management's involvement was limited to resolving immediate problems. Cause evaluation and prevention techniques were not utilized effectively and this remains a problem.

3.4.5. Management Attitude Toward Quality Assurance (C7)

Management generally did not establish verbal or written policies in support of quality in construction, such as a "Quality is everyone's business," or a "Do it right the first time" theme. Management also appeared to lack an adequate commitment to an effective nuclear quality assurance program in comparison to their commitment to meet cost and schedule goals. Management generally focused on working to minimum standards and regulations, and applying the CG&E and Kaiser QA program only where required and only to the minimum extent necessary. Although such mandates have merit individually, when taken collectively they indicated to the Zimmer project staff a clear choice in priorities; i.e., quality must be performed to the minimum requirements but it is lower in priority than cost and schedule. Since the SCO, there are clear indications of a reversal in this attitude.

4. TASK D - EVALUATION OF CG&E MANAGEMENT OF THE QA PROGRAM

4.1. OBJECTIVE AND SCOPE

The objective of Task D was to evaluate the CG&E management of the QA program to determine if systems, procedures, and techniques have been established and whether the QA program is adequate and effectively implemented.

The scope of Task D included the following subtasks:

1. Determine management's control of the adequacy of CG&E's QA program by evaluating the methods used to ensure that the documented QA system meets the requirements of the PSAR, Chapter 17; 10CFR50, Appendix B; and American National Standards Institute (ANSI) Standard N45.2. (D2)*

2. Review the results of the evaluations performed by CG&E to investigate major quality-related problems experienced at Zimmer. Assess the thoroughness and accuracy of these evaluations and the actions taken by management to implement the recommendations. (D3)

3. Review management of the QA program by CG&E in the following areas: (D4)

   (a) Work Instructions: Developing, maintaining, and implementing subtier procedures and instructions for work and inspections that affect quality.

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*Corresponds to the Subtasks in the Program Plan.

(b) Training and Indoctrination: Establishing and implementing appropriate quality-related training programs and employee indoctrination.

(c) Qualification, Certification: Ensuring that personnel performing quality-related activities are certified as being properly trained and qualified.

(d) Procurement Controls: Effectively communicating quality requirements in procurement documents, assessing the capability of suppliers, and the surveillance of supplier activities.

(e) Design Controls: Effectively reviewing design control processes and practices of major contractors.

(f) PSAR/FASR Code Controls: Establishing and implementing a system to assure that PSAR and Code commitments are met, design changes are compatible with the PSAR/Code, and PSAR changes are carried out in the design.

(g) CG&E Overview: Establishing and implementing effective programs in the area of audits, surveillance, inspection, and independent assessments of contractor activities.

(h) Records: Establishing and implementing a quality records control system which meets the requirements for assuring validity, accuracy, completeness, and traceability of records in a retrievable manner.

(i) Control of Nonconformances: Establishing and implementing an effective system for documenting and reporting deficiencies, including reports to the NRC, and the policy/procedures for implementing "stop work."

(j) Corrective Action/Cause Analysis: Establishing and implementing the system to assure that significant deficiencies are investigated and corrected promptly by an effective priority action system, including a means for assessing a cause of problems and analysis of deficiency trends.

(k) Tracking Systems: Establishing and implementing the effective means for tracking activities, action items, open items, and the followup of problems.

4. Evaluate CG&E's QA program interface relationships with S&L, HJK, GE, CI, and RCI. Measure conformance to requirements for assuring transmission of information and records relating to quality. The evaluation will also examine quality-related interfaces between CG&E's QA, Project, Construction, and Operations organizations, to ensure that the QA program structure and supporting procedures necessary to effective implementation are in place. (D5)

4.2. INVESTIGATION

Task D was designed to review and evaluate CG&E's management of the QA program to determine if systems, procedures, and techniques were established to plan, organize, lead, and control the QA Program. The investigation included: (1) an initial briefing by key Zimmer management personnel, (2) personal interviews of these managers and other selected personnel, (3) review of CG&E manuals, procedures, support documents, memos, letters, etc.

The criteria utilized to evaluate the acceptability of CG&E's management of the QA program were the Code of Federal Regulations 10CFR50, Appendix B; and ANSI Standard N45.2. The specific topics examined are identified under each subtask.

4.3. SUMMARY OF OBSERVATIONS

A summary of the observations based on information gathered and evaluated in Task D is presented below by each subtask.

4.3.1. Evaluation of CG&E QA Program Compliance with PSAR/FSAR Commitments (D2)

This subtask involved the review of CG&E management's methods, systems, and techniques that have been implemented to ensure that the QA program has continued to meet the commitments made by CG&E to the NRC in the NRC-approved PSAR, Appendix D and FSAR, Section 17. The following topics were examined during the evaluation:

1. Historic review of quality program commitments in the PSAR and FSAR.

2. Implementation of PSAR/FSAR commitments into quality-related procedures.

3. Organizational responsibilities for tracking PSAR/FSAR commitments.

Originally, the QA Program was described in the QA Manual and Appendix D of the PSAR. The NRC issued a construction permit on the basis of the commitments in Appendix D, and confirmed that the QA Manual conformed to 10CFR50, Appendix B.

The FSAR was first issued in 1975 and addressed the Zimmer Construction Quality Assurance Program in Chapter 17.1 and the Operations Quality Assurance Program in Chapter 17.2. Various ANSI Standards and Regulatory Guides were committed to in Chapter 17.1.

In the interim, the QA Manual and QA procedures changed substantially from the PSAR. The changes continued to meet the requirements of the PSAR

Appendix D, but not the requirements of the FSAR Section 17.1. The QA Manual and procedures were used as the sole documents describing the construction QA Program and its commitment to 10CFR50, Appendix B.

Chapter 17.1 was removed from the FSAR in November 1980 when it was determined to be unnecessary after the NRC had approved the QA Program in the PSAR. A new effort was launched in 1982 to reestablish Chapter 17.1 in the FSAR. It was submitted for NRC approval in early 1983.

As an example, ANSI N45.2.6-1973, which deals with the certification of inspectors, was committed to for the first time in Revision 15 of the FSAR. This revision was submitted to the NRC in August 1976, and provided to CG&E QA in September 1976. Research of the files indicated that the implementation of this standard into quality-related procedures was not effected until August 1978.

From a review of available documentation and interviews with key personnel, it was found that, until recently, there appeared to be no formal mechanism to assure that QA program commitments were implemented into procedures and instructions for quality-related activities.

Periodic outside audits and observations pointed out noncompliances of procedures and practices with the FSAR and ANSI standards. For the most part deviations were brought to QA's attention through these outside audits, as opposed to their being detected through internal reviews and audits of the FSAR commitments versus actual practices. Further, little documented evidence could be located to indicate that CG&E provided controls to ensure that its subcontractors also implemented the same commitments.

The Science Applications, Inc. (SAI) Management Audit of October 1980 found noncompliances with the FSAR and ANSI Standards and recommended the establishment of a Company policy toward Regulatory Guides and Standards.

Subsequently, there was some effort to push for compliance to FSAR quality commitments and the IAL of April 1981 brought new emphasis to this effort.

CG&E procedures were developed to track FSAR, Code, NRC, and other commitments after the 1981 IAL. These procedures assign responsibility to QAD to track 10CFR50.55(e) and NRC inspection commitments, which was done. However, management did not clarify who was responsible for tracking FSAR commitments, and in March 1982, in CG&E letter commitments to the NRC, LEAD was made responsible for performing these functions. However, because of a breakdown in communications among CG&E managers, LEAD assumed that NSD was performing the functions, NSD assumed that QAD or LEAD was performing the functions, and QAD assumed some other group was performing the function because its responsibility was clearly defined. As a result, by this time, it was difficult to establish the FSAR quality commitments.

There is evidence that, since the IAL, proposed FSAR changes have been routed among CG&E departments for review, including QA. CG&E finally assigned total responsibility to LEAD in 1983, including the tracking of PSAR Codes and Standards commitments.

4.3.2. Assessment of CG&E Evaluation of Quality Problems (D3)

This subtask involved the review of the results of evaluations performed by CG&E to investigate major quality-related problems at Zimmer. The thoroughness and accuracy of these evaluations and the actions taken by management to implement recommendations were also examined. Other observations of the Task D team relating to this subject can be found in the Section 4.3.3, observations on CG&E Overview, Corrective Actions/Cause Analysis, and Tracking Systems. The following topics were addressed as part of this subtask:

1. Extent of evaluations.
2. CG&E evaluations of contractors.
3. Evaluations by outside agencies.

4. Evaluations of deficiency reports.

5. Special evaluations.

4.3.2.1. Extent of Evaluations. During the early years, and through the initial construction period, there is little evidence to indicate that comprehensive evaluations of quality problems were performed by CG&E QA. This may have been primarily due to: (1) CG&E's reliance upon its contractors to execute an effective and comprehensive QA program, (2) the initial small staff of CG&E QA people who were concerned primarily with audits and surveillance and were later assigned all QA activity responsibility without a significant increase in manpower, and (3) CG&E QA appeared to be primarily concerned with resolving immediate problems, as opposed to establishing problem evaluation and prevention techniques. Recently there have been a few substantial evaluations of quality-related problems.

4.3.2.2. CG&E Evaluations of Contractors. For the most part, the QA&S group performed audits and surveillance of contractors. On occasion, CG&E did require HJK to evaluate its own Q/ ;ram deficiencies in the early years. However, little documented evidence could be found that CG&E performed similar evaluations. The QA&S emphasis was on the resolution of audit findings to solve the immediate problem, rather than conducting an in-depth analysis to resolve deficiencies on a system-wide basis.

4.3.2.3. Evaluations by Outside Agencies. Beginning in 1978, management audits performed by outside agencies began detecting numerous problems with the CG&E QA Program and indicated that trends and analyses were not being performed on a regular basis. QA proposed the performance of a semiannual analysis of NRs which was performed at least once.

4.3.2.4. Evaluations of Deficiency Reports. Periodic attempts have been made to perform evaluations of quality problems identified on various types of documents such as CARs, AFRs, and NRs. Limited success has been achieved due to three principal reasons: (1) CARs, AFRs, and NRs, etc., were slow in being processed, resulting in evaluations being performed long after individual problems were noted; (2) when the documents were eventually received they had a tendency to be inadequate; and (3) there was a lack of sufficient manpower.

The slowness in the processing of these documents has been attributed to what appears to be a somewhat casual attitude in meeting commitments for CARs, AFRs, NRs, NRC Inspection Reports, and 10CFR50.55(e) reports. Furthermore, evaluations of CARs themselves revealed they were generally inadequate or incorrect and no systematic procedure was followed to bring potentially serious problems to the attention of appropriate management levels for resolution in an acceptable period of time. Lack of personnel to perform expeditious evaluations remains a current problem.

4.3.2.5. Special Evaluations. On occasion, special evaluations have been performed by QA on major problems. In some cases the final document merely represents an apparent manual compilation of data with no summary evaluation or recommendation. Other cases of more recent vintage, however, appear to reflect a more intense effort to analyze the problem and provide recommendations for corrective action. Typically these evaluations are prepared for, and issued to, the QA manager, with limited distribution. In some cases such evaluations were relayed to the Vice Presidential level.

4.3.3. Evaluation of CG&E QA Program Implementation (D4)

This subtask consisted of a review and evaluation of CG&E implementation of the QA program to determine its adequacy and to recommend measures needed to ensure that construction can be completed in compliance with NRC Regulations. The following specific areas were evaluated:

1. Work instructions.
2. Training and indoctrination.
3. Qualification and certification.

4. Procurement controls.
5. Design controls.
6. PSAR/Code controls.
7. CG&E overview.
8. Records.
9. Control of nonconformances.
10. Corrective actions/cause analysis.
11. Tracking systems.

4.3.3.1. Work Instructions. In order to evaluate management's establishment, maintenance, and implementation of subtier procedures; and instructions for work and inspections that affect quality; the following elements were reviewed:

1. CG&E QA practice regarding work instructions and working-level procedures.

2. CG&E QA master documents for development of subtier procedures.

3. Historical problems with work instructions.

A large portion of the information collected relating to the generic term "work instructions" also relates to the other elements in this subtask. This is particularly true of specific comments which are contained in Procurement Controls, Design Controls, CG&E overview, Control of Nonconformances and Corrective Actions/Cause Analysis. Since these specific comments are more appropriately placed in the above subjects, only a broad overview of work instructions will be addressed herein. Task F also addresses work instructions in relation to CG&E interfaces with major contractors, and may be reviewed for additional observations and conclusions.

CG&E Practice Regarding Work Instructions

At the beginning of construction, it was CG&E's policy to rely upon each contractor to provide its own procedures, work instructions, construction activities, quality assurance, and inspection. CG&E retained an obligation to perform audits and surveillance of these activities. It appears that CG&E soon began reviewing and approving construction procedures of HJK, as well. Typically, HJK would perform this same task of its subcontractors. At the present time, CG&E's practice is to prepare its own QA procedures and to review and approve contractor procedure and work instructions.

As construction progressed and problems arose, CG&E took a more active role in the review of construction procedures, work packages, and completed records, particularly those of HJK. As noted in Subtask D5, CG&E assumed more control as construction activities increased and problems with work packages and associated records mounted.

Master Documents for Procedures

CG&E's original philosophy on project procedures encouraged the major contractors and subcontractors to develop their own procedures and subtier work instructions using the OPP and the Quality Assurance Manual (QAM) as the master documents. However, the original OPP (issued in 1972) and the original QAM were extremely broad documents which covered only the bare essentials necessary to get the project started. Specifically, they were weak on design control at precisely the time when control was extremely important. The OPPs and the QAM were evolutionary documents which became more comprehensive as time progressed, but their early weakness set the stage for a number of problems with subtier documents to follow. The CG&E QAM was the sole QA document until 1977, when additional subtier QA Procedures were issued in order to provide greater detailed requirements in specific areas.

Historical Problems with Work Instructions

Initially, work package preparation was apparently a relatively uncontrolled process primarily due to CG&E's failure to provide an effective procedure for their compilation, verification, completion, and use. Work packages were evidently initiated by HJK and subcontractor engineers and passed as being complete. As a result of pressures to expedite the schedule and minimize cost associated with idle craftspersons, the packages were issued incomplete with the apparent attempt to perform at least part of the work and maintain the schedule. It is estimated that over 50% of the packages were subsequently rejected by the crafts as being so incomplete as to be unworkable.

In addition to problems with ensuring that work packages were complete, in later stages of construction it was discovered that individual elements within the packages were being altered, voided, or discarded, which exacerbated deficiencies already existing in other areas (e.g., control of nonconformances, corrective action/cause analysis, and records).

Problems with work instructions and the scope of work continued during the construction activities of both RCI and CI. CG&E did not appear to exercise much control over RCI's procedures or instructions. On the other hand, CG&E was in the review/approval cycle for all of CI's construction procedures and Controlled Work Packages for essential equipment. Nevertheless, the NRC ultimately identified a number of concerns, including inadequate control of work assignments and incomplete work packages.

Problems related to the use of HJK's Weld 1 Form, Welding Procedures, Radiographic Weld Identification, and Welding Inspection and Surveillance forms constitute a case in point. The TPT Team reviewed records which show that welding instruction and control problems appeared frequently from 1975 to 1983. A second case in point is the consistency of problems cited from 1973 to 1983 regarding overall control of the design document system. Welding procedures/documentation and design documents are essential parts of the work instructions provided to the crafts and the instructions provided to inspectors and QA personnel.

4.3.3.2. Training and Indoctrination. In order to evaluate management's establishment and implementation of appropriate quality-related training and employee indoctrination programs, the following elements were reviewed:

1. CG&E management philosophy with respect to training.

2. Determination of training requirements.

3. Distribution of training information to cognizant management personnel.

4. Timeliness and effectiveness of QA training.

CG&E Philosophy

From the beginning of construction to 1976 there is little evidence that formal training in nuclear QA practices occurred, contrary to the requirements of Criterion II of 10CFR50, Appendix B. Most training in nuclear QA was accomplished by on-the-job training. It appears that the CG&E QA organization was involved in the contractor's indoctrination and training programs. However, the CG&E involvement did not always encourage training. CG&E QA directed HJK QA not to go overboard on training activities, but instead to save such training exercises for inclement weather days. The emphasis here is clearly to minimize cost and enhance productivity. It may be reasonable to assume that this same philosophy affected the degree of training among the few CG&E QA personnel. However, training in nuclear QA practices and principles was especially needed because of the lack of nuclear experience among the employees. Currently, it appears that training and indoctrination programs are recognized and are being conducted.

Determination of Training Requirements

From the beginning, specific training elements were added, generally as a result of problems noted in the various deficiency reports in use at a particular point in time. Quality Assurance training requirements were generally established by each CG&E department, the training was conducted by each department, and records were generally tracked and filed by department.

The QAD training program also appeared to be an reactionary process, slowly increasing in depth and scope as construction progressed and as more CARs, NRs, AFRs, etc., were initiated. Early emphasis on keeping costs to a minimum was evidently a factor in the lack of depth and the timeliness of the training conducted. The low level of QA staffing, and the many tasks that these individuals had to perform, tended to prohibit the dedication of an individual to establishing and implementing a comprehensive training program.

Training Information to Management Personnel

Management information systems to appraise managers of training requirements consisted generally of computerized lists of training classes conducted, and training which was due but not yet completed. Employee indoctrination programs to ensure that employees understood the difference between nuclear power plant construction requirements and nonnuclear plant construction requirements were generally not effective. Little evidence was found to indicate that management considered training to be one of the important elements of 10CFR50, Appendix B.

The site training program is still evolving. As a result of pressures since the IAL and SCO it was felt from interview comments that the importance of proper training is now generally recognized. However, problems are felt to still exist. The computer system used to document training that has been conducted, and training sessions that are due, has been inoperative for some time and a backlog of four month's data is accumulating in the QAD training office. Handwritten notes are used to maintain the records. Little evidence was found to indicate that a planned, systematic approach to define training requirements is being pursued even today.

Training Effectiveness

The TPT evaluation team observed that the majority of training up to the present (at least training to increase construction effectiveness) involved a cursory exposure to new and revised company manuals, procedures, instructions, and directives. For example, in one case, a class was held to train two people in Welder Performance Qualifications. The lecture included Quality Confirmation Program Procedure (QCPP) 9.21 Rev. 0, Section IX of the American Society of Mechanical Engineers (ASME) Code, and Section 5 of American Welding Society (AWS) D1.1. The class lasted one hour and thirty-five minutes. For the three publications cited, and for the amount of time recorded, it is difficult to appreciate the degree to which these persons were trained. More importantly, the extensive changes in procedures, forms, and manuals (which reflected philosophical changes in the content and application of the QA program over the years) necessitated an extraordinary number of short training sessions since the IAL, which probably did little to enhance the overall construction quality. Training that QA management and supervisory personnel received appears to be the same as that given to other QA personnel. Little evidence could be found to indicate that training sessions have been established for QA managers in management philosophy, management systems, and management techniques.

Recent actions have been taken to centralize the training program under the Nuclear Services Department (NSD) and to appoint a training coordinator on the Zimmer site. These actions are considered to be a positive step in correcting training programmatic deficiencies. The impact of these changes, however, has not generally been felt at the department level. Further, the present centralized training established under NSD appears to be primarily aimed at training for plant operations.

4.3.3.3. Qualification and Certification. In order to verify that CG&E Management is ensuring that personnel performing quality-related activities are certified as being trained and qualified to perform those activities, the following elements were addressed:

1. Personnel qualifications.
2. History of qualification problems.
3. Use of outside contract personnel.
4. Training to qualify/certify.

Personnel Qualifications

Record searches and interviews with personnel at the Zimmer site did not reveal adequate evidence demonstrating that early attention was given to the necessity for specifying requirements for qualified personnel involved in quality-related work. While craft inspector qualifications and certifications for code-related work were generally addressed, it appears little was done to establish the qualifications for other key QA personnel.

During the initial years of construction, the nuclear power industry generally obtained QA personnel from the ranks of its engineering staff, as did CG&E. The first QA manager (originally called the QA&S Principal Engineer) was considered well versed in the applicable ASME codes and other relevant standards which existed at that time. During his tenure, new regulatory requirements continued to be imposed on the nuclear industry, particularly with respect to codes and standards relating to quality requirements for nuclear power plant construction and operation. Despite the widespread awareness within the industry of the increasingly important requirement for experienced QA managers and engineers, CG&E elected to assign another in-house engineer as the QA manager when the original manager retired in 1976.

This attitude appears to have also prevailed with respect to the selection of auditors and QA supervisors during those critical early days when the mode of operation of the entire quality presence was formed. The lack of experienced and qualified nuclear QA personnel on site inhibited QA's ability to recognize the seriousness and magnitude of construction QA problems and to get them resolved. Interviews with QA personnel who had worked on the project since the early days of construction revealed that some of them felt neither they nor their managers were adequately trained or qualified in nuclear QA requirements.

History of Qualification Problems

The formal qualification of some CG&E QA personnel to nuclear QA standards does not appear to have taken place until after the major construction was completed. For example, Section 4.3.1 indicates that working-level QA procedures did not implement the requirements of ANSI N45.2.6 (which specifies qualification criteria for inspection, test, and evaluation personnel) until 1979, although committed to in 1975. Further, Section 4.3.1 also indicates that QA auditors were not qualified to ANSI N45.2.23 until 1979. Other problems relating to the lack of sufficient qualification/certification of CG&E personnel involved in quality-related work have been discussed in Training, Design Control, CG&E Overview, and Control of Nonconformances and will not be repeated here.

In 1976, the NRC cited CG&E for having no formalized training program for the indoctrination of QA/QC personnel, and for lack of means to verify that suitable proficiency was achieved and maintained. Also in 1976, the NRC cited CG&E for not providing training and indoctrination of Reactor Control QA personnel. NRC inspections in 1978 revealed the impact on inspection completions of the lack of qualified inspectors.

Use of Contract Personnel

The record review indicated that the restrictive hiring policy imposed by CG&E led to the practice of extensive reliance on contractor (job shoppers) inspection personnel for whom HJK had no previous history or confidence and, during one period of construction, led to the use of co-op students to assure quality. The qualifications of these job shoppers and co-op students were not reviewed by TPT. On occasion, HJK construction personnel were also utilized for some of the QA workload. The first indication that CG&E felt the need for surveillance of HJK's first line inspection was noted in 1981.

Training

Inspector training has been repeatedly addressed in frequently revised procedures and has apparently remained a problem throughout construction. It was apparently not until the NRC April 1981 IAL and November 1982 SCO that the basic need for experienced, qualified/certified personnel was more aggressively addressed. The qualifications of the QA engineers and auditors appear to have also improved since the IAL. Today's CG&E QA manager is considerably more experienced in nuclear QA than were his predecessors.

4.3.3.4. Procurement Controls. The following elements were addressed in order to assess the degree to which management has controlled purchased items (including the evaluation of the capability and performance of vendors):

1. CG&E assignment of responsibilities for essential and nonessential procurement.
2. Performance of, and responsibility for, vendor surveys.
3. Placement of vendors on the AVL.
4. CG&E review of Purchase Requests (PRs)/Purchase Orders (POs).
5. QA support and overview of the procurement function.
6. Material Traceability Documentation for essential items.
7. Material control, storage, and issuance.

<u>CG&E Assignment of Responsibilities</u>

CG&E and HJK were each responsible for specific types of procurements. In many cases, CG&E procured essential items and materials from its own selected vendors and had the items received, inspected, stored, installed, and perhaps Code-stamped by HJK. However, CG&E made it clear that HJK would not be required to evaluate CG&E bids or recommend vendors for components purchased by CG&E. HJK was assigned the task of receiving and inspecting all essential and nonessential material and equipment, performing source and receiving inspections of its own procurements, storing and issuing material/equipment, and performing vendor surveys to update the HJK AVL. CG&E assumed the responsibility to oversee the HJK procurement function by auditing these activities.

As noted in other sections of Task D, a basic philosophy of CG&E was to invoke QA to the minimum extent acceptable. Zimmer procurement QA activities were therefore limited strictly to Class 1 (safety-related) items which is consistent with the requirements in 10CFR50, Appendix B. Quality assurance criteria were typically established in the S&L specifications and it was generally CG&E policy that the criteria stated therein were all that were necessary. HJK was directed by CG&E not to ask vendors to provide Certificates of Compliance (C of C) for nonessential items unless the S&L specification called for the C of C.

Performance of Vendor Surveys

Throughout the construction of the Zimmer project, HJK has had to request permission from CG&E QA to perform its own vendor surveys, vendor audits, and source inspections. On occasion, CG&E QA denied permission for surveys that HJK had requested. The denials were generally on the grounds that a vendor survey is not necessary to place a vendor on the AVL. CG&E considered review of a vendor's QA Manual to be sufficient to place the vendor of essential items on the AVL, without verification that the described QA program was in place. On the other hand, there have been occasions in which CG&E QA performed a vendor audit along with the QA Manual review.

Placement of Vendors on AVL

The AVL was a particular point of contention between CG&E and HJK. Cincinnati Gas & Electric Company apparently felt that HJK had been performing too many vendor surveys to qualify vendors for the HJK AVL, and directed HJK to limit their surveys only to those vendors who would actually be suppliers (as opposed to potential suppliers). HJK maintained they were obligated to survey vendors to maintain their "N" stamp.

CG&E Review of PRs/POs

One of the contributing factors to the use of unapproved vendors for the purchase of nonessential material, which was later upgraded to essential, has apparently been the lack of CG&E and HJK QA review of the outgoing PO to verify that a qualified vendor was specified. At CG&E, PRs are reviewed to ensure S&L quality clauses have been attached.

QA Support and Overview

Effective procurement controls may have also been inhibited during the early days of construction, when procurement activity is normally the highest, because only one QA engineer was assigned on site, to be followed later by four more. These engineers were responsible for auditing all site activities including the procurement function, performing vendor surveys for CG&E-purchased components, and auditing subcontractors. It was noted that a significant number of procurement problems were discovered after construction was more than half completed, during the period when the number of QA staff on site was low.

Material Traceability Documentation

Numerous NRC audit reports, CG&E internal audit reports, and documents cited problems regarding the AVL, C of C, traceability of heat numbers, the upgrading of nonessential material to essential, the maintenance of material in long-term storage, missing documents and other related procurement problems. Problems relating to control of the receiving inspection function were also evident.

Vendor qualifications were not always well-defined and purchases of materials were made without due consideration as to whether the materials were to be used for essential or nonessential purposes. As a result, quality records were not always received for materials used in essential applications.

Material Control

In addition, instances were noted where material purchased as nonessential was then upgraded to essential and installed. Further investigation revealed the original purchase was made from unapproved vendors. Procurement of items from unapproved vendors appeared to be a problem that continued during the course of construction until the SCO in 1982.

4.3.3.5. Design Controls. This subtask was performed to assess QA management's effectiveness in establishing design control processes and practices for major contractors. The following elements were reviewed:

1. Assignment of responsibility for design control.
2. History of design control problems.
3. CG&E audits of S&L.

Assignment of Responsibilities

As noted in other sections of this report, it was generally CG&E's policy to rely upon the Contractors' QA Programs to provide the necessary quality assurance, while CG&E provided an overview. This practice was not uncommon or inappropriate in the nuclear industry. Thus, S&L was charged with developing the design of the Balance of Plant (BOP) and GE was responsible for the design of the Nuclear Steam Supply System (NSSS). New designs were issued directly to the HJK Drawing Control Center without the necessity of CG&E Engineering or QA review. Design changes that were initiated at Zimmer, however, were reviewed by the CG&E GED, and QA, and then by the designer. Work was not to proceed until approval of the designer was obtained. This review of design changes and performance of audits of S&L and GE design functions were the two primary design control mechanisms implemented by CG&E.

History of Design Control Problems

In 1977, during construction, DDCs to S&L drawings were initiated in large numbers. Many design deficiencies were not being discovered until after installation was in progress. CG&E QA later apprised CG&E GCD that all construction must be performed to S&L approved drawings. DDCs initiated against these drawings must also be approved by S&L before implementation of the change.

There have been many thousands of DDCs that have been initiated against S&L designs at Zimmer. Some DDCs took literally years to get back from S&L. By 1979, CG&E QA was concerned how HJK was going to ensure that the as-built configuration of the plant would coincide with the latest drawing revisions. CG&E apparently did not follow-up on this concern, because the following year it was determined that many as-built drawings did not agree with the S&L design drawings, DDCs had apparently not been initiated to update the design drawings, and HJK inspectors were inspecting to the as-built drawings instead of the design drawings.

It was during this period, 1980, that confusion seemed to exist as to whether CG&E QA and the NED should be reviewing design changes at all. CG&E QA first decided that QA review of S&L DDCs and GE Field Dispositions (FDIs) and Field Deviation Disposition Requests, (FDDRs) was not required because QA did not participate in the initial design review. Later, when it was pointed out that the FSAR required QA review, QA's reaction was to revise the FSAR to delete the review requirement. A year later there was an apparent loss of control of DDCs. GCD was allegedly making hardware changes before S&L approved the DDCs; however, QA was not in the DDC review cycle, and QC was apparently not performing the inspections of the changes.

In at least one circumstance, it appears that inspections were performed using conditionally-approved design documents for more than four years. Other indications of design control problems were that permission was apparently given to erect, prior to receipt of approved S&L drawings; conditionally-approved or nonapproved design documents were filed in the HJK Document Control Center; design documents were voided without substantiation; S&L engineers were working on site with drawings not properly marked to indicate status, e.g., "for information only;" inspectors inspected hardware to as-built drawings that differed from the approved design drawings; and construction and inspection were performed to DDCs that had not yet been approved by S&L. As noted in the Design Control section of Section 4.3.3, it was Zimmer-stated policy that all construction must be performed to S&L approved drawings and to DDCs approved by S&L before implementation of the change. These conditions violated Criteria III and VI of 10CFR50, Appendix B, as well as the CG&E QA Manual.

CG&E Audits of S&L

During most of the construction period, few field audits of S&L were conducted and most of these appear to be audits which addressed an activity (e.g., NRC bulletins or document control procedures) in which S&L was involved. Annual audits were conducted at S&L headquarters in Chicago, but the first indication of a comprehensive series of audits was September 1978. Audits increased in frequency in 1978 and 1979, apparently as a result of pipe hanger problems. In 1980 and 1981, only four audits were conducted. In 1982, the frequency increased significantly to ten audits, which correlates to the IAL and SCO pressures which were brought to bear on CG&E.

4.3.3.6. PSAR/FSAR Code Controls. This subtask was essentially covered under Section 4.3.1. However, a few more comments can be offered on the delegation of the responsibility for PSAR/FSAR/Code tracking and the interface of CG&E QA to LEAD:

Responsibilities and Interfaces

As noted in Section 4.3.1, the responsibility for tracking design commitments in the PSAR, and later in the FSAR, was unclear. Until about March of 1982, LEAD was responsible for accumulating approved design changes from S&L, interfacing with S&L in the preparation of a revision to the FSAR, and submitting the FSAR revision to NRC for approval. Subsequently, upon receipt of the approved FSAR revision from NRC, LEAD would issue copies of the revision to holders of complete sets of the FSAR. This practice appeared to occur regularly for FSAR sections other than Chapter 17.1, which covered the Zimmer Construction QA Program.

However, it apparently was not LEAD's responsibility to ensure that new or revised ASME Code or ANSI Standard commitments in the FSAR were actually implemented or, conversely, that changes in design criteria were submitted for input into the FSAR. This responsibility appears to have been S&L's, i.e., construction was to be in accordance with design documents prepared, approved, and issued by S&L. Difficulties later arose as discussed under Design Controls, Subsection 4.3.3.5, when construction changes were apparently performed without the initiation of a DDC, or construction changes were performed before an approved DDC was returned from S&L.

In any event, the IAL of April 1981 caused a review of the current design. This review resulted in the very large Revision No. 75 to the FSAR, in order to bring it up-to-date.

4.3.3.7. CG&E Overview. This subtask was performed to determine the degree to which CG&E established and implemented effective programs in the area of audits, surveillance, inspection, and independent assessments of contractor activities. The following topics were reviewed:

1. CG&E management commitment to an effective audit program.
2. Depth and scope of audits.
3. Audit planning, staffing levels, and personnel qualifications.
4. Responses and followup to AFRs.
5. Criteria for audit frequency.

Management Commitment

CG&E was committed to 10CFR50, Appendix B requirements during the early years of construction. One QA engineer was assigned to perform on-site field audits and vendor audits, with three more QA Engineers in the CG&E main office. Management audits of the (then) QA&S section of the GED were performed by engineers of other disciplines in the GED (the first QA&S audit by an external auditor was apparently in 1976). In late 1976, QA&S moved to the project site and, in January 1980, the QA&S Section became independent from the GED and became the Quality Assurance Division (QAD), reporting to the Senior Vice President, Electrical Production and Engineering.

Audit Depth and Scope

Early audits were generally limited in scope; each audit normally addressed only one procedure which further represented one element of 10CFR50, Appendix B. The audit depth was often restricted to one facet of one of the Appendix B criteria, e.g., "purchase of essential piping material." From April 1973 through 1976, the CG&E audit group performed approximately 81 audits for an average of approximately 20 audits per year. Although construction activity was high during this period, a significant portion of the 81 audits was dedicated to auditing narrow aspects of construction activities, as opposed to ensuring that the broader aspects of 10CFR50, Appendix B were being effectively implemented.

By 1979, the NRC noted that CG&E QA audits were not aggressive enough and required improvement. Some improvement had been noted by the NRC since the May 1979 IAL; however, CG&E appeared to be waiting for NRC to identify nonconformances.

Without systematic and comprehensive audits, it appears that CG&E QA did not detect the subsequent RCI problems. This observation is based on the fact that the SWO that CG&E issued against RCI in December 1980 was issued after the NRC strongly suggested that it be issued. The NRC had previously investigated RCI's activities at the LaSalle Nuclear Plant and had a number of concerns. A subsequent CG&E investigation indicated that RCI was going to have to prepare detailed procedures addressing design criteria, design information flow paths, and the responsibilities of S&L, RCI and CG&E. It appears that QA eventually reviewed and commented on some of these new procedures.

Audit Planning, Staffing, and Personnel Qualifications

Prior to 1979, difficulties were being experienced in obtaining timely and acceptable responses to AFRs (Audit Finding Reports). Since 1979, it is apparent that audit planning and execution generally did not address all 18 criteria in 10CFR50, Appendix B. The first indication that the provisions of ANSI N45.2.12 were implemented was apparently in November 1980.

After the April 1981 IAL, a formal audit group was established with a director reporting to the QA Manager. Increased emphasis on expanding the scope of the audit program is evident since that date, and management support is evident by the increased number of auditors that have been assigned to the QAD Audit Group. The number of qualified personnel assigned to perform the CG&E overview/audit function, however, is still apparently insufficient to allow audits to be performed to the depth required to ensure that provisions of 10CFR50, Appendix B are being implemented. Despite the obvious progress, an audit conducted in November 1981 by the General Electric Company indicated that HJK in-process and internal auditing was not being performed as required. CG&E had a direct responsibility to oversee the HJK audit program, but apparently failed to do so. It was during the post-IAL period that NRC once again observed that CG&E audits were insufficient in some identified areas.

Responses and Followup

It is apparent that problems in obtai ing satisfactory responses to AFRs have existed from the start of construction and remain a problem to the present. In October 1982, some AFR responses had been overdue by as much as two years.

Audit Frequency

In past years, up to and including the present, the frequency of auditing particular activities seems to depend primarily upon the amount of work activity (output) which each activity exhibits, as opposed to the importance or complexity of the activity.

For example, during 1976, CG&E assumed the role of construction manager from HJK and assumed QA control of subcontractors from HJK. From January 1977 through 1979, approximately 212 audits were performed by the CG&E audit team for an average of almost 71 audits per year. During this period it appears that the audits were still not effective in ensuring that 10CFR50, Appendix B was being implemented effectively. During the period 1971 through 1977, the NRC had conducted a total of 49 inspections of their own, and 21 of the 49 inspections reported 46 infractions and 5 deficiencies. It is not apparent whether AFRs were distributed above the Vice Presidential level during the early years but, in August 1977, a policy was implemented in response to an NRC concern which directed that all significant findings be brought to the attention of the President of CG&E.

Based on further information in Task C, regarding the extent and number of NRC inspections, CG&E management should have increased its audit frequency as NRC inspection findings were received.

4.3.3.8. Records. In order to assess the degree to which CG&E management established and implemented a quality records control system which meets requirements for assuring validity, accuracy, completeness, and traceability of records in a retrievable manner, the following topics were reviewed:

1. Availability of records.
2. Collection and control of records and working documents.
3. Record retrievability.

Availability of Records

This subject is covered under Document Control in Section 2 (Task B).

Collection and Control of Records

In 1976, when construction was almost half completed, 30% of GE design documents were found to be missing from the HJK Configuration Control Center (CCC). Also in 1976, in an agenda published for a CG&E/HJK meeting, generic problems with HJK QA/QC are listed and include, among other problems: (1) lack of a procedure to assemble inspection records and QA documentation at the time of system turnover, (2) no verification that inspection records at the time of turnover are to the latest design documents, and (3) that inspection records were being kept in many different locations on the project site. In 1977, CG&E's Field Audit of the HJK QA Record System found that, with a few exceptions, the system was functioning satisfactorily.

In 1978, an NRC inspector discovered that voided NRs had not been filed as records. In 1980, CG&E discussed procedures for transferring document custody from HJK to the CG&E Energy Production Department (EPD), citing the massive clerical effort involved (HJK QA records were actually moved to CG&E on April 7, 1981), and also the problem regarding searching and accumulating document packages. Management discussions were conducted as to whether records management should be a responsibility of the EPD. During this period, CG&E QA management criticized HJK for keeping partially completed records in the field for six years (in the case of one document), four years for several more documents, and for having a drawerful of unsorted, unfiled, and loosely stacked documents.

In late 1980, CG&E QA decided to transfer concrete placement records to the EPD so that EPD could get experience in receiving, sorting, indexing, filming, and retrieving records. This seems to represent the first evidence of a dedicated effort designed to collect and control historical records. In 1980, problems still existed concerning record locations not being controlled in conformance to procedures. Also in 1980, the QAD evidently found it necessary to provide directions to the GCD concerning actions to be taken to improve the quality of documents for record storage.

In 1982, CG&E could not locate four types of missing records and requested HJK to provide them. These missing records were needed to avoid writing CARs/CERs/NRs on procedures that may well have been fully qualified, but that had an indeterminant qualification status due to insufficient records on hand. Also in 1982, the CG&E QA Manager requested that HJK provide selected copies of internal audit reports which CG&E did not have.

As of the date of this report, problems still existed with records control. An evaluation of In-Process Inspection Deficiency Reports (IIDRs) concluded that a problem with finding IIDRs for review exists, and further concluded that the system for controlling and tracking IIDRs was extremely difficult.

Record Retrievability

This subject is covered in Section 2.3.3 (Task B).

4.3.3.9. Control of Nonconformances. In order to assess the degree to which CG&E Management established and implemented an effective system for documenting and reporting deficiencies, including reports to the NRC and policy/procedures for implementing "stop work," the following elements were evaluated:

1. Effectiveness of the deficiency reporting system from 1970 to the present.

2. Management awareness of problems.

3. CG&E QAD use of "stop work" authority.

Effectiveness of Deficiency Reporting System

It was found that there was apparent confusion and shifting of policy regarding the effective utilization and administration of the Nonconformance Report (NR) from the start of construction until after the SCO.

Early in the construction period, CG&E and KEI apparently struggled with the problems of determining what kind of deficiencies should be recorded on NRs. The NRs were apparently being written for every discrepancy, including cleanliness violations and procedural discrepancies. Since procedures called for the initiation of a Hold Tag as well, for nonconforming items, it was impracticable to place Hold Tags on document discrepancies.

In order to improve the effectiveness of the system and to resolve these problems, CG&E directed the implementation of CARs for (generally) procedural deficiencies; IIDRs for discrepancies that could easily be reworked before final inspection; Condition Evaluation Requests (CERs) ; and, later, Management Corrective Action Requests (MCARs) for documenting (generally) a series of related deficiencies. CERs are used to document discrepancies in the field and are forwarded to Quality Engineering, who determine if an NR or CAR is to be initiated, and if the discrepancy involves a 10CFR50.55e reportable deficiency. The CER is also used to increase communication between line and staff QA personnel without formalizing that communication with the NRC.

As more methods were developed to document discrepancies and deficiencies, CG&E appeared to lose control of the nonconformance reporting system. Some of the typical problems that arose and violated various Criteria of 10CFR50, Appendix B or the CG&E QA manual, included the following:

1. The quantity of reports posed a much larger workload than the on-site staff could handle.

2. Apparent failure to identify root causes of deficiencies.

3. Failure to specify effective means to prevent recurrence of deficiencies.

4. Failure to control the issuance, disposition, and voiding of NRs.

5. Lack of a means to document deficiency trends in order to take effective corrective action.

6. Since some of these reports required a suspension of work, and a requirement for reinspection, the impact on the construction schedule was an obvious concern, and instances of working around these hold points were discovered.

7. A lack of training or conformance to the requirements for filling out the reports.

8. Outstanding NRs were sometimes dispositioned by inappropriately voiding them and HJK was purported to be physically changing NRs in an inappropriate manner.

9. NRs were not dispositioned by contractors in a timely manner; some remained open for years without resolution.

10. Discrepancies were recorded on CARs or IIDRs when they should have been recorded on NRs.

Management Awareness

In the April 1981 IAL, the NRC seemingly recognized that the nonconformance control system was out of control, by referencing problems in nonconformance reporting in three of the ten paragraphs of the IAL. Records indicate that CG&E was aware that a serious problem had existed in this area since 1977 but failed to take effective corrective action when needed.

Since the SCO, significant improvements and attention have been noted in both management control of the system and in correcting past problems. However, the work required to establish control of the system is still significant and this control, once established, must be demonstrated.

CG&E Use of Stop Work Authority

During the early construction years, the authority for approving and issuing SWOs was vested in the Construction Manager, not the QA Manager. This authority was eventually transferred to the QA Manager, and an examination of the QA files indicates that a number of SWOs have been issued by QA. Available evidence and interviews seemed to verify that SWOs issued since the IAL have been effective in stopping work.

4.3.3.10. Corrective Actions/Cause Analysis

This subtask was performed to assess the degree to which CG&E management established and implemented a system to ensure that significant deficiencies are investigated and corrected promptly by an effective priority action system, including a means for assessing the cause of problems and an analysis of deficiency trends. The following elements were evaluated:

1. Management awareness of the status/problems of the corrective action system.

2. Management's action to resolve problems.

3. Analysis of deficiency trends.

Management Awareness

Recurring problems relating to CG&E's control of the corrective action system are evident from the beginning of construction until the present. It is further apparent from documents examined that CG&E management, up to and including the Vice President, was aware of the problems relative to timely resolution, but there is little evidence to indicate that an effective, systematic effort was initiated to track, analyze, and correct systematic or generic deficiencies until after the SCO. Comprehensive analysis of problem cause is still an apparent need, and actions to correct related deficiencies, after a deficiency is discovered, are not generally evident, with the exception of the present QCP. Primary emphasis seems to have been placed merely on the correction of the immediate problems.

Management Action

During the construction period of 1976 and 1977, CG&E QA pressed HJK for better corrective action responses on NRs. Although the need for action to prevent recurrence of discrepancies was considered, there appeared to be a reluctance to state lack of personnel training existed, because it would reflect on the QA and Construction Programs.

An increasing degree of attention and emphasis on timely followup was noted from 1979 to the present which roughly corresponds to the period of increasing NRC audits in 1978, independent management audits in 1978, and the first IAL in 1979. The QA group also still appears to have difficulties in obtaining corrective action responses and followups from individuals.

Analysis of Deficiency Trends

Positive efforts to institute a system to develop trends of different deficiencies were noted, although an effective system has not yet been developed. It was also noted that the 1982 Monthly Activity Reports contained trending information on classes of discrepancies, but that these graphs appear to have been dropped from the 1983 reports. Trending actions prior to 1982 do not appear to have been a part of CG&E's QA program, although they did on occasion request such information on a case-by-case basis from HJK.

4.3.3.11. Tracking Systems. In order to assess the degree to which management established and implemented an effective means for tracking activities, action items, open items and the follow-up of problems, the following elements were evaluated:

1. CG&E practices relative to tracking open items (e.g., NRs, CARs, MCARs, AFRs, IIDRs, CERs, NRC Commitments, DDCs, etc).

2. CG&E management's emphasis on effective tracking of open items.

3. FSAR and letter commitment tracking.

CG&E Practices

Related discussion information can be found in Task C and Subtask D.4 "Control of Nonconformances," "Records," and "CG&E Overview." There appeared to be no formal tracking system of various types of commitments during the early construction years. When efforts were directed in 1982 towards ascertaining the status of outstanding NRs, CARs, AFRs, etc., it was discovered that some had been open for nearly three years and still required resolution.

Although a review of letters and memos indicates an awareness of outstanding items, little evidence was found to indicate that the problem of consistent follow-up was either solved at the middle management level or elevated for resolution to upper management. Some improvement in tracking outstanding audit findings commenced in 1979, which corresponds approximately to increased NRC audits in 1978 and the first IAL in May 1979. However, cases were found in February 1983 in which the tracking of individual Audit Finding Reports has apparently broken down, allowing these AFRs to remain open for two to three years without an interim query from the CG&E QA audit group. Similarly, the lack of an effective tracking system has allowed NRs and CARs to remain outstanding for years as well.

Management Emphasis

The CG&E QA group was assigned the responsibility for reporting 10CFR50.55(e) deficiencies to the NRC in 1977 and procedures were developed. A system to track the status of these deficiencies, as well as NRC IRs, was established in January 1981. Since this time, and up to the present, QA appears to have established an effective, computerized method for tracking these items. In addition, GA has established a tracking list for NRC concerns since the IAL. Although some assigned action items to the NRC concerns have been months overdue, the tracking system seems to be working. Tracking activities, and the attendant follow-up and evaluations, are being performed by the Quality Engineering group of QAD. There are indications, however, that these responsibilities are interfering with the other Quality Engineering functions and could be just as easily be performed by others.

FSAR and Letter Commitment Tracking

A method of tracking FSAR commitments and CG&E letter commitments was established procedurally in 1981 with moderate success. Responsibility for this task appeared to become confused in 1982 and the tracking system deteriorated (see Section 4.3.1). It appears to have been firmly reestablished with LEAD in early 1983.

4.3.4. Evaluation of CG&E QA Program Interfaces (D5)

This subtask consisted of an evaluation of CG&E's QA program interface relationships with its major contractors including S&L, HJK, GE, RCI, and CI. The evaluation also addressed the quality-related interfaces between CG&E's QA, Engineering, Construction and Operations organizations, to ensure that the QA Program structure and supporting procedures necessary to effective implementation are in place.* Topics evaluated included the following:

1. Establishment of authorities and responsibilities.

2. Lines of communication and authority.

3. Interface between QAD and LEAD.

4. CG&E QA audits and surveillance of contractors and other CG&E departments.

5. CG&E QA participation in schedule and project status meetings.

6. CG&E QA independence.

7. CG&E QA concurrence on quality-related procedures and work packages.

8. CG&E interfaces with GE, S&L, RCI, and CI.

4.3.4.1. Establishment of Authority and Responsibility. The initially small QA Group relied heavily on the design engineers' (S&L and GE) QA Program for design control, and on the Constructor's (HJK) QA/QC Program for procurement and construction control. The QA&S section retained responsibility for auditing and surveillance of the design and construction activities.

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*The subject of "program interfaces" necessarily duplicates some material covered in Tasks B and F (Sections 2 and 6). It is presented here only to the extent relevant to the QA program.

Within CG&E, the Manager, Construction Department was delegated the responsibility for the management of construction work and ensuring that all construction work was performed in accordance with approved drawings, specifications, procedures, and instructions. All requests to stop work had to be authorized by the Construction Manager. In later years, stop work authority became the responsibility of the QA Manager.

A single Field QA Engineer was assigned to perform audit and surveillance of construction activity at the site until 1976. The remaining QA engineers remained at the main office to audit procurement documents, design documents, etc., and interface with the engineering groups. According to an early QA Manual, with revisions to 1976, QA&S had the authority to contact appropriate people directly in other organizations on quality matters; and any flow of QA information between S&L, GE, HJK, and CG&E had to be routed through QA&S.

Despite CG&E's original position that quality control was delegated to the constructor and vendors, CG&E appeared to become more involved with HJK's daily affairs and QA/QC management. By 1974, HJK had to submit the resumes of its new QA personnel to CG&E QA for approval, as well as its construction procedures. Further, HJK had to obtain permission from CG&E QA to perform vendor surveys, source inspections/audits, and the addition and/or reassignment of QA engineers and inspectors.

The QA&S Field QA Engineer interfaced with the HJK QA Manager directly. Other QA&S engineers interfaced with HJK QA and the other HJK organizations through its audits and surveillance; however, QA&S did not move from the main offices to Zimmer until 1976. This may have interfered with an effective interface and timely resolution of problems.

As construction started, CG&E was responsible for supplier surveys and source inspections of its own procurement and HJK was responsible for these functions for its procurements. It appears very early in the project that the division of responsibilities and authority between CG&E and HJK, as well as the applicable Zimmer QA Program requirements, became unclear. Once HJK had proceeded to implement its QA Program, it was necessary for CG&E to clarify, or establish, the ground rules in a number of QA areas. Initially these areas included procurement document review, quality assurance application to non-Class I items, survey requirements for placing a vendor on the AVL, and vendor data requirements.

By 1980, CG&E was apparently able to exert considerable influence over HJK QA by: (1) directing HJK QA to terminate Kaiser personnel, and (2) reorganizing the Zimmer QA Program to require HJK QA to report to CG&E QA.

CG&E QA began performing 100% reinspections of the inspections conducted by HJK and other contractors. This appears to have created a great deal of friction between CG&E inspectors and HJK inspectors and slowed down work.

QA&S had the authority to contact other CG&E groups directly throughout the major construction period, until 1978, when the QA&S section obtained independence from GED and reported directly to the Vice President, without changes in functions, authorities and responsibilities.

4.3.4.2. Lines of Communication and Authority. There are indications since the IAL that the responsibilities and authorities of the NED, GCD, and QA departments may require clarification. The lines of authority appear to be well documented, but there have been periodic misinterpretations of responsibilities. Various project documents show that the Manager of GCD is responsible for constructing the Zimmer plant according to design requirements. This authority appears to have evolved into a position similar to that of a traditional project manager. The QA group, in practice, acts through GCD for quality-related matters that affect construction, and through NED for quality-related matters that affect design, even though the QA group has the authority to deal directly with contractors on quality-related matters.

On occasion, the QA group requested the Manager of GCD to interact with a contractor on apparent quality-related concerns, such as the preparation of the weld data forms that have become an NRC concern, lack of cleanliness control around safety-related equipment, and the distribution of design documents. Further, GCD has apparently sometimes assumed that it could perform QA inspections because it had contractor responsibility. Recent examples were: (1) the assignment of the Engineering Operating Test Department (EOTD) by GCD to perform inspections, although the inspections were clearly the responsibility of the QA Department, (2) indications that GCD attempted to perform QA inspections after making hardware modifications to DDCs, and (3) an attempt by NED to perform QA audits.

4.3.4.3. Interface Between QAD and LEAD. The interface between QA and LEAD is discussed in Section 4.3.1. Recent improvements since the SCO have better defined the QA/LEAD interface regarding commitment reporting.

4.3.4.4. CG&E Audits and Surveillance. As noted in other sections of this report, audits and surveillance performed by CG&E QA of site contractors provided the primary means for interfacing with the contractors during the construction years. The activities of all major contractors were audited to some degree, while CG&E verified through audits of HJK that HJK performed audits of the site subcontractors.

Scheduled audits at the site and at contractor home offices, and day-to-day surveillance of site construction activities afforded CG&E QA the opportunity to assess the adequacy of all phases of contractor quality activities and obtain corrective action, when necessary, directly from contractor management. Audit reports and supporting paperwork provided documented evidence of audit conduct, interfaces, results, assignment of corective action to specific contractor individuals or groups, and followup requirements. Moreover, problems detected by CG&E audits were discussed as action items at CG&E/HJK project status meetings from time to time.

The adequacy of CG&E QA audits in terms of depth scope, frequency, etc., is discussed in subsection 4.3.3.7.

4.3.4.5. CG&E Participation in Meetings. Joint HJK QA and CG&E QA meetings were conducted periodically throughout the construction of the Zimmer project to discuss construction activities. Project meetings are held routinely to discuss project status, cost, schedule, quality problems, personnel staffing needs, etc. Documentation indicates that CG&E QA actively participated in these meetings. Periodic contact between CG&E QA and HJK QA is formally maintained today through Senior Management Committee meetings, audits, and surveillance and CG&E accumulation and review of quality records.

4.3.4.6. CG&E QA Independence. Prior to 1978 the CG&E QA organization (QA&S) was part of the GED. During this period various revisions of the OPP Manual organization charts indicate that the QA&S group reported to the CG&E President, Senior Vice President, or Project Manager. This arrangement appears to have satisfactorily ensured the independence of the QA&S group from other CG&E groups.

The establishment of the independent QA Department in 1978, recent additions to QA staffing levels, and other proclamations from CG&E management indicate management support for QA independence. Subsection 4.3.4.2 indicates that some documented clarification of the CG&E departments may be needed in order to assure QA's independence.

4.3.4.7. CG&E Concurrence on Procedures and Work Packages. During the early years of construction CG&E relied on its contractors and suppliers to provide an effective QA program for their work. In many cases, the extent of CG&E evaluation of these QA programs was a review and concurrence of their QA Manual. Occasionally, the four-man QA&S group would review construction procedures of major essential construction activities. The extent of procedural reviews was necessarily limited by the small staffing level.

Concerns expressed during, and subsequent to, the April 1981 IAL increased the review of contractor construction procedures, inspection planning, and work packages. These reviews appeared to reach a peak during the site activities of CI. CG&E QA was in the review/approval cycle for all of Catalytic's construction procedures and Controlled Work Packages for essential equipment. During these reviews, CG&E QA established its own hold points, witness points, and other interface requirements. The adequacy of these reviews is discussed further in Subsection 4.3.3.1.

Today, it appears that most construction procedures, quality records, audit reports, and status reports of vendor surveys are submitted to CG&E QA for review and/or approval.

4.3.4.8. CG&E Interfaces with GE, S&L, RCI, and CI. The primary interface with GE has been through audits. GE provided the NSSS design and the necessary QC and QA surveillance to assure compliance with GE specifications and approved design documents. Generally, construction and inspection were provided by HJK. CG&E QA performed audits of the GE activities, and HJK construction activities performed for GE. CG&E QA was on distribution for all GE quality-related documentation. This appears to be the mode of operation during the construction period, and it is TPT's evaluation that this interface between CG&E QA and GE remained essentially undisturbed throughout the major construction period.

Similarly, QA's interface with S&L over the years has been primarily through audits of design activities at S&L's home office. CG&E QA was part of the reviewing cycle for S&L DDCs that were initiated at Zimmer, but elected to discontinue this practice in 1980. It was decided by QA that DDCs do not require QA review because QA did not review the initial design.

RCI was contracted to provide design analysis, construction activities, and QA/QC to an S&L design specification. Since HJK Engineers Inc. was not part of the work effort, it was CG&E QA's responsibility to perform audits and surveillance of RCI.

CG&E QA reviewed and approved the RCI QA manual prior to start of work and subsequent revisions of the manual. Apparently, a survey of RCI was not performed to verify QA Program implementation. However, QA performed periodic audits of RCI work. GCD authorized RCI to perform work at the site via the "RCI Field Order" and NED authorized RCI to perform design analysis work through memos. Any NRs that were initiated by RCI were copied to CG&E QA for input to the CG&E punchlist. QA appeared to have direct contact with RCI on quality matters.

Other problems that were subsequently identified included welding workmanship deficiencies, questionable welder qualifications, inaccurate drawings, etc. These are typical examples of deficiencies that are ordinarily detected by QA audits. However, the CG&E QA&S Section "Log of Field Audit Reports" identifies only seven audits performed on RCI by CG&E QA during an eight-year period. The last audit was performed in February 1979, indicating QA apparently did not audit RCI for almost the final two years of work that RCI performed before the SWO in December 1980. Three of the last four audits, including an audit of welding activities, had no adverse findings. Clearly, CG&E did not audit RCI to all the Criteria of 10CFR50, Appendix B applicable to RCI work. Considering the major RCI problems that were later revealed, it appears that the CG&E audits were not only insufficient in number, but were ineffective.

Catalytic, Inc. (CI) was selected by CG&E GCD to perform the rework of RCI pipe supports and to work off QCP punchlist items. The CG&E/CI contract was signed in August 1981 with QA requirements to 10CFR50, Appendix B, and ANSI N45.2 applicable. The initial task was to primarily complete open punchlist items.

Catalytic's ASME Code Stamps were not immediately applicable to the Zimmer plant, so it was necessary for HJK to certify CI code work. Eventually, the separation of responsibility for CI code work versus HJK code work was established. It appears to have remained HJK's responsibility to maintain CI's controlled drawing stick file for S&L P&IDs, and to ensure that CI had controlled S&L design documents available to them.

CG&E QA had direct contact with CI and the CI QA Manager through: (1) audits of CI's work, (2) review and approval of CI work procedures, (3) review and approval of CI Controlled Work Packages, and (4) participation at periodic project review meetings.

Because of the number of procedures that CI developed and routed through CG&E QA for review, CI work on hardware did not actually start until the summer of 1982. By September, the NRC had identified a number of concerns regarding CG&E's control of CI's work including such things as inadequate control of work assignments to CI, incomplete work packages and weld inspection records, lack of in-process CG&E inspection hold points, and inadequate CG&E audits of CI. CG&E QA appropriately assigned various CG&E individuals the responsibility of investigating these concerns and providing a course of action, or corrective action. TPT was informed that this action has not been completely accomplished.

During the same period, CG&E upper management reassigned CI to work on the completion of punchlist items in the startup effort. Catalytic left the Zimmer site in May 1983.

4.4. CONCLUSIONS FOR TASK D

4.4.1. Compliance with PSAR/FSAR Commitments (D2)

Based on the information available, management did not adequately establish mechanisms to ensure that QA Program requirements committed to in the PSAR and FSAR were implemented in CG&E and subcontractor quality procedures in a timely manner. Once Chapter 17.1 was removed from the FSAR, there also appeared to be confusion by management as to whether those construction QA Program commitments were applicable to subsequent daily quality-related activities. The impact of this situation on the plant is reflected in other conclusions below. Generally, as the project progressed, the application of quality controls within management were not in step with the level, pace, and complexity of the construction activities. However, a system now appears to be in place and the FSAR is being updated.

4.4.2. Assessment of CG&E Evaluation of Quality Problems (D3)

Comprehensive evaluations of major quality problems are of very recent vintage. Inadequate staffing and concentration on resolving individual problems precluded the opportunity for the analysis of problems of broad scope. Individual problems were attacked, but the magnitude and the extent of problems apparently remained largely undetected. Progress has been made in the last year with limited resources, but perhaps only as a result of continued external pressures since the IAL and, more directly, since the SCO. Evaluations and trend analyses are being accomplished today by the Quality Engineering group. It appears that these functions could be more effectively performed by another group within QA that would allow Quality Engineering to direct its attention to more technical matters.

4.4.3. Evaluation of CG&E QA Program Implementation (D4)

4.4.3.1. Work Instructions. CG&E control of the process of developing, maintaining, and implementing subtier procedures and instructions for work, and inspections that affect quality, has been inadequate from the start of construction to the present.

4.4.3.2. Training and Indoctrination. It was generally found that the QA training program of the Zimmer construction project was a reactionary process, increasing in scope and depth as problems were identified. Little evidence of planning, or systematic appraisal of training requirements in advance of specific work commencement, was found. Inadequate staffing and emphasis on the construction schedule and minimizing costs appeared to inhibit the establishment of a formal training program. CG&E QA's training program today appears to consist primarily of many short sessions on procedural changes, with less emphasis on training in job functions and general nuclear QA practices and principles.

The responsibility for the identification of training needs and their implementation has been essentially fragmented among individual department managers. Until recently, there appears to have been little coordination. The recent establishment of a CG&E corporate Director of Training should benefit coordination, especially if construction activities are included in training plans and the QA Department has the opportunity to provide input as to specific needs in quality assurance training.

The impression gained from this review is that management did not appear to recognize the extent of training required prior to construction. Additionally, it is felt that management was relatively unprepared for the problems of organizing and administering such a large construction project, and did not realize the extensive training required to satisfy nuclear regulatory requirements.

4.4.3.3. Qualification and Certification. Effective, comprehensive qualification and certification of QA personnel, for the most part, was not accomplished until after the major construction was completed. This is apparently attributed to: (1) lack of management attention in early years and inability to recognize the complexity of Nuclear QA requirements, (2) failure to implement qualification requirements committed to in the FSAR in a timely manner, and (3) management's overemphasis on minimizing costs and pursuing the construction schedule, relative to the emphasis on QA. Since the IAL, increased management attention has produced substantial progress in this area.

4.4.3.4. Procurement Controls. Procurement controls have been subjected to the same cost and schedule pressures as has been seen in other sections of the Zimmer QA program. An apparent lack of a clear-cut delineation of CG&E and HJK responsibilities and authorities in this area, coupled with ongoing differences of opinion between CG&E and HJK regarding vendor surveys/audits/inspections, vendor data requirements, and Approved Vendor List development have contributed to a number of procurement problems. Corrective action attempts do not appear to have been effective prior to the IAL.

CG&E policy over the years has been basically to rely upon the integrity of the vendors to provide a quality product. This includes reliance on S&L to establish quality criteria in procurement specifications and reliance upon the vendors to meet the criteria. There are indications, however, that management has placed increased emphasis on procurement control after the IAL. This is evidenced by an increase in the Quality Engineering staff performing procurement requisition review for essential items and the scheduling of many more vendor audits. However, review of only the procurement requisition, instead of the outgoing purchase order, will not ensure that an approved vendor is used.

4.4.3.5. Design Controls. Until 1981, CG&E lacked effective control over the design change control function. CG&E should have placed more audit emphasis on field design control procedures. This could have helped identify and correct the design control problems experienced at Zimmer in a timely manner. CG&E has initiated an intensive effort after the SCO to get the system back on track.

4.4.3.6. PSAR/FSAR Code Controls. Zimmer did not have an effective system in place to ensure plant construction in accordance with the Codes, Standards, and other commitments in the FSAR. The numerous design changes, and attendant delay for years in processing of some DDCs, have complicated the process. CG&E has started to amend and update the FSAR, and progress has been achieved in the timely initiation and processing of DDCs that impact Codes, Standards, and other commitments in the FSAR.

4.4.3.7. CG&E Overview. It is concluded that the CG&E overview function was performed initially by a small group of auditors who were technically qualified, but whose management failed to provide sufficient nuclear QA training, direction and support to allow a comprehensive audit program to be executed in accordance with the requirements and intent of 10CFR50, Appendix B. It is further concluded that the intensive audit program was applied too late to ensure that procedures were modified and personnel were performing to those procedures early in the program when the need was most critical. Management's awareness of a deteriorating situation is generally apparent from 1978, and clearly from 1979 on, although the relatively sparse NRC audit findings may have contributed to CG&E's impression that all was well. Finally, it is concluded that CG&E management had no real understanding of the requirement to perform comprehensive audits to 10CFR50, Appendix B, and that this lack of understanding was manifested in the excessive amount of time taken to respond to AFRs and management's apparent lack of emphasis in assuring expeditious responses.

On the whole, it must be concluded that the CG&E QA audit program appeared to be ineffective. This observation is based on the many severe noncompliances that were detected by outside audit groups that should have been detected by the QA audit group. Although there have been recent improvements, the QA audit group is understaffed for implementation of an effective audit program. In addition, criteria need to be established for audit scheduling, scope, and depth.

4.4.3.8. Records. Considering the records examined and team observations, no effective assurance exists that documents to be maintained as quality records are entirely complete, accurate, valid, or readily retrievable. It would also appear that management did not take effective action early in the construction project to ensure the validity and availability of these documents. Quality records control remains a problem today.

4.4.3.9. Control of Nonconformances. As the basic discrepancy reporting document, the NR is prominent in the records examined during this study. Despite allegations that CG&E has attempted to subvert the NR in order to avoid reporting deficiencies to the NRC, it is felt that the introduction of CARs, MCARs, IIDRs and CERs were a result of CG&E's attempts to appropriately refine the system and try to more effectively resolve the problems associated with the rapidly increasing number of NRs. In fact most industries, including the nuclear industry, utilize some of the alternatives adopted by CG&E. Moreover, all of the alternate forms are available for NRC review at any time.

This conclusion is not, however, an attempt to mitigate the follow-on consequences of CG&E's early loss of control of the deficiency reporting system. It is concluded that the apparent loss of control of nonconformance reporting occurred early in the construction period and was not regained by the date of the SCO. Attempts to regain control resulted in minimal effectiveness, and some actions exacerbated an already serious situation.

4.4.3.10. <u>Corrective Action/Cause Analysis.</u> Standard management tools to collect relevant data, analyze the data relating to the problem, propose alternatives on the basis of analyzed data and the operating environment, and select solutions were apparently not utilized or, at the least, were not effective. It is apparent that management was aware of the problem with control of nonconformances, but it is not known whether the absence of problem solutions stems from lack of knowledge or experience concerning the problem impact in the nuclear environment, or whether upper management considered it to be a problem at all when compared with the overall corporate policy to maintain the construction schedule and minimize cost. In either case, it is clear that the problems associated with the NR system were subordinate to construction problems until the Show Cause Order was initiated. Since the SCO, considerably more management attention has been directed toward noncompliance control.

From the beginning of construction until the present, CG&E's QAD corrective action system was generally not effective in ensuring that identified discrepancies in material/systems/procedures were investigated in a timely manner, analyzed to determine root causes, and corrected by priority actions to prevent recurrences. Additionally, it is concluded that failure to correct related deficiencies after a discrepancy was discovered was an important element of follow-on actions dictated by the NRC in the SCO. It was further concluded that CG&E afforded minimal emphasis on developing trends to identify generic problems early in the construction period, and only elevated this technique to a higher level of importance after the IAL and SCO. Improvements have been noted, but additional improvement is required, especially in identifying the cause of problems and responding with corrective action in a timely manner.

4.4.3.11. <u>Tracking Systems.</u> During the major construction period there is little evidence to indicate that management established an effective system to track open items to assure their completion. The lack of an effective and centralized tracking and evaluation system during the major construction period undoubtedly contributed to the apparently unexpected avalanche of NRC and outside audit agency findings that struck in later years. Not until the May 1979 IAL did available documentation reviewed by the Task D team begin to reveal a more concerted effort to establish the status of open items, action items, NRC commitments, and responses to deficiency reports. The IAL of April 1981, and the SCO of November 1982, seemed to provoke more interest in this area and considerable progress has been made.

4.4.4. <u>QA Program Interfaces</u> (D5)

The QA Department's interface with the other CG&E organizations appears to have been less then satisfactory in certain instances in the past. Without the traditional Project Manager function in place, the pressures of construction schedules and GCD's misinterpretation of its construction control responsibility may have led to occasional abuses of the QA/QC responsibility for inspection and audit.

This apparent misinterpretation of authority and responsibility appears to have been due to a lack of clear-cut procedural definitions of interfaces, since QA responsibilities with subcontractors have also been occasionally usurped. However, QA seems to now be in the proper information/review/approval cycle. There is every indication since the SCO that top management will provide the QA Department with the sufficient authority, responsibility, and access to information that the QA Manager feels is necessary.

The QA Department's association with its subcontractor organizations seems to go to extremes. On one hand, the CG&E QA interface with S&L QA and GE QA has been minimal, but marginally sufficient relative to contractual responsibilities. On the other hand, CG&E QA's interface with Kaiser QA increased over the years to the point that the association became less than amicable. The degree of control that CG&E applied to Kaiser QA seemed to be contrary to its own philosophy of holding its contractors totally responsible for implementation of their QA and QC functions. CG&E and Kaiser no longer worked as a team, but instead seemed to develop an adversarial relationship. Since the IAL, personnel changes in both CG&E and Kaiser QA Managers seems to have improved the relationship. The time elapsed since the SCO has provided both sides with a breather and an opportunity to reestablish a working relationship.

The controls and interfaces that CG&E QA applied to the activities of RCI appear to have been minimal. QA had direct contact with RCI. In addition, it had ample opportunity to perform its audits, and had information provided from CG&E Management Assessment Audits that problems existed with the RCI QA Program. Yet, the problems went virtually undetected by CG&E QA.

Based on interviews with several individuals, and discussions with other TPT members who were reviewing NED and GCD interfaces with Catalytic, it appears that Catalytic had a good reputation for its work among CG&E personnel. It appears, however, that the obscurity of the CI work scope, the lack of CI/Zimmer interface procedures, and CG&E QA audits which appeared to be more programmatic rather than technical, contributed to NRC's concerns.

QA's future relationship to RCI and CI is moot since neither organizations is involved at Zimmer any longer. In TPT's view the relationship to HJK has improved and must continue to do so. QA should increase interface with S&L to resolve the remaining problems involved in incorporating design changes.

5. TASK E - EVALUATION OF CG&E QUALITY CONFIRMATION PROGRAM

5.1. OBJECTIVE AND SCOPE

The objective of Task E is to evaluate CG&E's management of the Quality Confirmation Program (QCP) to determine its adequacy and effectiveness in achieving the objectives and commitments of the program.

The scope of Task E includes the following subtasks:

1. Evaluate management controls for QCP commitments and objectives. (E2)*

2. Assess CG&E audits and evaluations of QCP. (E3)

3. Assess CG&E management capability to plan and manage a Quality Verification program. (E4)

5.2. INVESTIGATION

In carrying out this task, the work included: (1) interviews of selected QCP personnel and certain other personnel in interfacing organizations and (2) review of QCP procedures, CG&E internal correspondence and letters of commitment, NRC letters and inspection reports, and reports, allegations, and affidavits from intervening organizations and individuals that pertain to the QCP.

In performing this review, conclusions were made by evaluating the information obtained that was pertinent to each of the characteristics noted in each subtask.

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*Corresponds to the Subtasks in the Program Plan.

5.3. SUMMARY OBSERVATIONS

The QCP was developed in response to the concerns the NRC identified in their IAL dated April 8, 1981. The QCP addressed specific problems identified in NRC Inspection Report 50-358/81-13 dated November 24, 1981. The QCP definition of problems and action items eventually became Exhibit 17 of this same NRC inspection report.

5.3.1. Evaluation of Management Controls for QCP Commitments and Objectives (E2)

This subtask consisted of an evaluation of the management controls that were in place to ensure that the objectives and commitments of the QCP were being met. The following topics were addressed during the evaluation:

1. Definition of the QCP and the subdivision into elements of work that are logical, orderly, and controlled.

2. QCP organization structure.

3. QCP management personnel's understanding of their relationships regarding QCP including management authorities, responsibilities, and accountabilities.

4. QCP staffing level.

5. Use of contractor personnel in the QCP.

6. Technical qualifications of QCP management/supervisory personnel.

7. Management skills of QCP management personnel.

8. QCP personnel's understanding of the scope of each commitment.

9. Whether commitment of the QCP has been addressed in the implementing procedures.

10. QCP management's actions regarding planning, procedural compliance, status information, reporting methods, organizational interface, training, and scheduling.

11. QCP management's actions on QCP problems with respect to timely detection, root cause identification, resolution, and preventive measures.

5.3.1.1. Definition of the QCP. As a result of reviewing the various documents associated with the QCP, it appears that the internal CG&E document that describes the scope of the QCP as a whole is the QCP procedure on "QCP Organization, Scope and Interface." This document summarizes the 11 original tasks by number and title, but refers the reader to Exhibit 17 of NRC IE Inspection Report 81-13 for details of problems presented and actions required. Since the original scope definition, 4 items have been added to some of the original 11 tasks and 4 new tasks have been (or are being) identified. Because of the referral approach taken by this document, these added items and tasks have not been formally addressed. As conceived at the present time, the QCP is not intended to be a comprehensive quality verification program for Zimmer. Its scope is limited to those items agreed upon with the NRC.

The problem definition and action items listed in Exhibit 17 were intentionally nonspecific. In retrospect it appears that lack of specific definition of the problems and lack of specific definition for the actions to be taken have caused considerable confusion and increases in scope with new interpretations of the action commitments.

Recent attempts to define and quantify the scope, envelope, and specifics of the action items have provided some improvement in understanding. However, in some instances there appears to be a lack of ability to define specifically what it is that needs to be done and to know how much is enough to close the item out.

5.3.1.2. QCP Organization Structure. The QCP organization structure was clearly defined by organization charts and by procedures describing organizational relationships and responsibilities. The structure provides for staff positions to handle functions of a generic nature to the QCP such as overall procedure preparation and control, the compilation and publishing of periodic program status reports, and other such functions. The line organization is subdivided to directly address the original eleven tasks of the QCP and also the four recent additional tasks (in three cases, tasks have been combined to more effectively utilize personnel where the qualifications/expertise required to accomplish the tasks are basically the same).

5.3.1.3. Management Personnel Relationships. The management personnel (including the task coordinator and staff members) of the QCP appear to understand their relationships within the QCP including their responsibilities, authorities, and accountabilities and operate accordingly. The Director of the QCP, however, does not have Stop Work authority either by policy or practice. According to the FSAR, Revision 91, January 1983, this authority is vested solely in the CG&E Manager, Quality Assurance Department (QAD) position. The Director of the QCP does not view this as a serious concern for three reasons: (1) the components, systems, and structures involved in the QCP are on Stop Work with regard to safety-related construction or rework by virtue of the Show Cause Order (SCO) of November 1982; (2) notwithstanding the SCO, these same QCP items are theoretically completed; and (3) he cannot envision the Manager, QAD denying his request for a Stop Work should some set of circumstances indicate the need for a stop action.

The responsibilities of all QCP positions (except clerical) are described in the QCP procedure on organization, scope, and interface. One of the positions, QCP Quality Engineer, has no permanent assignment of personnel but is filled on an as-needed basis from the QCP staff; this situation is addressed in the procedure. While perhaps an unusual practice, it is considered to be an acceptable approach which recognizes the need for a function although not on a full time basis. It was apparent during the interviews that certain personnel had performed in this role when they were describing their activities.

5.3.1.4. Staffing Levels. Historically, the adequacy of the staffing level of the QCP is difficult to assess for a variety of reasons. However, CG&E's approach was reasonable. Typically, the staffing of any particular task followed a logical pattern; i.e., initially a task coordinator and perhaps one or two others prepared the necessary procedures, then the task was manned to perform to those procedures.

In some cases, QCP management found that the criteria were incorrect or incomplete to the extent that a major revamping was necessary and the staff was cut back to a few people to rewrite procedures. After the necessary revisions were completed, the task was restaffed to complete and/or redo the confirmation.

Circumstances such as these understandably caused many peaks and valleys in a particular task's staffing level as well as switching the staffing level from task to task.

Although a detailed analysis was not performed, present staffing with respect to task activity at this time generally appeared to be adequate. Two task coordinators expressed a need for more people. In one case, three people were added on or about May 31, 1983, one more was in the process of being brought aboard, and two to three others are being sought (the total would satisfy the coordinator's estimated need). In the other case, the task coordinator stated that he had recently requested additional personnel. His responsibilities include Task IV, presently on hold for a Code interpretation, and Task II. Bechtel has been given the responsibility for Task II, for technical review of weld procedures in early 1983. Two other task coordinators claimed to be capable of handling input from their interfacing organization at a much higher rate than is presently being experienced.

5.3.1.5. Use of Contract Personnel. The QCP had 73 personnel on May 31, 1983, only three of which are CG&E employees (the director and two task coordinators). The remainder of the organization is composed of contract personnel (job shoppers) from some eight different service companies.

However, during interviews with 24 of the 73 QCP personnel, no detrimental conditions were evident due to the use of contract personnel. To the contrary, quite often positive attitudes and conditions were expressly stated, or strongly indicated, by the manner in which questions were answered. For example, the harmony within the QCP organization was brought up by many and such terms as "we" and "our" were used when referring to CG&E's QCP and to CG&E in general.

Another factor which supports the use of multiplicity of service companies from which QCP personnel have been drawn is QCP management's perception of advantage in being able to be more selective when acquiring contract personnel. The previously mentioned review of the qualifications and background of QCP personnel would tend to support this position.

While contract personnel are under the direction of the QCP Director, he does not have the personnel interchanges with them that he would have with CG&E employees, i.e, merit increases, career advancement planning, etc. He can, however, exercise a negative performance rating by requesting the removal of a nonperformer. This form of relationship is the way-of-life of the construction industry and therefore is not viewed as detrimental to the QCP, or to the Zimmer Project as a whole.

5.3.1.6. Staff Technical Qualifications. The QCP appears to be staffed with competent personnel that are, for the most part, well suited to their particular assignments (some concerns involving management qualifications are stated elsewhere in this report). This was determined from a review of personnel qualifications and associated background information, with respect to individual assignments, per the QCP organization chart.

Only one position description exists for the QCP management that describes duties and qualifications, that one being for the position of Director. However, as was pointed out earlier, all position responsibilities are described in a QCP procedure. Further, a review of QA files shows that all QCP personnel (except clerical) are trained and that their qualifications are certified in accordance with ANSI N45.2.6 and/or SNT-TC-1A, as applicable.

5.3.1.7. Management Skills. The present QCP management is action-oriented and operates with a management style that has gained the admiration and respect of every QCP individual interviewed, as well as others outside the QCP organization. It is clear that credibility exists within QCP management. The Director recognizes some lack of QA experience as well as lack of technical understanding of some of the QCP hardware problems; however, he has supplemented these areas of weakness with a well-qualified staff.

For the most part, the QCP Director makes decisions readily and delegates responsibilities with the appropriate authority to accomplish the job. Consequently lower management and task supervision have a clear understanding of their job and the necessary tools to complete it. It wa evident throughout the interviews that the entire QCP organization (including task members) has an appreciation for the Director's management style, feels they can go to him with their concerns, and has confidence that he will pursue legitimate concerns either horizontally, vertically, or both through the CG&E management. Recognition of the Director's management skills apparently outweighs his recognized lack of a technical and/or QA background in the aspects of nuclear power station construction (the latter being fully admitted by the Director himself).

5.3.1.8 Personnel Understanding of Scope. The QCP personnel interviewed (including the task members) exhibited a fair-to-good-to-excellent understanding of the scope of the commitments they were involved in (to the extent the scope had been defined in procedures). In reviewing the documentation, it became apparent that the scope and envelope of the QCP commitments are not clearly defined and, consequently, have not been thoroughly understood by the QCP management (by their own admission). Apparently this lack of specific definition was intentional early in the program.

5.3.1.9. Implementing Procedures. While some effort had been initiated on a study to ensure that each Exhibit 17 commitment of NRC Inspection Report #81-13 had in fact been addressed in QCP implementing procedures, it was not until this question was raised in the initial TPT interview of the QCP Director during the week of May 2, 1983 that this study was given priority. The study was then completed May 11, 1983, and the report shows that several commitments are either not addressed or inadequately addressed by the QCP procedures. Since that time two similar studies have been undertaken, one on the observations of report #81-13 that were not recorded in Exhibit 17 and the second on the NRC Nuclear Evaluation Team (NET) report commitments and recommendations.

Some of the original QCP tasks are still being defined and understood. Task VIII still does not have a procedure written for accomplishing the task, and Tasks X and XI did not have procedures issued for use until late May 1983.

5.3.1.10. Management Actions/QCP Status. QCP management actions reflect that appropriate attention is being paid to such things as planning, scheduling, reporting, training, etc. This is evident through weekly staff meetings to discuss problems and inform QCP management of status, weekly site-wide meetings which include representation from CG&E interfacing organizations and contractor companies, weekly internal status reports to QCP management, and monthly status reports to CG&E management.

QCP tasks, or portions of them, which are assigned to other companies, viz. HJK, S&L, and Bechtel, have the assignment addressed in QCP procedures which, apparently, have been informally transmitted to those companies; but, according to the QCP director, assigned responsibilities have not been defined in contractual documents, either directly or by reference, and it follows that scope changes are not handled by contract changes.

Two tasks are inactive at this time; one (Task V) is waiting for NRC acceptance of the final report, and the other (Task IV) is on hold for a Code interpretation which QCP management apparently believes could result in the elimination of field verification, a major portion of the task. Some tasks were slower at getting started than others; two tasks, for all practical purposes, were unmanned until November 1982 when two people were assigned to prepare procedures (which were finally issued in the latter part of May 1983).

5.3.1.11. Management Actions on QCP Problems. QCP management's actions on problems with regard to carrying out QCP activities appear to be reasonably effective with respect to detection, cause identification, resolution, and prevention. Objective evidence attests to this in the form of condition evaluation requests, corrective action requests, and procedure revisions for programmatic concerns; but actions on such things as procedural noncompliance by QCP personnel are evident to a much lesser extent. Discussions during interviews indicated that the latter actions were normally taken on-the-spot by QCP supervision and/or management and each condition was satisfactorily corrected more or less in-process without being documented, which is considered a normal and acceptable part of the subordinate/superior interface.

Management's effectiveness in problem root cause identification and resolution appears to work well on internal QCP matters. This is not the case with regard to QCP management's handling of root cause identification and corrective action associated with audits of the QCP (reference Section 5.3.2 for a further discussion of audits of the QCP). These statements appear to be contradictory since management qualities are the same; however, the general lack of confidence in the audit/corrective action program may have contributed to the lack of adequate attention to problems identified in audits of the QCP.

5.3.2. Assess CG&E Audits and Evaluation of the QCP (E3)

This subtask consisted of a review to assess the adequacy and accuracy of CG&E's own evaluations and audits of the effectiveness of the QCP, including the actions taken on major problems experienced in its implementation.

CG&E's formal assessment of the QCP has been in the form of two audits:

1. Field audit 390 dated March 12, 1982.
2. Field audit 419 dated October 8, 1982.

Audit 390 was performed by Gilbert/Commonwealth in February 1982, under the auspices of CG&E QA and utilizing a CG&E audit number. This audit appeared to be reasonably comprehensive. It was conducted in two parts; the first part was an audit of each task action identified in QCP. The second part was performed utilizing check lists to evaluate compliance with procedures.

Some discrepancy exists in the numbers of concerns and findings in various places in the report package. The Audit Summary identifies 19 concerns and 19 findings.

As of June 1983, the findings addressed by Audit Findings Reports (AFRs) 390-2, -3, -8, -9, -17, and -19 were still open pending satisfactory implementation of corrective action responses. AFRs 390-4, -10, -11, -12, and -13 are still open pending the submission of satisfactory responses to the audit group. This status apparently has not changed since November 8, 1982.

There is no evidence in the audit package that indicates attention has been given to the concerns identified. The lack of response to the concerns was confirmed during a discussion with CG&E's Audit Director.

The Audit 390 cover letter indicated a follow-up audit would be conducted upon completion and resolution of all the findings and concerns. There has been no follow-up audit per se although the audit group verifies implementation prior to closing the item out, according to the CG&E Audit Director.

Audit 419 (which was not intended to act as a follow-up to Audit 390) was conducted by the CG&E audit group in October 1982. It addressed Task I, Structural Steel, Task V, Radiographs, and Task VII, Nonconformances. The audit was conducted with checklists that identified the specific requirements of five QCP procedures. Seven AFRs were issued. One finding was determined to be invalid and, as of June 1983, acceptable corrective action had not been submitted on an AFR 419-1, Item 2.

Corrective action statements for many of the findings are very brief, many times only one line. They tend to say what was done to fix the identified deficiency with no identification of the root cause of the problem, no search for similar deficiencies, and little in the way of identifying any actions taken to prevent recurrence.

5.3.3. Assess CG&E Management Structure and Capability to Successfully Develop and Complete the Broader Scope Quality Verification Program (QVP) (E4)

1. The first step in this assessment was to analyze the existing CG&E QCP organization as the natural organizational element to set up and complete the QVP.

The present QCP is basically a document review and inspection program where areas to review and inspect are predetermined (in Exhibit 17) and deficiencies are reported on NRs. Nonconformance Reports are handled through the normal disposition process which is outside the QCP. Follow-up inspections after any rework is completed are not part of the QCP task.

The present CG&E management recognizes that the QVP will be more comprehensive than the present QCP and will involve disciplines and skills not now required of the QCP. They also recognize that the complexity of developing and implementing a QVP may involve working in concert with others.

The definition of the QVP is not at this time a reality. Assuming that this would be the initial task of a QVP organization, such a task would require personnel with different areas of expertise than those presently involved in the QCP, based on the assessment given in Sections 5.3.1 and 5.3.2. It is not clear at this time whether performance of the required rework in the field would be an integral part of the QVP but, if so, the present QCP organization is not involved in hardware rework and consequently is not organized and/or staffed to do so.

Based on the foregoing it is evident that the QCP organization and staff are inadequte to develop and complete the QVP.

2. The second step was to analyze the capability of other CG&E organizational elements, based on the data obtained in other sections of this report.

This analysis resulted in the following observations relative to the QVP:

(a) Lack of present management experience in dealing with inspection problems, both hardware and records, raises questions regarding the ability of present management to set the correct policy and pass down the appropriate management decisions regarding the resolution of inspection problems that would be required in the QVP.

(b) The present engineering organization lacks the technical experience and qualifications that are expected to be required to perform an independent design review which is a likely requirement of the QVP. In addition, the in-house capability is currently insufficient to effectively monitor the activities of others on such a task, as well as participate in field reviews and the determination of construction quality and adequacy.

(c) The construction group could effectively manage HJK activities in the construction and rework that might ensue from a comprehensive QVP.

(d) The Nuclear Production Department does appear to have the available staff to effectively plan and complete those areas of a QVP that are likely to be relevant to the start-up and transition to the operations aspect.

(e) A key requirement that is not apparent in the existing CG&E project organization is strong management capability to plan and integrate all interfaces and organizations that would be involved in the development and completion of a thorough QVP.

(f) Finally, an important ingredient is the independence that is required to complete the QVP in a credible manner. Almost by definition, this requires participation by an external organization. Prior experience in such an endeavor would be desirable.

5.4. CONCLUSIONS FOR TASK E

1. Management Controls (E2)

A significant turning point in the history of the QCP was the assignment of the present Director to the program.

Present QCP management has a reasonable organizational structure including an adequate definition of responsibilities, authorities which are defined, and a high degree of management skill in evidence particularly in the administrative as opposed to the technical areas of QCP management.

Present QCP management appears to have the full support of its members as well as the support of those outside QCP that were interviewed and, based on TPT's evaluation of the management style and management systems in place, both provide favorable indicators of present QCP management. However, lack of QA experience, lack of technical understanding of hardware problems, and lack of experience in successfully completing such a program involving ASME Code work, NRC interface, and major subcontractor interfaces are negative factors.

It is TPT's opinion that with the CG&E upper management giving full support to QCP, and with consideration for the recommendations in this report, the present QCP management will be able to complete the QCP as it is presently defined and meet the objectives and commitments of the program. While there are still some shortcomings in the program, particularly in the total definition of its scope and envelope, and while information is needed from interfaces, this has been recognized by the QCP management and measures are in work or planned that should bring CG&E's existing commitments to the NRC to an acceptable conclusion.

2. Audits and Evaluations (E3)

The treating of audits, audit findings, root cause identification, corrective action, and overall management assessment of the QCP through audits has been ineffective generally and requires improvement.

3. Ability to Develop QVP (E4)

As defined, the QCP is only a small part of a thorough QVP. A comprehensive and logical plan is required to define the scope and objectives to provide assurance of the design and construction.

Although TPT believes the present QCP management and organization have a role in QVP (i.e., individual personnel appear well qualified to perform certain tasks), the magnitude of the QVP indicates the need for not only management highly skilled in administrative skills, but also with extensive technical and prior experience in setting up, implementing, and successfully completing nuclear programs similar to QVP. Such skills are not evident in several areas of the Zimmer project management. Additional experienced staff and/or the services of an experienced external organization will be required to satisfactorily complete the QVP. An independence from involvement in prior activities would provide greater credibility.

6. TASK F - EVALUATION OF CG&E PROJECT MANAGEMENT INTERFACES WITH CONTRACTORS

6.1. OBJECTIVE AND SCOPE

The objective of Task F was to evaluate the adequacy of CG&E's project management methods for: (1) administration and control of the work of major contractors and suppliers and (2) management of changes to their work and contracts to ensure effective control of performance. This evaluation included interfaces between CG&E and the following contractors:

1. Sargent & Lundy Engineers (S&L)

2. Henry J. Kaiser Company (HJK) [formerly Kaiser Engineers Incorporated (KEI)]

3. General Electric Company (GE)

4. Catalytic, Incorporated (CI)

5. Reactor Controls, Incorporated (RCI)

The scope of the evaluation for each interface included the following subtasks:

1. Evaluation of CG&E's ability to control contractor interfaces and to monitor contractor performance. (F2)*

2. Evaluation of CG&E procedures for controlling interfaces with contractors. (F3)

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*Corresponds to subtasks in the Program Plan.

3. Evaluation of the implementation of CG&E procedures to control interfaces with contractors. (F4)

4. Evaluation of the scheduling and control of the work of major contractors. (F5)*

6.2. INVESTIGATION

In performing this evaluation, TPT personnel were initially briefed by CG&E department managers. Subsequently, TPT personnel interviewed personnel from CG&E, the contractors, and the NRC and reviewed documentation pertinent to this task. TPT reviewed CG&E and contractor organization charts, procedures, practices, policies, communication methods, design and construction control methods, problem identification and resolution methods, and daily activities. TPT's evaluation is based on the combined results of these interviews and the document review.

6.2.1. Major Contracts

Each of the major contracts and the impact of containment design changes are discussed below.

6.2.1.1. Sargent and Lundy Engineers. S&L was signed in 1968 as the architect-engineer (AE) for the design and management of all engineering aspects of Zimmer 1. S&L had previously been the AE on major construction projects for CG&E for 75 years, and had extensive involvement in the nuclear industry prior to being selected as the AE for Zimmer. S&L was the AE for no less than seven reactors prior to Zimmer (e.g., Dresden 2 & 3, Quad Cities 1 & 2, Zion 1 & 2, and LaCrosse). It was also actively engaged in at least 11 contemporary plants including Zimmer (e.g., LaSalle 1 & 2, Byron 1 & 2, Braidwood 1 & 2, Fermi 2, Marble Hill 1 & 2, and Fort St. Vrain).

*Additional subtask to those identified in the Program Plan.

The Zimmer contract with S&L was signed on January 19, 1968 by B. J. Yeager, then Vice President and General Manager of CG&E. The contract was for time and materials plus a fee based on direct construction costs, and it included the following provisions:

1. S&L shall provide all engineering services required by the owners, with a scheduled completion date of January 1, 1975.

2. The responsibility for engineering and construction shall be centered around the manager of the General Engineering Department (GED) of CG&E.

3. It is the duty of the manager of the GED to keep the Owners' Group informed of S&L's activities and progress. (The Owners' Group is the management of CG&E, Columbus Southern Ohio Electric Company, and the Dayton Power and Light Company.)

The service agreement (contract) with S&L and the Owners' Group did not require specific management reports. However, the OPPs for 1972 through 1978 required the following:

1. Monthly reports in narrative form covering engineering activities for the preceding month and plans for the following month.

2. Monthly and cumulative reports of engineering manhours and engineering costs.

3. Monthly reports of design drawing status.

4. Periodic schedules to establish target dates and intervals for overall phases of engineering and construction.

5. Periodic reports of trips made by S&L to manufacturers, vendors, consultants, agencies, and others with respect to the project.

6. Monthly records of S&L design drawing issues, comprising an index of mechanical, structural, and electrical drawings.

TPT noted that while target dates and intervals were required for overall phases of engineering and construction, no detailed scheduling or network planning was required. Detailed cost reporting to define the cause or resolution of cost problems was not required. Further, design change listings or status reports were not required, only listings which defined the drawings issued.

6.2.1.2. Henry J. Kaiser Company. HJK was selected as the constructor. Important considerations in this selection were that HJK was just completing a steel mill 40 miles from the Zimmer site, making their personnel easily transferrable to the nuclear project, and that HJK had successfully dealt with local area craft unions (labor relations).

The contract with HJK was signed by B. J. Yeager, President of CG&E, on September 30, 1970. The contract was on a cost-plus-fixed-fee basis and included the following provisions:

1. HJK shall provide all construction management, including supervision and payment of crafts.

2. HJK shall perform all scheduling and manpower estimates related to construction.

3. HJK shall not act as agent of owner except as specified by owner in writing in this contract. (HJK was authorized to act as agent in purchases of equipment and material and payment of subcontractors not under a CG&E purchase order.)

4. HJK shall implement a quality control and inspection program for construction with the criteria supplied by the Owner's Engineer (S&L).

5. The responsibility for construction shall be centered around the Manager of GED (then A. E. Rothenburg) of CG&E for rendering of construction services.

Contractual details from the September 30, 1970 contract are summarized below, indicating the limits of contract management as described in items 1, 2, and 4 above.

"Provide a total construction program, including the furnishing of all labor, procurement (as required), transportation, tools, equipment and other facilities (except such items as are being furnished by Owner), field staff, supporting home and branch office services and such other services as are required to construct the Project in accordance with the plans, drawings and specifications to be provided by Owner's Engineer. In performing the Work Constructor shall:

1. Provide planning and scheduling, preparation of accounting systems and budgetary estimates, cost control, cash forecasts, accounting, and such reports related thereto in such form as may be required by Owner.

2. Provide all direction, control, supervision and coordination of all construction activities of employees of Constructor, and Specialty Contractors (consistent with specialty contract documents) as required to construct the Project.

3. Provide construction and contract administration and coordination functions, including industrial relations.

4. Provide field procurement services, including warehousing and expediting services, logistics planning, preparation or assistance in preparing and reviewing field procurement documents and the award of Owner's purchase orders as Agent for and in the name of Owner in accordance with mutually agreed limits and procedures.

5. Prepare or assist in preparing and reviewing specialty contract documents; award of specialty contracts as Agent for and in the name of Owner in accordance with mutually agreed limits and procedures.

6. Establish surveying control lines and grades.

7. Provide field engineering, reproduction, and construction inspection services during construction.

8. Provide safety, first aid, security and fire protection services.

9. Provide quality control and quality assurance together with associated records in accordance with criteria to be supplied by Owner's Engineer.

10. Provide assistance during startup of the Project.

Constructor shall submit written procedures detailing the coordination between Constructor, Owner, Owner's Engineer, suppliers and the Atomic Energy Commission during the performance of the aforesaid services. Upon approval by Owner, such procedures shall be followed by Constructor in performing the Work and shall be subject to mutually agreed amendments."

In addition to the stipulations given above, the contract also specified a project construction schedule, which was described as noted below:

"The Work for the first unit of the Project shall be commenced as of the date of this Agreement. The estimated date for commercial operation of the first unit is January 1, 1976. Constructor shall, as soon as practicable after execution of this Agreement, prepare and submit to Owner for Approval an overall Project construction schedule. Such schedule will incorporate the schedule for the engineering drawings and specifications to be provided by Owner's Engineer, the delivery dates for the principal equipment and other key data to be furnished by Owner."

The above contractual reporting and work requirements were later expanded in the April 12, 1973 revision to the OPPs to include the following specific reports:

1. Monthly progress reports in narrative form covering construction activities for the preceding month and plans for the following month.

2. Monthly report of Oakland costs for itemized home office activities during the preceding month and the corresponding accumulated costs.

3. Monthly critical path method (CPM) schedule and/or bar chart derivatives thereof.

4. Monthly procurement status report (18 copies).

5. Monthly composite report consisting of Part I and II as follows:

   (a) Part I, Physical Progress Report

      (1) Summary by major facility
      (2) summary by construction standards (upon request)
      (3) By detail account (upon request)
      (4) Target schedules and progress charts.

(b) Part II, Costs Data

(1) Project summary cost and comparison to estimate report

(2) Summary cost report by major facility

(3) Summary cost report by element of cost

(4) Cost report by detail account

(5) Cost report by major construction standards

(6) Cost report by detail construction standards

(7) Report on major changes

(8) (Reserved)

(9) Unit cost summary graphs

(10) Detail unit cost report

(11) Unit cost by detail standards

(12) Cost report by CG&E work orders and work order itemization numbers (upon request).

6. Periodic test reports covering major testing programs that are generally nonroutine.

7. Accident reports pertaining to lost time accidents involving employees of HJK and/or employees of subcontractors shall be reported to the degree of detail required by state and federal laws.

8. Photographs as follows:

(a) Set I, for construction record.

(b) Set II, for publicity use.

9. Periodic reports of trips made by HJK to manufacturers, fabricators, vendors, subcontractors, consultants, agencies, and others with respect to the project.

10. Periodic schedule for major segments of construction and testing.

The contract was based on a date of January 1, 1976 for commercial operation.

The contract with HJK was modified in June 1976 to allow CG&E to assume a more direct role in construction management. Specifically, site construction management became the responsibility of H. B. Gear, who under contract to CG&E reported to B. K. Culver, Manager of the Generation Construction Department (GCD) of CG&E. Mr. Gear was placed in charge of all construction activities including HJK all subcontractors, and CG&E field personnel.

Meetings and correspondence between CG&E and HJK in August 1976 clarified HJK's responsibilities and encouraged them to cooperate. Specifically,

1. CG&E took over management of work defined by CG&E purchase orders that had been previously managed by HJK.

2. Industrial relations continued to be handled by HJK, but the staff was reduced to one man.

3. HJK was to transfer all field purchase orders from the HJK Purchasing Department to the CG&E Purchasing Department as rapidly as practical.

4. Site security was taken over by CG&E.

5. The structural and electrical organization structures of HJK remained the same. However, the mechanical section (piping) of HJK was reorganized along the lines suggested by CG&E with a more direct line of communication from CG&E to the craft superintendent.

6. Specific HJK personnel were transferred from the project.

The reasons given by CG&E for taking over construction management were (1) dissatisfaction with HJK's performance, (2) expenditures which were increasing above the $300 million level, and (3) a belief that testing and startup of the plant was imminent.

CG&E confirmed that HJK would still be responsible for organizing the day-to-day construction activities and various peripheral activites such as QA, scheduling, cost reporting, etc.

The HJK/CG&E contract allowed the original agreement to be modified because of a clause which stated that CG&E shall have the right in its sole discretion to suspend the Work by written notice to Constructor at any time or times during the course of the Work. The written notice shall specify any services which Owner desires Constructor to provide during the suspension period.

The subsequent relationship between CG&E and HJK was strained. This was evident in later correspondence from the CG&E management which noted several incidents where HJK was relunctant to institute these specified changes. CG&E hoped that such reluctance was merely the result of misunderstanding and temporary confusion from organizational changes. However, the adversarial relationship has apparently increased since the takeover.

6.2.1.3. General Electric Company. The effective date of the contract between GE and CG&E was August 29, 1969. The contract was formally signed by W. H. Dickhoner, then Vice President of CG&E, in April 1972 and by J. R. Birle, Manager of Marketing, Atomic Power Engineering Department of GE.

The GE work scope, as written in the contract, states the Contractor shall design, develop, and furnish f.o.b. points of shipment, as follows:

1. The NSSS design and operating requirements and data, as described in the Plant Requirements Document, revised April 1, 1970.

2. One light water reactor NSSS, capable of supplying adequate steam for a power plant unit having a net electrical rating in the range of 800 to 900 MW when operating at 3.5 in. Hg abs. exhaust pressure.

3. Contractor shall observe and complete according to specifications provided by S&L.

Major GE schedule dates and cost/budget criteria were as established and subsequently modified in the contract. These then became contractual commitments to which GE adhered.

The original contract price for the equipment furnished and services performed by GE was a firm price subject to adjustment upward or downward for changes in labor and material cost indices tied to the date of arrival of shipment.

The contract reads that responsibility for installation of the equipment rests with the Purchaser of the Plant. This puts GE in the role of a nuclear vendor or supplier of equipment with no on-site role.

6.2.1.4. Catalytic, Incorporated. CI was hired in August 1981 to perform construction on punch-list items, since CG&E believed that HJK was not performing well in this area. CI was a smaller organization that had performed well on three other nuclear plants. CG&E explained to Region III NRC personnel that CI would replace HJK in performing work on the Quality

Confirmation Program (which had been agreed upon with the NRC subsequent to the IAL in April 1981), work on punch-list items on turned-over systems, and work on selected ECRs. The Region III NRC staff approved CI.

The contract was signed by E. A. Borgmann, Senior Vice President of CG&E, and R. L. Holey, Senior Vice President of CI. The price of the contract was based on actual cost plus overhead and a fee which was a variable percentage of the accumulated billing for field staff and labor each year.

The scope of work and special nuclear considerations were as follows:

1. CI will perform, where requested by Owner, from time to time by prior written instructions, miscellaneous work of a maintenance, minor new construction, repair and renovation nature.

2. CI shall perform all work assigned under this Agreement in accordance with applicable codes and standards while performing this work at the Zimmer facility and other applicable codes and standards as specified by Owner. (CI did not possess an N-stamp at this time.)

3. CI shall document, maintain, and implement a Quality Assurance Program which complies with U.S. NRC Regulations 10CFR50, Appendix B "Quality Assurance Criteria for Nuclear Power Plant," and ANSI Standard N45.2 "Quality Assurance Program Requirements for Nuclear Facilities."

Contract administration of CI work was limited to the control of specific written agreements for work authorized by CG&E as stated in item 1 above. These written agreements related largely to punchlist items and were controlled on that basis.

6.2.1.5. Reactor Controls, Incorporated. RCI contracted with CG&E on a fixed price basis in December 1973 to install the reactor pressure vessel

(RPV) internals and the control rod drive (CRD) hydraulic system. The contract was signed by Richard I. Millett, President of RCI, and W. H. Dickhoner, Executive Vice President of CG&E. RCI provided all management, supervision, quality assurance, inspection, craft labor, tools, and consumable materials to perform the installations. The RPVIs were to be installed by April 1976. RCI had the required N-stamp since it was installing safety-related equipment to ASME Section III design criteria both at Zimmer and at other plants, such as LaSalle.

The contract was developed for CG&E by S&L with a specification attached as to how the equipment would be erected. All drawings and data were to be submitted to S&L for review. In addition, as-built drawings were to be submitted to S&L.

Contract administration activities associated with the RCI contract were limited to normal invoicing procedures as stated in the contract. This limited control apparently resulted because key schedule dates were as stated in the contract and the contract was fixed price.

6.2.2. Mark II Containment Loads

Changes in containment loads strongly impacted the relationships of CG&E with all major contractors on the Zimmer plant and significantly affected construction activities.

The background and chronology of events affecting the Zimmer plant is summarized below.

In April 1975, Pennsylvania Power and Light Company stopped work on portions of the Susquehanna Nuclear Power Station because of concerns about suppression pool dynamic loads. In May 1975, the Mark II Owners Group was formed, consisting of all affected boiling water reactor (BWR) owners and GE. They found that the design needed to include the additional loads caused by suppression pool chugging. An interview with the Chairman of the

Owners Group disclosed that not until December 1979 did CG&E feel that it had a set of loads to which it could design NSSS piping and equipment. During this five-year period, construction at Zimmer proceeded around the Mark II affected equipment with many reworks of the affected piping and supports. GE participated in a generic way with the Owners Group in solving the problem.

S&L was heavily involved in Mark II-containment and piping changes since they were responsibile for generating the required engineering changes to affected hardware. Load changes were being handled generically through the Mark II Owners Group. GE provided the basic requirements of suppression pool size and general configuration. S&L developed the hardware design for the suppression pool. All detailed calculations and redesign for Zimmer were conducted in the Chicago offices of S&L and integrated with other affected nuclear power plants like LaSalle. According to the chairman of the Owners Group, all parties involved, including utilities, AEs, and GE, worked exceptionally well together to solve this unique and difficult problem.

The Mark II containment problems were handled by the GED of CG&E and had a large impact on its work and the Zimmer project schedule. The Mark II loads changes had to be coordinated by the manager of GED, and later by the manager of the NED, between the Mark II Owners Group and S&L, who generated the specific design changes to the suppression pool and associated mechanical equipment and piping.

Mark II events are summarized below to explain the magnitude of their impact on the Zimmer project.

<u>1975</u>. Redesign requirements and possible project delays were identified when the NRC issued a standard letter to licensees concerning suppression pool dynamic loads under postulated

LOCA conditions for a plant with Mark II containments. This was the beginning of a major on-going load evaluation effort and assessment of the effects on the plant.

1977. The Mark II containment design loads were increased by GE and the NRC. During the fall, S&L developed a computer code to calculate the load set. S&L developed new load response spectra and RCI began reanalysis for the new loads for the CRD hydraulic system piping. By the end of 1977, system checkout, flushing, and hydrostatic testing of nonsafety-related systems were making good progress; however, design changes, especially those involving the Mark II containment, delayed the installation of system supports (hangers, snubbers, restraints, etc.) and precluded activities involving the suppression pool, primary containment and reactor vessel fundamental to BWR NSSS start-up.

1978. In early 1978, based upon the newly established loads, the reanalysis of the reactor building piping was initiated. In October 1978, the NRC issued new containment acceptance criteria. From this point, Mark II containment modifications dictated the physical construction schedule. As reported in Power Engineering, "Obviously, plant construction cannot be completed until the design is complete, but design is impeded by continuous regulatory change." Additional BWR Mark II loadings were discovered, S&L modified the previously determined response spectra, and RCI restarted the CRD piping stress analysis effort.

1979. The Mark II loads were revised again. Frustrated by continuous load changes, CG&E proposed a conservative upper-bound approach to design loads based on empirical data in December 1979, because of uncertainty in the final pool dynamic loads and results of on-going small-scale and full-scale tests. S&L

prepared a new loads spectra. Reanalysis effort of CRDHS was started by NUTECH under a contract to RCI.

<u>1980</u>. During 1980, the Mark II containment design changes had increasing impact on construction. Where possible, systems were completed and turned over for testing on a priority basis; however, the modifications in the suppression pool and drywell were occurring on critical path equipment and structures and therefore precluded the testing of key items. System completion, testing, and plant startup had no alternative but to wait for Mark II containment design and completion of construction. Due to changing design requirements, containment modification extended throughout 1980.

<u>1981</u>. Mark II containment redesign was the controlling factor on the schedule in 1981. At this time, most of the new load requirements had been defined, but surrounding structures and systems were also affected, and approved design documents were needed so that construction could proceed.

<u>1983</u>. The final set of loads have not been published by the Mark II Owners Group at the date of this review.

6.3. SUMMARY OF OBSERVATIONS

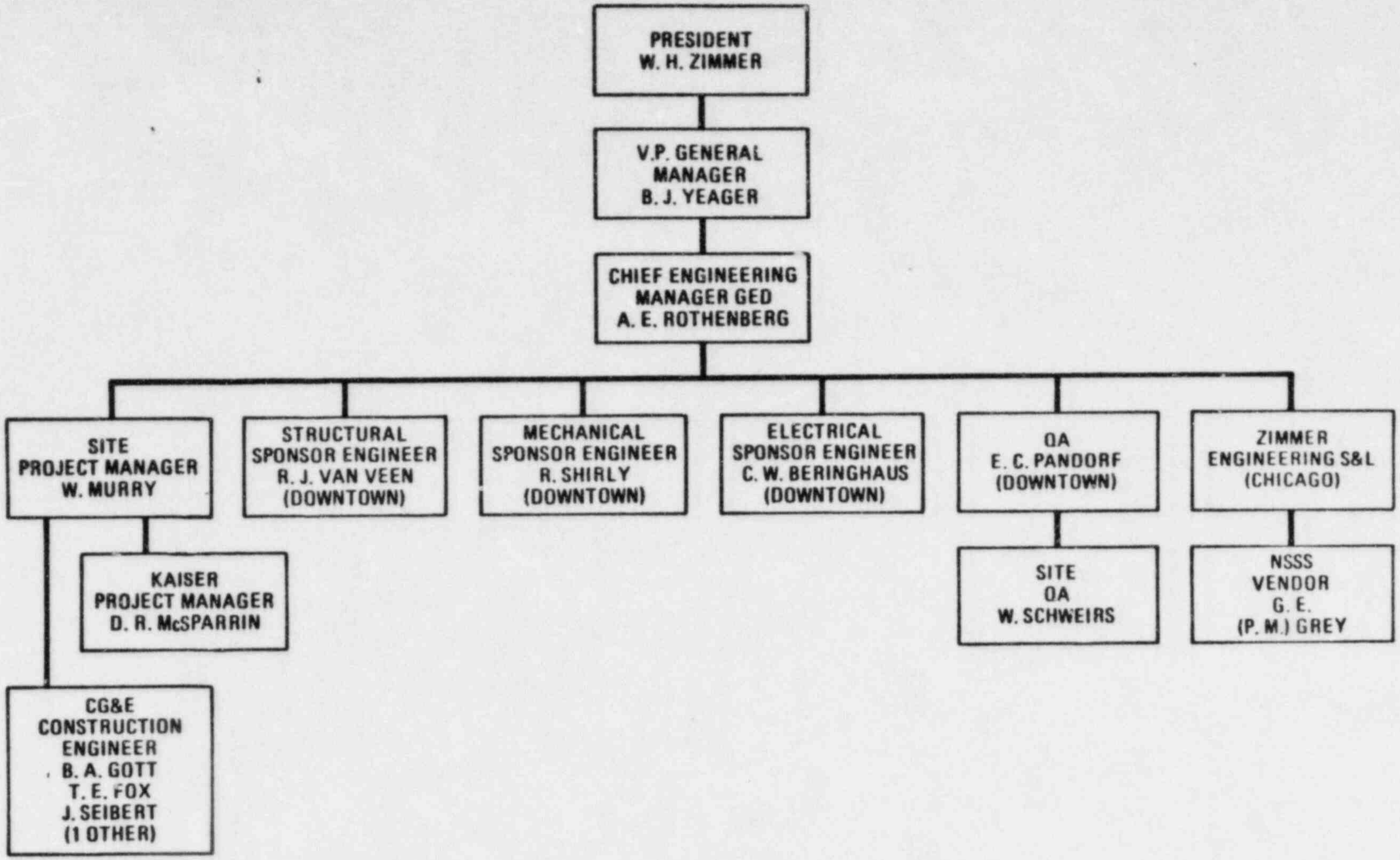
6.3.1. <u>Evaluate CG&E's Ability to Control Contractor Interfaces and Monitor Performance</u> (F2)

This subtask concentrates on the relationship of the CG&E project organization to each major subcontractor and its ability to control contractor interfaces and monitor performance. CG&E's monitoring of contractor performance using QA audits and surveillance is further discussed in Section 4.3.4 (Task D).

From 1970 to the end of 1975, CG&E interacted with S&L, GE, and HJK through the GED. A very small group of people was under the personal direction of the GED Manager. The OPP, issued in March 1972, basically expanded the contract requirements between CG&E and the major contractors, briefly defined how the various contractors and CG&E were to interact, and included guidelines on purchasing. GC&E's management of the Zimmer project was at first patterned after the way it had successfully constructed coal-fired plants in the past. These projects had been executed with very small groups of people from CG&E directing the subcontractors in construction of coal-fired plants and other non-nuclear construction. Construction engineering, which was part of the GED, was located at the site, while the other disciplines, such as mechanical and electrical engineering, were located in downtown Cincinatti and engaged in support activities for construction. Site engineering and construction problems were solved by the site manager and lower levels, usually on the spot, with apparently little or no documentation of the solution. Because of this direct management style, the construction engineering manager was, in fact, acting much like the Project Manager for most projects.

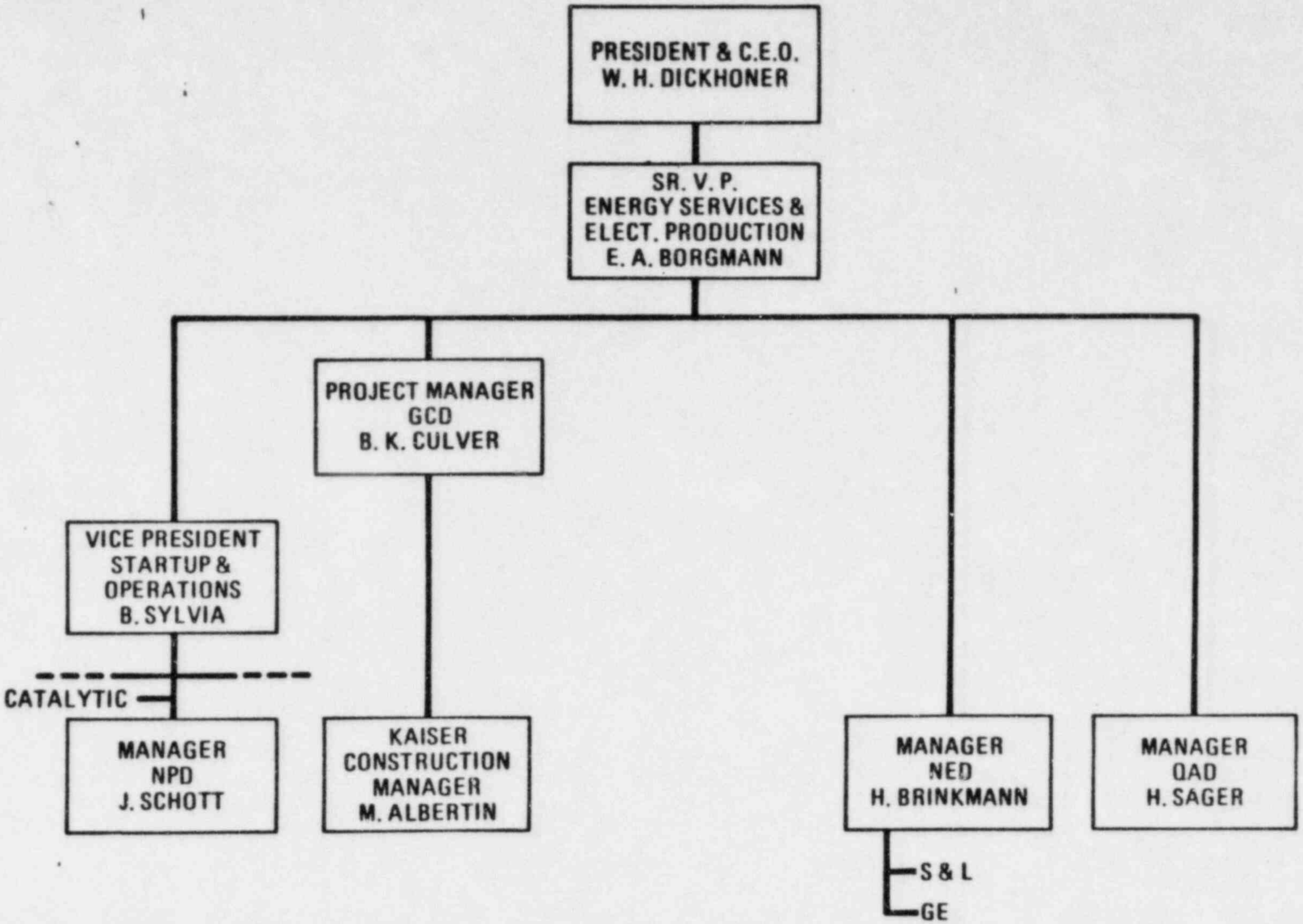
Figure 6-1 shows the original Zimmer organization and indicates CG&E's relationship to subcontractors. Figure 6-2 shows the organization structure at the time of the SWO. Although these charts show no substantive change in the relationship between CG&E and the major contractors, significant differences have occurred in the working relationship, and hence, CG&E's ability to control interfaces and monitor performance (see below). The working relationship and interface between CG&E and specific contractors is discussed below.

6.3.1.1. Sargent & Lundy Engineers. Initially, the mechanical engineering section of the CG&E GED (later NED) had a charter to perform project engineering tasks such as monitoring S&L, developing cost accounting on purchase orders, projecting cash flow, reviewing ECRs and DDCs, making design changes, keeping up with codes and standards, and providing licensing support.



C-17173

Fig. 6-1. 1969 CG&E organization



C-17173

Fig. 6-2. 1982 Zimmer organization

Herb Brinkmann, then Manager of the Mechanical Engineering Section of GED, was also Chairman of the Mark II Owners Group developing new design loads for the NSSS piping. Although this was an extremely important task (which was essential to the satisfactory completion of Zimmer), his efforts to monitor S&L engineering and design changes and their impact on Zimmer construction were questionable, because the Owners Group consumed nearly all of his time.

S&L conducted all of its engineering for Zimmer from its Chicago offices until March 1982, when it assigned a large staff to the site to deal more directly with field engineering changes. Previously, GED (later NED) had interfaced directly with the S&L Zimmer Project Manager (Dick Pruski) in the Chicago offices. This was S&L's standard way of conducting engineering on all its contracts.

S&L's Project Manager attended each monthly management meeting at the Zimmer site. Since S&L had a long and well established relationship with CG&E, CG&E senior management apparently felt that monitoring and control of S&L's activities were unnecessary and that S&L should merely be held accountable under its contractual obligation to perform all engineering at Zimmer. Interviews with GED personnel expressed that when attempts were made to exercise greater control and influence over S&L activities, senior management would admonish GED personnel to leave S&L to do the job. This minimized monitoring and auditing of S&L activities.

6.3.1.2. General Electric Company. NED has a charter to perform project engineering tasks to monitor GE activities. This is similar to its responsibilities toward S&L except that GE's relationship was as a nuclear vendor providing equipment to CG&E, with engineering handled by S&L and construction by HJK and others. GE reports to CG&E through the GE Zimmer Project Manager stationed in San Jose, California. However, CG&E relied upon S&L to control interfaces and make decisions regarding GE equipment.

GE does no site construction or inspection. It maintains a site QA representative who ensures that the GE scope of supply equipment is installed properly to ensure the validity of warranties. Additionally, GE's site role has been to ensure that changes made by S&L to GE equipment are reviewed, approved, and properly documented in the GE drawing system universally used on all GE projects. GE's site representative provides liaison between S&L and the GE San Jose office for processing and review of design and construction changes deemed necessary by S&L.

The GE Project Manager has always attended the monthly management meetings, but apparently, direct interface between NED and GE has been minimal. GE generally has not been included in engineering decisions by CG&E and S&L.

6.3.1.3. Henry J. Kaiser Company. CG&E's GCD has a charter to manage the site construction activities of all subcontractors including HJK, CI, and RCI.

Despite the extensive reporting requirements contained in the HJK contract and subsequently in the OPP, CG&E apparently viewed its ability to control HJK as inadequate during 1970 to late 1975. In CG&E's view, HJK was consistently underestimating and undermanning each construction task. Costs were escalating and milestones were revised regularly. During this period, the CG&E/HJK relationship had deteriorated so much that CG&E decided to assume management of all construction activities defined by CG&E purchase orders and to let HJK continue to manage construction under its own purchase orders.

In 1976, the CG&E GCD staff consisted of seven people overseeing roughly 200 HJK project staff. The Zimmer construction engineering staff built up to about 20 by the end of 1977, while HJK's staff remained at about 200.

CG&E's GCD group performed the following activities in relation to HJK:

1. Assisted in assembling design information for construction work packages.

2. Reviewed HJK construction work and completed paperwork associated with each work package.

3. Prepared and reviewed DDCs.

4. Developed project schedules and critical path networks to connect the construction to an overall project schedule (started about 1978).

5. Established work priorities by system integrated with preoperational test requirements.

6. Performed productivity studies of HJK's activities to help cut costs.

According to information obtained in several interviews with CG&E personnel currently at the Zimmer site, CG&E believed it could increase HJK's productivity by studying its activities and playing a more direct role in construction management. Thus, CG&E took over construction management in June 1976, with the idea that it would manage HJK more efficiently than HJK had. An efficiency organization (United Research) was hired by CG&E to modify HJK's work habits for more efficiency. After three months, United Research was released because it was mainly involved in time and motion studies, not what CG&E felt was at the heart of the problem. CG&E took over the study with the cooperation of HJK management. As a result of the study, the unit cost numbers used in HJK's cost estimates were modified to make them more realistic. While this increased the estimated completion cost, it more accurately projected the manpower needed to complete each construction task. HJK's productivity looked better in the 1979 Project Status Report.

CG&E's direct hand in construction management caused conflict because HJK was reluctant to give up its construction management status. HJK's construction engineers particularly resisted being directed by CG&E. The rift between CG&E and HJK affected work adversely.

Interviews with CG&E construction engineers showed unanimous frustration with having the responsibility for completing construction without having the authority to direct HJK individuals. The engineers were dissatisfied with CG&E management for denying them the authority to direct HJK personnel; they responded by using a task master style of management. This "tough guy" management style appears to be condoned by CG&E. The interface level did not use an approach of problem identification, mutual discussion, mutual problem solution, action item, and mutually agreed upon schedule. Generally, HJK and CG&E interacted at the department manager level to solve major problems after working-level communications had broken down.

Interviews with HJK personnel revealed that HJK responded defensively to this method of management by insisting that its people take direction only from HJK line managers and by responding formally in writing to verbal direction. Apparently, HJK wished to prevent the confusion that results when direction comes from multiple sources. Thus, HJK line managers instructed their people to disregard verbal instructions from CG&E personnel until HJK management had time to integrate them into the workstream in an orderly way. This instruction may have caused some of the misunderstanding between HJK and CG&E.

6.3.1.4. <u>Catalytic, Incorporated</u>. As stated previously, CI, working primarily for the NPD, was hired in mid-1980 mainly to work on punch-list items. CI could also perform other work for GCD such as (1) upgrading the structural steel associated with the CRDHS to accommodate seismic loads and (2) removal and replacement of the fuel pool heat exchangers.

CI reported to both NPD and GCD depending on the jurisdiction of the work. It worked on punch-list items on systems that were turned over, except those concerning ASME Code-covered equipment since CI did not have an ASME N-Stamp.

CG&E QA reviewed CI procedures even though they had been tried and proven at other sites. This delayed CI from starting to work at Zimmer by approximately six months.

CI quickly completed its assigned work and cleared many punch-list items merely by collecting all the outstanding paperwork on them.

A problem that arose within CG&E was that although NPD had the technical ability to control the work, its engineering manpower was inadequate to interface with CI. Therefore, NPD asked GCD to interact with CI prior to October 1982. Work was written up on a turnback form, and GCD engineers would choose either HJK or CI to perform it.

In fall 1982, NPD established an agreement with GCD to have CI perform all construction on nonessential systems turned over. CI then reported only to NPD.

6.3.1.5. <u>Reactor Controls, Incorporated.</u> RCI signed its contract in 1973 to install the reactor vessel internals (RVIs) and the CRDSH by the original contracted completion date of April 1975. RCI was to work to a specification written by S&L. RCI site activities were manaaged by GCD, who authorized and monitored work via the RCI field order. As noted in Section 4.3.4, QA had direct surveillance of RCI quality.

NED issued memos to authorize RCI to perform design analysis work. Based on these memos, RCI designed and installed the CRDHS (GE supplied equipment) and the interconnecting small bore piping. RCI was supposed to N-stamp the CRDHS piping once it completed its piping stress analysis; however, ASME inspectors from the Hartford Steam Boiler Inspection and Insurance Company would not allow the N-stamp to be placed on the equipment until the stress report was completed.

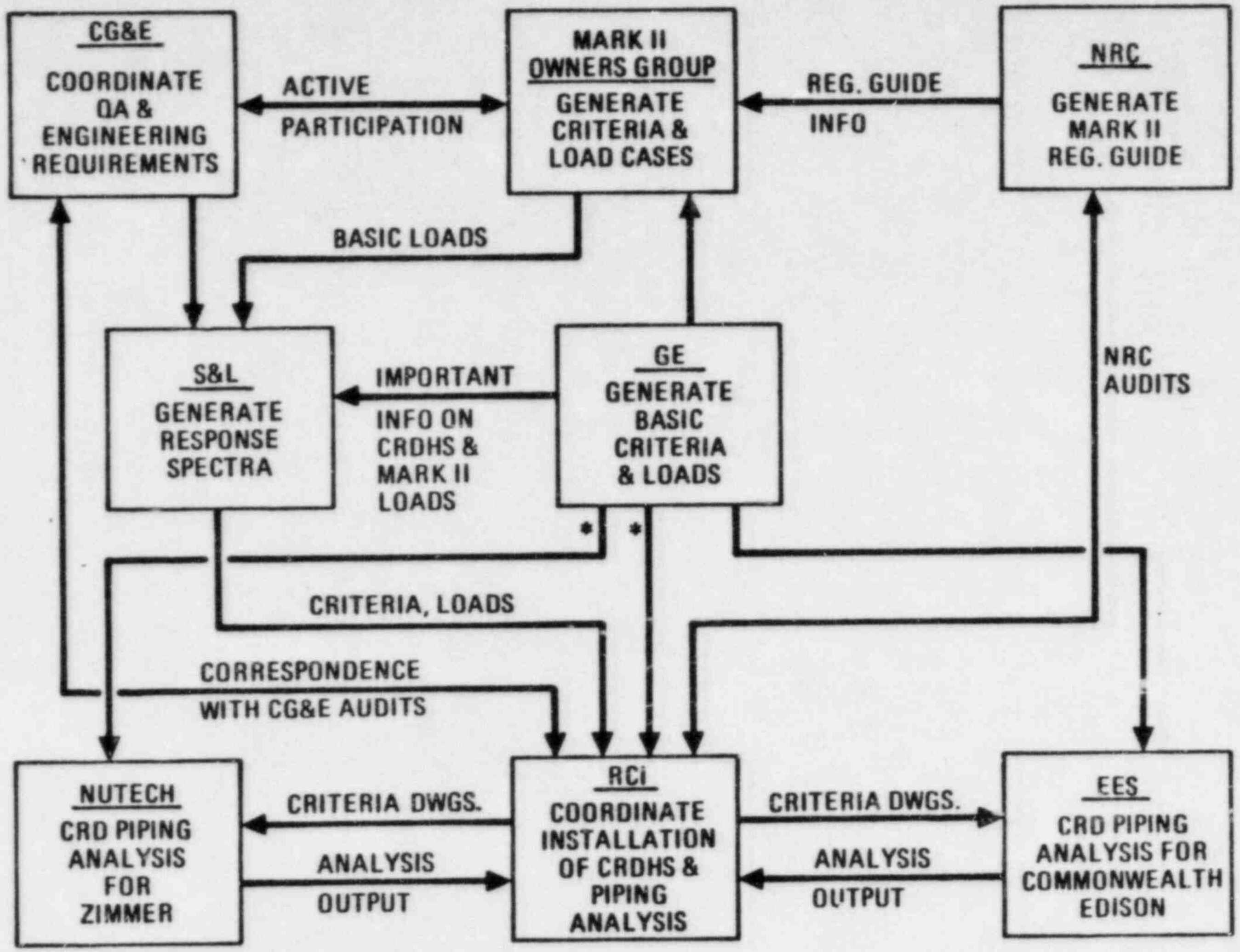
In 1979, long after the piping had been installed, RCI allowed its N-stamp to expire before the piping could be stamped. CG&E management responded by asking RCI to query the ASME about what could be done to restore its N-stamp. ASME responded that the equipment could be N-stamped when the stress report was completed because the installation had been completed when the N-stamp was in force, but that the N-stamp should be predated.

The Mark II suppression pool chugging loads greatly impacted RCI's work. Each time that RCI was about halfway through a piping stress analysis, S&L would issue a new set of loads. These frequent load changes required both modifications to the hardware and reanalysis of the piping.

In April 1980, the NRC audited similar work on the CRDHS that RCI was doing for Commonwealth Edison Company at the La Salle NPS. It found discrepancies in RCI's QA and work procedure and questioned Zimmer information being provided by S&L and the consultant (NUTECH) performing the piping analysis. The NRC inspector found RCI's monitoring and control procedures to be inadequate for the analysis because engineering information was being transmitted directly from S&L to NUTECH without RCI being in the information flow path. This was in violation of RCI procedures.

The slow flow of information prevented RCI from obtaining needed data in a timely manner. Figure 6-3 diagrams the very complex information flow between the separate companies. RCI dealt with five major organizations on the Zimmer CRDHS piping analysis (CG&E, S&L, GE, NUTECH, and NRC) at the same time in several different information flow paths.

S&L was slow in generating response spectra for use in the piping analysis. The Mark II Owners Group was slow in producing new load cases.



*INFO ON CRD SYSTEM.

C-17173

Fig. 6-3. Information paths on CRDHS piping analysis, NRC and CG&E audits, and technical information from S&L and GE

RCI could not get critical information from S&L and GE. The whole process became bogged down. The result was that CG&E issued a Stop Work Order, (SWO) No. 80-14 on all RCI work at Zimmer on December 12, 1980.

Reviews found RCI to be deficient in control procedures. This reflected the previous concerns of the NRC auditors that RCI did not have written procedures for carrying out its work. RCI agreed to write procedures covering its business practices, but it would not change its methods, since it believed them to be acceptable.

By July 1981, CG&E decided that RCI was unqualified to proceed with the CRHDS piping analysis. S&L was awarded the CRDHS piping analysis contract. CG&E felt that this would help correct the situation, since a significant number of parties was removed from the information flow path for the piping analysis.

6.3.2. Evaluate CG&E Procedures for Controlling Interfaces with Contractors (F3)

This subtask is intended to evaluate the CG&E project management procedures and practices for controlling the activities of the major contractors at Zimmer.

Initially, the basic philosophy of CG&E on Zimmer was to leave detailed procedures for conducting work to the contractor doing the work. This philosophy applied to HJK, GE, S&L, CI, RCI, and others. A CG&E Quality Assurance Manual was issued for use on the Zimmer project on June 1, 1971. Then an OPP for Zimmer was issued on March 16, 1972. This document procedure was site-specific developed from a similar procedure used on the Beckjord coal-fired power station. Prior to issuance of this OPP, the relationship between CG&E and the contractors was governed by the contracts and preliminary versions of the OPP.

The OPP issued in 1972 was basically an expansion of the contract requirements between CG&E and the major contractors. It reiterated the responsibilities of S&L, HJK, and CG&E and used organization charts to identify people and points of contact across the interfaces. In addition, it listed required management meetings between CG&E, S&L, and HJK and gave requirements for recording the minutes of these meetings. It defined correspondence by distribution lists and defined design document and specifications review, routing, and document control requirements. The 1972 version of the OPP did not detail document control procedures and AEC requirements, but deferred to the QA Manual. A later version of the OPP, issued on November 1, 1977, had extensive changes in the areas of design document control and NRC and ASME requirements. It also added a detailed explanation on how to specify documents as "essential" or "nonessential" and how the HJK Document Control Center should handle such documents. It defined DDCs, their use, proper processing, review, and approval; this was not in earlier versions of the OPP even though DDCs were being used as early as 1974. By 1977, CG&E apparently better appreciated the need for procedures to govern the project. The November 1977 issue of the OPP was CG&E's first attempt to use a procedure that significantly considered NRC requirements. Apparently, during 1976 to 1977, CG&E decided that the previous procedures were inadequate, especially in the area of design document control and quality assurance. CG&E construction engineers could not determine the status of changes because of problems with documenting DDCs on drawings.

DDCs lacked control and monitoring. The site document control center was HJK's responsibility. Creating engineering documents and changing design documents was S&L's responsibility. Requests for changes are initiated by DDC's, potentially from any authorized group.

The procedure for writing a DDC requires that the affected documents be indicated on the face of the DDC. However, in practice, the initiator of a DDC did not know all the documents affected. All documentation affected was not known until S&L personnel started to incorporate the change.

S&L would change the appropriate documents and send them to the HJK Document Control Center for distribution and storage.

The DDC procedure was weak in that it contained no feedback mechanism to allow the Document Control Center to update its records pertaining to that DDC and the document affected. Thus, S&L and the HJK Document Control Center, which contained all the documents to which the plant had been constructed, recorded different DDC status.

HJK apparently did not recognize the problem within its Document Control Center because it did not have qualified operating personnel to judge whether the DDC affected various documents. Also, CG&E did not monitor the Document Control Center closely enough to detect the problem early and correct the procedures. Not until early 1980 did CG&E recognize the problem, and not until late 1981 through 1983, was corrective action evidenced in writing. CG&E is now fully aware of the problem and has taken appropriate corrective action.

The Engineering Change Request (ECR) system was initiated by the NPD in 1977 to control engineering changes in the operations area. CG&E Operations management felt that with imminent fuel loading (1978) and S&L being phased out, it needed better control over engineering changes. The problems were as follows:

1. Engineering changes were being made by other organizations without CG&E approval such that the priority and need for the change was not established on an overall project basis before it was implemented.

2. Some changes were not properly engineered because of lack of CG&E review.

3. Changes would appear on drawings before CG&E knew about them. Thus, CG&E could not anticipate and plan for the changes.

Thus, CG&E needed to establish control over engineering changes that previously had been the responsibility of S&L. Initially, each department (including S&L) had its own procedure for writing and controlling ECRs. Not until after the IAL did CG&E produce a single procedure to control ECRs.

In 1978, GED realized that it needed better project procedures than currently in force. Interviews determined that one man on the GED staff had the task of writing procedures in his "spare time" to cover engineering business methods. The procedures described how GED performed its work. When CG&E QA reviewed the procedures, it stated that they were totally inadequate because they were not written to recognized industry standards.

After the IAL in April 1981, a new effort to write OPPs was initiated. The ongoing effort to write procedures by the single staff member was terminated in April 1981 so that the current OPPs could be written for engineering. The OPPs were written from existing sub-tier procedures. Some OPPs were already being written for the NPD in anticipation of the IAL. Thus, detailed procedures to govern project management and the interfaces between major contractors were not being written as an overall integrated project objective until after the IAL.

The OPPs that have been in preparation since the IAL in April 1981 generally appear to contain the necessary level of detail to help CG&E govern project management of Engineering, Construction, and Material Acquisition and Control.

6.3.3. Evaluate Implementation of CG&E Procedures to Control Interfaces with Contractors (F4)

As stated above, the OPPs were very general and provided an umbrella document for detailed contractor procedures. Evidence suggests (i.e., correspondence) that the procedures were followed by both CG&E and contractors, but that the OPP was not detailed enough to prevent misinterpretation. For instance, procedures were supposed to be modified by a revision to the procedure document, but were often modified via interdepartment correspondence.

Changes in contractor work scope should have been transmitted by letter. Such changes, including major project directives, were done by interdepartment correspondence.

S&L and GE appear to have observed the OPP requirements in their interactions with CG&E. A letter format was used for communications, with proper distribution as required by the OPP. The GE work was funneled through S&L as required by the OPP and also directly to the Manager of GED when appropriate.

Monthly management meetings were held between CG&E, S&L, and HJK as dictated by the OPP (1972). Minutes of these meetings were dutifully filed by CG&E for future reference. Monthly program reports were written to record the status of construction and kept on file by CG&E. The reports prepared by HJK were very detailed and captured the essence of schedule, cost, and construction problems.

Changes in project direction were often discussed in these management meetings. Direction from CG&E was recorded in the minutes of the meetings. Followup letters to major contractors delineating such changes were issued inconsistently. Although the OPP defined these channels of communication for such action, they were not always followed. For instance, notification of CG&E's takeover of construction management from HJK in 1976 was initially written in an interdepartment (internal) memo. A followup letter was written detailing various aspects of the takeover but was not received by HJK until after the effective date of the takeover. Interviews with several HJK managers expressed that they often received project direction in such a manner with little or no prior notice.

CG&E reported on monthly management meetings using internal memos. When S&L, GE, or HJK wrote minutes to these meetings, they were transmitted by letter according to the OPP. Although CG&E's use of internal memos to the major subcontractors appears to have been effective (although it did not follow the OPP), the recipient of the internal memo was often confused as to the memo's authority, and CG&E sometimes needed to issue an official project letter to clarify the situation as a followup.

In general, the minutes of monthly meetings between contractors were clear and moderately concise. They communicate the status of a number of concurrent tasks and include the action of S&L and GE in discussions with the NRC about Zimmer. Assignment of action items to individuals is missing and would have been informative. However, this was done in a lower-tier document in working-level and punch-list meetings. Thus, tasks were assigned to individuals at a different level of reporting.

6.3.4. Scheduling and Control of the Work of Major Contractors Evaluated (F5)

HJK conducted scheduling consistent with its contract and the OPP until 1977 when CG&E assumed project scheduling and development of critical path networks. HJK determined the criteria for developing scheduling with minimal input from CG&E, except in terms of the completion dates specified by the contract and OPP. Single-point scheduling was developed by working backwards from the date of fuel load. The HJK schedules tended to be construction work activity schedules which merely laid out individual construction tasks and manpower estimates. A three-week projection was updated every week. System-level schedules were tied into an overall project schedule by hand. Thus, the scheduling up to 1977 was of a more detailed nature, with only loose connections between engineering and construction activities. Construction and engineering activities on both sides of the interface between CG&E and HJK were carried out in this manner.

In 1977, the CPM was introduced in CG&E's GCD. A group was set up to produce critical path networks. However, interviews with many people in CG&E, S&L, HJK, and GE showed no general awareness that an overall project schedule existed until late in 1981. However, construction progressed well despite the major schedule delays caused by the Calvert Cliffs Decision and the Mark II containment load changes, both of which were outside CG&E's direct control.

In the later stages of construction when the work changed from bulk to systems construction, scheduling was primarily based on plant system priority, as determined by the needs of the preoperational tests. A memo delineating the top priority systems was widely circulated and used by both CG&E and contractor construction engineers. A project network schedule was produced but was only used to a limited extent, as evidenced by the minimal attention to the critical path network in monthly management progress meetings. An interview with people who produce the network, expressed that during these meetings, punchlist items and problems were first discussed for several hours, then the status of network scheduling was discussed for about 15 min. The critical path network was discussed as a separate topic and was not used as a framework for evaluating whether work was being performed on schedule and in a sequence relevant to known critical paths. Critical path network schedules were distributed to working-level construction engineers during 1981 to 1982, but not previously.

Work package preparation was a non-uniform process with no project procedures from CG&E to govern their production. This manifested itself in work packages being initiated by CG&E, HJK, RCI, then CI. HJK's Document Control Center was the final resting place for completed work packages prior to pickup by the craft superintendents. HJK was pressured to release incomplete work packages and proceed with construction to keep ahead of schedule. As a result, the crafts rejected a large percentage (50%) of packages as unworkable. Sometimes craft teams would have to stop work, reducing worker productivity. An interview with HJK's Package Supervisor revealed that HJK lacked control over package preparation, completion, review, and tracking. HJK has developed a new system which should be seriously considered for adoption by all who prepare and control work packages at Zimmer.

Interviews with HJK management personnel expressed that GCD had imposed directional changes wihtout prior notice or proper documentation as required by the OPP. In certain cases, exact immediate implementation of CG&E statements would have required layoffs. In addition, HJK claimed that the order from CG&E contained in the interdepartment correspondence demoralized the HJK working-level people involved, causing them considerable confusion and mental anguish about their jobs. To minimize this effect on its staff, HJK management told the staff to disregard such internal memos until HJK management could implement the order in a nondisruptive manner.

As noted above, incorporation of DDC procedures has been a problem. DDCs have been logged and controlled from the beginning of the project. The number of DDCs has been large, but not significantly larger than other nuclear projects of that vintage. Some DDC numbers were mixed up early in the project, but the number of such mixups seemed to be rather minimal and they were handled adequately by CG&E as evidenced by correspondence on the subject in 1973.

In early 1980, when CG&E suspected an accounting problem with the status and drawing effectiveness of DDCs, GCD started to check the DDC's by categorizing the status into 11 categories. The status was obtained from the documents in the HJK Document Control Center. By November 1980, when CG&E had a list to compare with S&L records, significant discrepancies between the two lists were found.

The solution to the problem was to go back and account for every document affected by a DDC. The PI-ZI form is used for this. It had the DDC number on one half of the page and all the affected documents on the other. This on-going project is now reconciling all DDCs.

S&L uses the MAPP computer program to track all DDCs. Currently, an effort is being made to reconcile differences between the records of S&L and CG&E through the HJK Document Control Center. S&L could not account for whole blocks of DDC numbers. Part of the problem was that some DDCs had been voided by CG&E without notifying S&L. Likewise, DDCs were written on non-essential equipment without notifying S&L.

As noted previously, a major system weakness was the document control procedures which did not require the proper followup of incorporated DDCs with the original records in the Document Control Center. In addition, DDCs were being used for purposes other than recording design document changes. For example, until about 1981 or early 1982, CG&E was correcting inspection deficiencies by writing a DDC to correct the paper before QC buyoff. Typically the author would state that the reason for writing the DDC was "to reflect as-built condition." The NRC would not allow this and wanted NRs written. The philosophy behind this practice was to correct deficiencies during the construction process. CG&E is currently writing NRs for all inspection deficiencies as well as adding a reference to the original DDC which was written for that purpose.

As stated previously, the ECR system was introduced in 1977 by the NPD to track engineering changes. The system was used without a single comprehensive procedure until the end of 1980. This procedure was superceded by OPP 3.3, issued in October 1981. The procedures now appear adequate to govern the processing of ECRs.

NPD and NED produced most of the ECRs within CG&E. S&L also produced ECRs. The ECRs provide a focal point for all concerned engineering organizations and construction to evaluate, approve, and execute engineering changes. The ECR system appears to be adequate for initiating, recording, and tracking engineering changes.

6.4. CONCLUSIONS FOR TASK F

In TPT's view, the following deficiencies exist (or existed) in CG&E's administration and control of major subcontrators. The recommended organizational structure for completing the Zimmer project should rectify these deficiencies.

6.4.1. <u>Control of Contractor Interfaces and Performance</u> (F2)

1. In the past, NED has had little or no real influence on the technical activities of S&L and GE. Although NED was the receiver and reviewer of engineering information, it has been so understaffed it has had very low effectiveness as a monitor of S&L and GE. NE has reacted to problems rather than anticipated them. Its time has been consumed in detailed work reviewing procedures and previously written DDCs rather than in monitoring the engineering activities of others. Thus, its review and oversight charter has not been meaningful. In about 1981 to 1982, NED tried to become more actively involved, but senior management must lend its support before NED influence and responsibility can increase.

2. The CG&E relationship with GE was cordial but remote. CG&E NED should establish a technical overview of the NSSS and BOP overall system engineering. To facilitate this, CG&E and GE interface should be established rather than relying on S&L. GE has transferred all Zimmer specific changes to their own standard project organization structure, drawings, specifications, reports, and design change system which they used on all BWR projects. An effort should be initiated to ensure that the GE record of changes to the design are consistent with the perceptions of CG&E and S&L.

3. The S&L and GE staff seem adequately competent both technically and organizationally. Generally, they appeared to have adequate numbers of people on the Zimmer project. However, in some cases, such as the design freeze effort in which S&L is supervised by CG&E, they lack adequate direction from CG&E, slowing down progress. S&L will not act on verbal direction from CG&E but insist on written direction, which it sometimes has difficulty obtaining. This was claimed as a common problem in CG&E's relationship

with subcontractors. CG&E should make a more conscious effort to expedite responses to all its subcontractors.

4. The management structure that evolved from CG&E's 1976 takeover of construction management concentrated decision- and policy-making power in the GCD. In its subsequent role, CG&E GCD appeared generally technically capable, but adversarial relationships and disagreements on work instructions developed. No formal procedures were followed to deal with CG&E/HJK interfaces. Management needs an increased appreciation for mutual agreements on the direction between CG&E and HJK, and these agreements need to be documented to prevent future confusion.

5. In general, CI was found to perform well in the punch-list or systems-oriented phase of construction. Although the definition and control of its work sometimes appear questionable, the NPD management was quite satisfied with CI work.

6. RCI had deficient control procedures after considerable time at Zimmer. TPT made the following conclusions, based upon the document review and interviews with cognizant individuals:

   (a) CG&E could have provided more definitive directions by providing RCI with detailed OPPs which outlined the criteria and procedures needed to conduct work at Zimmer. (The OPP in effect when RCI started work was inadequate in detail to perform this function.)

   (b) CG&E could have audited RCI more frequently during its activities at the site and at RCI's home office in San Jose, California. Annual audits were ineffective because the non-QA participants (that is, CG&E project engineering personnel) were inadequately trained in auditing procedures and requirements and did not have adequate time to prepare and execute the audits because of understaffing in GED. CG&E did not have a detailed auditing procedure for project engineering personnel or an appropriate training program.

(c) The management philosophy relied on S&L and GE, who had technical direction of RCI construction, to ensure that RCI performed properly.

CG&E has taken corrective action by hiring GE to inspect the reactor internals and define any deficiencies and corrective actions needed. In addition, it has contracted with S&L to perform the piping stess analysis and cleared with the ASME to allow RCI to use its N-stamp on the CRDHS piping installed prior to the expiration date of RCI's N-stamp. Any modifications to the piping will now be made under the direction of GCD. TPT concurs with this action subject to strengthening the CG&E organization as recommended in this report.

6.4.2. Procedures for Controlling Contractors (F3)

CG&E's original philosophy on project procedure was to let major contractors develop and use their own procedures, with the OPP as an umbrella document. The concept was good, but the implementation and control were inadequate. The original OPP, issued in 197[illegible] was a very broad but brief document that covered the bare essentials as to how CG&E was to interact with the major contractors. This OPP was inadequate as a basis to develop and record engineering/construction records, write procedures, and control software and design documents, especially design drawings and DDCs. Thus, from 1970 to 1977, before the procedure was rewritten, control of engineering and construction documents was inadequate with respect to nuclear industry requirements. ECRs were also not well controlled. The ECR system was not introduced until 1977 and did not have a unified procedure until

1981. The OPP has been rewritten since the IAL and appears to be an adequate base upon which to establish final detailed project procedures. A major effort is still required to prepare and maintain a comprehensive set of working-level project procedures.

6.4.3. Implementation of Procedures for Controlling Contractors (F4)

The very general and broad OPP was found to have been satisfactorily implemented initially by both CG&E and its contractors. S&L and GE continue to perform their work in accordance with this overall guide without major problems. More detailed implementation of procedures within CG&E and its site contractors has not been as good. Revisions to the OPP to provide greater detail or to develop sub-tier procedures were inadequate, resulting in unsatisfactory implementation. Informal procedures were utilized; memos, meeting minutes, letters, interdepartment correspondence, and verbal communications were all (often effectively) used in different ways to implement procedures. This unstructured process for implementing procedures confused the user as to the expected response.

6.4.4. Scheduling and Control of Work of Contractors (F5)

1. Adequate project planning and scheduling programs and management information systems appear to be available. However, their development, integration, understanding and utilization by CG&E and the major contractors have shortcomings. HJK appears to have minimal involvement and input. Schedules and planning documents are not used to establish priorities or work plans at monthly contractor meetings. Engineering, quality assurance, construction, and planned testing activities are inadequately integrated. TPT concludes that a centralized planning organization would be desirable to integrate the planning owrk of the operating group into a single reference.

2. HJK work package preparation and control were inadequate to prevent incomplete packages from being issued for work by the crafts. Construction productivity decreased considerably because of inadequate procedures and the pressure to release incomplete packages due to schedule needs. This situation should not be allowed to recur. The new control system developed by HJK should be seriously considered for adoption.

7. TASK G - EVALUATION OF PLANNED TRANSITION FROM PLANT CONSTRUCTION TO OPERATIONS

7.1. OBJECTIVE AND SCOPE

The objective of Task G was to review and evaluate existing procedures and the methods by which these procedures are to be implemented in the transition of the plant from the construction phase to the operations phase.

The scope of the Task G review included the following subtasks:

1. Evaluate the performance of the transition program to November 1982. Review the overall performance of the Transition Program carried out from its inception to November 1982 to provide insight into the effectiveness of project management's implementation of the program. (G2)*

2. Evaluate the policies and the planned transition program. Review those policies and procedures which establish the responsibility and jurisdiction of organizations involved in the planned future transition from construction to operations. (G3)

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*Corresponds to the subtasks in the Program Plan.

7.2. INVESTIGATION

Task G was accomplished by:

1. A review of the policies and procedures establishing the responsibility and jurisdiction of all organizations involved in the various phases of the program; i.e., construction, preoperational testing, and start-up testing.

2. A historical review of the original program from its inception in November 1978 to its termination in November 1982 to provide insights into the effectiveness of Project Management's implementation of the program.

While the planned historical review of the program was completed, the planned evaluation of the program policies and procedures required modification. CG&E had decided to redo the preoperational test program in its entirety and has returned all essential systems to a construction status. Procedures under which this rework will be implemented are being developed and will be radically different from the procedures which controlled the initial transition program. Under these circumstances, there was little point in reviewing in detail, and attempting to draw conclusions from, the existing policies and procedures. However, some general conclusions could be drawn from both the historical review and from TPT's understanding of the nature of the planned program. These conclusions form the basis of our recommendations. The conclusions are also supported by the information obtained through interviews of selected personnel at the site.

Information obtained through interviews with CG&E personnel involved in the Transition Program and a review of the applicable documents was analyzed and evaluated in relation to characteristics which would be expected to be found in a well-managed nuclear power plant project.

7.3. SUMMARY OF OBSERVATIONS

A summary of the observations based on information gathered and evaluated in Task G is presented below:

7.3.1. Evaluation of Performance of Transition Program to November 1982 (G2)

The transition program officially began in October 1978 with turnover of the first system (dc power) from the Generation Construction Department (GCD) to the Nuclear Production Department (NPD) for preoperational testing. Testing began in November 1978. By the time of the SCO, 35 of the 180 identified system/subsystem tests had been completed and the preoperational test program, as a whole, was estimated to be 46.8% complete. In April 1983, all of the essential systems (but none of the 65 nonessential systems) were turned back to GCD and the test completion percentage for these systems was returned to zero. The net result of the four-year exhaustive effort was that the preoperational test program had shown that the essential systems were not ready for start-up.

One of the major reasons for the disappointing program results was the repeated redesign effort associated with the modification of the drywell steel and the suppression pool piping support structure. Because of these modifications, the system design was significantly changed three times. The changes affected many of the essential NSSS systems and, because of piping and cable changes, caused modifications to the test program and the need for retesting.

Early in the program, it was decided to assign the highest priority to the "operational release" of portions of systems from GCD to NPD. Equipment so released could be operated by NPD, even though preoperational testing could not be performed. The rationale for this approach was to get as much of a system in operation as soon as possible so that major deficiencies could be identified and corrected. Subsequently, when the system or subsystem was actually completed the preoperational test could be performed as a formality since it was expected all of the operational problems would have already been identified and corrected. Correction of construction deficiencies, needed modifications, etc., on equipment turned over for operation required only the approval of the NPD Shift Supervisor (and the placement of appropriate jurisdictional tags on the equipment involved) in order to permit GCD to perform needed work. Systems or subsystems released for preoperational test, however, required a formal "turnback" of jurisdiction to GCD for each item of work. The number of such turnbacks grew so large that, in June 1980, the question was raised as to whether it was not more logical to turnback entire systems than to retain the existing procedure. At that time, it was decided not to change the procedure, but the systems remained in a state of completion which did not permit meaningful preoperational testing.

The reasons for the ever increasing number of turnbacks were many and varied. Among these was the discovery that required documentation of construction completion tests was, in many cases, not available. This situation was reported in a Station Review Board (SRB) Subcommittee Audit Report in September 1978, but apparently no action was taken at that time. The documentation in question was not required to be physically turned over to NPD at the time of system turnover for preoperational testing. However, the signature of the Manager. Quality Assurance Department (QAD) on the "Turnover for Preoperational Testing Form" (Form 6.1) was interpreted as an assurance that all construction testing had been completed and the necessary documentation was actually in order. In actuality, QA did not normally begin to audit construction testing documentation until after turnover had occurred. This resulted in a large number of system turnbacks so that GCD could perform and/or repeat necessary tests to generate the required documentation.

In January 1979, the QAD Manager reported that the procedural paperwork problem involved with the turnover process was under control, presumably meaning that QAD was now capable of performing their required function in the turnover process. However, in the case of the Residual Heat Removal

System (PT-RH-1), which was turned over to NPD in April 1979, 19 turnbacks to GCD were immediately required to correct construction deficiencies.

Deficiencies and/or discrepancies in each of the plant systems/subsystems were tracked via the "Preoperational Turnover Master ZPS-1 Punch List," which was generated and controlled by the System Support Group of GCD. Items were entered on the Punch List with the following designations:

Code 1: Restraints to release for operation
Code 2: Restraints to release for preoperational testing
Code 2YY: Restraints to preoperational test completion
Code 3: Items requiring completion prior to fuel loading.

A Code 2 item in existence when the system is turned over, or which is subsequently identified, would be reclassified as a Code 2YY item. Such items are generally the result of Nonconformance Reports (NRs) and/or Engineering Change Requests (ECRs). In considering the progress of the transition program, it is perhaps instructive to review the situation for a single system, PT-RH-1.

As mentioned above, the system was turned over for preoperational testing in April 1979. Testing actually started in May 1979 and ran until July 1979, when the program was estimated to be 65% complete. There were then so many outstanding turnbacks that it was decided to void the test work (and revise the test procedure) in view of the significant hardware changes that had to be made to the system.

In December 1980, it was reported that the system logic had been verified and all components had been operated, although no preoperational testing could be done since the suppression pool was unavailable due to construction work incident to drywell and suppression pool structural steel redesign. In March 1981, the system had 76 outstanding Code 2 items and it was stated to be difficult to justify starting a preoperational test with so many outstanding Code 2 items. In April 1981, there were 77 Code 2 items, 22 of which GCD promised to complete prior to June. By June, however, the number of Code 2 items had grown to 87. Nevertheless, preoperational testing resumed in June 1981 (only system logic could be tested; flow tests were not possible since the suppression pool was still unavailable). By July 1981 all testing that could be performed had been completed (an estimated 10% of the entire preoperational test), and there were still 87 Code 2 items outstanding.

The QCP started in June 1981, and generated a significant number of NRs and resulting Code 2 items. In August 1981, there were 121 such items on the RH System. In September 1981, the list had grown to 137 items, and it was determined that the drywell steel would have to be reworked for the third time. By November 1981, the list had grown to 141 items. By March 1982, the list was up to 237 items and the second retest and test procedure were voided. The total of Code 2 items on the Punch List for this system, as of May 1983 was about 439.

In August 1981, CI was hired to work off QCP-generated punchlist items on systems turned over to NPD for preoperational testing. In September 1981, Mr. Ralph Sylvia was hired as Vice President, Nuclear Operations and began placing increased emphasis on the need to support the preoperational test program. In October 1982, both CI and the Preoperational Test Coordinator reported to Mr. Sylvia providing both visibility for the test program and a dedicated construction staff to support it. In fact, CI made very little progress since questions over work assignments, scope and incomplete work packages raised NRC concerns which, in turn, prevented the full utilization of CI's capabilities regarding the completion of punchlist items.

7.3.2. Evaluation of Policies and Procedures and Planned Transition Program (G3)

This subtask was originally intended as a review of the CG&E policies and procedures which would control the Transition Program. Considering the far-reaching changes that are being implemented in the program, and the changes that will accordingly be required in the policies and procedures, the aim of the subtask was modified to a more general overview of the planned program.

As a consequence of the NRC SCO in November 1982, all construction work on safety-related systems has been halted. CG&E has taken this opportunity to reevaluate and redirect the transition program to better accomplish its required functions. The first step, which was completed in April 1983, was the return of responsibility for all systems and subsystems to GCD except for about 65 nonsafety-related systems which will remain the responsibility of NPD. For the systems returned to GCD, personnel interviews indicated that it is planned to establish teams; each of which will be responsible for a single system and will function to identify, schedule, and perform all work including the QA documentation necessary to clear all open punch-list items for that system. The teams will be composed of personnel from each of the affected organizations (GCD, NPD, NED, QAD, S&L, HJK, etc.). Details of the team composition, team leadership, responsibilities, and procedures remain to be finalized. Following lifting of the Stop Work Order and completion of each team's efforts, the completed systems will be turned over to the NPD for performance of preoperational testing with essentially no outstanding punch list items. It should then be possible to carry out the necessary testing in an expeditious and efficient manner.

For the 65 nonsafety-related systems which had previously been turned over to NPD and on which construction work can still proceed, NPD will retain responsibility. They will perform all necessary work to clear outstanding punch list items, complete all necessary documentation and then perform the preoperational testing. This work will be carried out by making use of the NPD Maintenance Division to complete construction work. It is planned to assign craft labor support from HJK directly to NPD to supplement the maintenance staff. In this respect, HJK will function in the same manner as had been planned for CI, namely, under the direct control of NPD and independent of GCD. This arrangement appears to promise two major benefits: (1) since all work will be performed within, or under the direct control of, NPD, there should be no interdepartmental coordination difficulties interfering with the efficient completion of outstanding work on a system-by-system basis; and (2) completion of the work should provide invaluable experience for the maintenance staff on details of systems for which they will eventually have complete responsibility.

As part of the overall shift to centralizing all aspects of completion of test work within NPD, a recently approved Administrative Control Procedure transfers responsibility for maintenance of the system punch list to NPD when responsibility for that system is also transferred. At that time, the system punch list entries will be deleted from the Master Punch List. Previously, responsibility for the punch list remained with GCD regardless of system responsibility. This procedure has not yet been implemented, even though NPD has established system punch lists for about 50% of the 65 systems under their control.

The organization of the test program itself has also undergone substantial changes. Prior to March 1983, the test engineers reported to a Test Coordinator (a GE employee) who in turn reported to the Vice President. Since that date, the test engineers have reported to one of four Test Coordinators (BOP, NSSS, HVAC, and Radwaste) who, in turn, report to the newly created position of Start-Up Superintendent of NPD. The Start-Up Superintendent reports to the Manager, NPD. This position has been filled by the former NPD Superintendent of Technical Services and all of the engineers formerly assigned to that division have now been assigned to the start-up organization. Included in the start-up organization are a Start-up Scheduling Group and a Supervising Engineer to direct the work of a start-up construction contractor (originally CI, but now expected to be HJK craft labor). In view of the planned establishment of the construction completion teams, it would be anticipated that the start-up organization will be modified to eliminate the start-up contractor, once work on the 65 nonessential systems is complete.

Responsibilities of all organizations involved in the Transition Program are defined in the Preoperational and Start-Up Testing Manual, approved in September 1981. In view of the many organizational changes that have occurred since that date, as well as the planned changes in the method of completing construction (the team concept), it is necessary to revise this document at the earliest opportunity since it is stated to be the overall controlling document for the entire start-up program. Since such revision is required, there is little point at this time in commenting on the present document. However, certain stated organizational responsibilities are worth mentioning, as follows:

1. NED has responsibility for review of S&L test specifications and design changes. However, all communication between CG&E and S&L is stated to be via GCD. This arrangement places an organization in the communication chain with no responsibility for the work involved (and also perhaps no inputs).

2. S&L is responsible for notifying the Manager of GCD (rather than NPD) whenever anticipated engineering changes require changes to the start-up schedule.

3. "Preoperational tests" are required only for safety-related systems and subsystems. For nonsafety-related systems, "acceptance tests" are performed. The manual, however, does not define how an "acceptance test" differs from a "preoperational test." Further, Chapter 14 of the FSAR lists only preoperational tests even though some of the tests listed are identified in CG&E's test summary reports as "acceptance tests."

4. The manual does not assign any responsibilities to Nuclear Services Department (NSD) for the start-up program.

S&L has the responsibility for reviewing test specifications prepared by GE for the NSSS, while NED has responsibility for review of S&L-generated test specifications. TPT made a limited evaluation of the adequacy of the CG&E review of an S&L test specification (the Structural Integrity Test), and then only of the bypass leakage part of the test. TPT has serious technical reservations as to whether this test, as specified, could yield any meaningful data on leakage past the drywell floor. Nevertheless, this test specification had received the full complement of CG&E review and approval signatures. The specification is presently in the process of revision by S&L, but the basic question arises as to how thoroughly any of S&L's work has been reviewed by CG&E in the past. Statements were made that, in actuality, little or no review by CG&E of S&L's work was ever done (or allowed by management). In the context of the start-up program, it appears that an independent, expert review of S&L-generated test specifications, procedures, and evaluation should be performed.

7.4. CONCLUSIONS FOR TASK G

It is clear that the results of the preoperational test program, as originally conceived and carried out, were unsatisfactory because of the significant design changes imposed during the program, compounded by the decision to allow "operational release" of systems and subsystems prior to completion of the construction of the entire system. This shortcoming has apparently been realized, and the corrective action provided is to return the program, in effect, to its beginning by returning all essential systems to GCD jurisdiction and committing the project to completing all construction activities and then repeating the entire preoperational test program. Judgments as to the adequacy of this approach must remain tentative at this time since details of how the transition from construction to operation will actually be implemented have not yet been finalized. Nevertheless, certain conclusions and recommendations can be offered.

The "team" concept, wherein representatives of all the affected CG&E departments are assigned a group (with the responsibility for coordinating all needed work to successfully complete the preoperational testing of a specific system or subsystem) promises to supply the coordination of effort which appeared to be lacking in the initial program. As of this date, procedures have not been prepared to establish the number of teams, their responsibility and membership, and the authority which a team will have to set work priorities for the various CG&E departments and subcontractors involved in construction completion, QA documentation, resolution of deficiencies uncovered in testing, etc. Thus, the efficiency of the "team" concept cannot be evaluated. However, it is clear that without substantial involvement of upper management in monitoring, evaluating, and directing team performance, the planned transition program will suffer, as an even greater number of uncoordinated demands are made by the teams on a limited resource base. With appropriate management support, the teams promise to provide the needed interdepartmental coordination.

At the close of the original transition program, NPD had a staff of 35 test engineers, two-thirds of whom were CG&E employees. It would be expected that this staff, experienced in the Zimmer plant projects, would be adequate to support the planned program. The NED situation is less clear. As of May 1983, the department had a total engineering staff of 24 engineers (60% CG&E employees), only nine of whom were assigned responsibilities for NSSS and/or BOP systems. Considering the backlog of outstanding ECRs (about 1100) and the undoubtedly large number of additional ECRs that will be generated in the course of renewed testing, it would be expected that the staff will have to be enlarged if it is also to be capable of supporting the "team" concept. Since there will be a need for people with experience directly applicable to the Zimmer project, it is most probable that CG&E will obtain the needed manpower by acquiring contract labor from S&L, GE, EDS, or similar sources. This approach has the usual drawback; valuable expertise is lost when the temporary personnel complete their job assignments unless the prior transfer of experience is properly addressed by management. However, considering the time available (unavoidably) until the Stop Work Order is lifted, and while known construction deficiencies are remedied, CG&E should make every effort to expand the NED staff with CG&E employees and provide them the necessary on-site training so that they can function adequately as members of the various teams.

Existing procedures, in effect, have S&L review GE's work, while CG&E reviews S&L's work. There is some doubt as to the thoroughness with which this review has been performed, especially in view of the NED staff size. In the context of the transition program, this review should take the form of an independent, knowledgeable group with the responsibility to confirm that proposed tests (preoperational and start-up) actually fulfill the requirements of NRC Regulatory Guide 1.68; that the test data obtained provides the desired level of confidence that the system under test performs in accordance with design criteria; and that any exceptions taken to the test do not invalidate the test. Under existing procedures the reviews are, in effect, carried out by GE and/or S&L (depending on whether the system is NSSS or BOP) and are then submitted to the Station Review Board (SRB) for approval before final acceptance by the Manager, NPD. The SRB consists of, in addition to the NPD Manager, the Director of QA Operations (who reports to the Manager, QAD) and four NPD division superintendents (Technical Services, Radiation Chemistry, Operations, and Maintenance). For the type of technical review envisaged here, the SRB does not appear to be the appropriate body, since only the Director of Operations, QA does not report to the NPD Manager, and thus the Board might be susceptible to pressure (either from upper management or internally generated) to be less than objective, especially as the preoperational test program nears its conclusion and fuel loading becomes imminent.

FSAR Table 14.1-1 lists 96 preoperational tests some of which, according to CG&E's test summary, undergo preoperational tests and some of which undergo acceptance tests only. Existing procedures do not address the difference between the two types of tests. This matter should be clarified.

Organizational responsibilities and communication procedures in the Preoperational and Start-Up Testing Manual are, in certain instances, inappropriate and out of date and should be revised. Specifically,

1. As shown in the 1982 organization chart (Fig. 2-4), NED is responsible for contracts with S&L. The manual reference to communications through GCD on design changes and test specification requirements requires revision.

2. Integrated planning for the preparation and maintenance of start-up schedule should include all affected CG&E organizations including S&L. The present requirement for S&L to only notify GCD of anticipated changes should be modified accordingly.

3. Regulatory Guide 1.68 requires that the operating history of other nuclear plants, including reportable events, be considered in preparing test procedures. It would seem appropriate to assign NSD the responsibility for the collection and timely distribution of such information to test engineers for their use in preparing/revising test procedures.

8. TASK H - EVALUATION OF CG&E MANAGEMENT THROUGH CASE STUDIES

8.1. OBJECTIVES AND SCOPE

The objective of Task H was to assess the role and behavior of CG&E management in response to selected specific problems and/or series of events, using the case study approach as a cross-check on the observations and conclusions reached separately in each of the other tasks in this independent review project.

The scope of Task H is defined as a case study on each of the following topics:

1. CG&E Management Attitude Toward "Whistle Blowers."
2. Structural Steel in the Control Room.
3. 2400 feet of Small Bore Piping.
4. Welding Procedure and Welder Performance Qualification.

8.2. INVESTIGATION

For each of the four case study topics, the investigation was conducted in the following steps:

1. A review of documentation describing the problem and how it was detected; the analyses performed and any determination of direct and root causes; the corrective actions authorized, taken, and verified; and the identification of key personnel knowledgeable about the problem and its handling.

2. Interviews with key personnel and a comparison of the information obtained from different interviews and from documents.

3. Evaluation of the effectiveness of CG&E management in investigating and reporting the problem and in authorizing, controlling, and verifying problem analysis and corrective action.

4. Comparison of the results of the case study regarding management's role and behavior with the observations and conclusions arrived at separately in the other tasks within this review project.

8.3. SUMMARY OF OBSERVATIONS

8.3.1. CG&E Management Attitude Toward Whistle Blowers

In the course of its investigations and evaluations of the quality assurance systems at the Zimmer plant, the NRC has received a number of statements that were made by employees and former employees at Zimmer to the effect that significant problems existed with respect to the satisfactory implementation of the required Quality Assurance Program. In some cases those persons alleged, either then or in later statements to the NRC or to others, that because they had "blown the whistle" they were subsequently harassed, intimidated, or discriminated against in one way or another during the period of their service at Zimmer.

In this part of the review, TPT examined available documents and interviewed persons having knowledge of this aspect of the Zimmer history in order to assess CG&E management attitudes toward the whistle blowers. As part of the process, TPT reviewed several NRC reports and examined files in CG&E's QA department and in other departments for relevant documents. Numerous people were interviewed, either in person or by telephone, some of whom are currently employed at the Zimmer site; but many others are former employees of either CG&E, or of HJK, or of subcontractors. TPT reviewed all written statements made available by the whistle blowers, and any other supporting documents relevant to their statements which could be found. In particular, in order to obtain direct first-hand understanding, TPT interviewed as many of the people who had alleged they had been subjected to retaliatory action as could be located, and who wished to relate their information to TPT.

Throughout this inquiry TPT has been particularly careful to retain a completely objective approach. In all cases, TPT has looked for documented evidence of the historical actions that were related to them during interviews or that were recorded in whistle blowers' statements. TPT attempted to obtain more than one perspective on given events or circumstances by direct interviews and telephone discussions with additional people, when that was possible. Emphasis was placed upon determining what the attitude and actions of CG&E's management were with respect to the whistle blowers and comparing the findings with observations in other tasks within TPT's overall review.

Case History

Table 8-1 has been prepared to summarize information gathered in this case study covering 20 individuals, who were selected as either having claimed mistreatment after citing quality deficiencies at Zimmer or alleged being harassed during performance of quality inspections. The table was fashioned to provide both a brief view of the whistle blowers' actions and claims and a brief assessment of the actions and attitudes of CG&E management personnel with respect to each case.

As is shown in Table 8-1, only a few of the individuals whose cases were reviewed actually claimed to have been subjected to retaliatory actions after having cited quality deficiencies. There are many more cases of alleged harassment of quality inspectors by construction personnel. A number of such cases have been investigated by the NRC; e.g., in Region III Report No. 50-358/81-13, covering the investigation of construction activities conducted during the period

TABLE 8-1
LIST OF "WHISTLE-BLOWERS" AND TREATMENT

Name	Employed By	Dates Employed	Position	Type of Complaints	Testimony/ Affidavit	Type of Reprisal Alleged(2) (a)	(b)	(c)	(d)	(e)	(f)	Whistle Blower Action: Comments on Allegations	CG&E Action and Attitude Regarding Whistle-Blowers: Was CG&E Involved Directly or Indirectly?	Did CG&E Take Action?	Was CG&E Action Appropriate?	Does Reprisal Allegation Appear To Be Valid?	Comments on CG&E Action and Attitude
1. Dave Jones	HJK	11/80-7/82	QA Engr/ QA Analyst	QA prog. deficiencies. Improper disposition of NRs. Lack of vendor audits.	Testimony to congressional Subcommittee 6/82. Various affidavits.		X	X	X	X		Mistreatment or reprisal of D. Jones was denied by all former HJK supervisors. HJK claimed payroll error caused temporary pay cut, later corrected.	Indirectly	Not insofar as known	See comments.	Evidence appears to refute the allegations.	No evidence that influenced HJK's action with respect to Jones. CG&E management's attitude and lack of action regarding alleged QA deficiencies was inappropriate.
2. Edwin Hofstader	Husky Prod. Co.	~1972 to 8/78	Mgr Ind. Engineering	Size and design of cable trays improper. Claimed low-strength steel was used for cable trays, poor quality welds and unqualified welders used.	Affidavit 8/7/81	X					Termination by Husky	Hofstadter complained repeatedly because NRC tended to ignore or refute his statements.	Indirectly	Yes, after NRC Report 78-21. See comments.	In part, only. See comments.	No evidence to judge.	CG&E's lateness in investigating and correcting cable tray problems was inappropriate. No indications CG&E influenced Husky regarding Hofstader.
3. Len Spievak	Technitron Welding School	~10/76	Consultant Husky Prod. Co.	Poor quality welding on Husky cable trays by untrained welders	Interviewed by NRC:'78						Termination by Husky	Spievak's report to Husky Prod. Co. addresses technical issues only.	Indirectly	Yes, after NRC Report 78-21. See comments.	In part, only. See comments.	N/A	CG&E's lateness in investigating and correcting cable tray problems was inappropriate.
4. Donald Blanch	Foothill Elec.	~'73-~'78	Supervisor	Cable trays overloaded. Improper installation of cable.	Affidavit 6/26/79						None	Blanch stated only concerns for quality. No allegation of any mistreatment.	Indirectly	Yes, after NRC Report 78-21. See comments.	In part, only. See comments.	N/A	CG&E's lateness in investigating and correcting cable tray problems was inappropriate.
5. Mr. "Q"	Not disclosed	Info. withheld by TPT	Electrical Welder Foreman	Poor quality welds and improper documentation. Intimidation of others.	Not disclosed(4)						See comments	Claimed no mistreatment of self, but alleged mistreatment of C. Griffis, a Catalytic employee.	Directly, since inspections were done by CG&E and Catalytic.	No. See comments.	Yes	No. See comments.	Info. shows Griffis was not mistreated. Also, Catalytics Welding records have been found acceptable by CG&E. Allegation of bad welds seem inaccurate. CG&E action and attitude was appropriate.
6. Mr. "R"	Not disclosed	Info. withheld by TPT	Electrical Welder Foreman	Poor quality welds, improper documentation. Intimidation of others.	Not disclosed(4)						See comments	Claimed no mistreatment of self but alleged mistreatment of C. Griffis, a Catalytic employee.	Directly, since inspections were done by CG&E and Catalytic.	No. See comments.	Yes	No. See comments.	Info. shows Griffis was not mistreated. Also, Catalytics Welding records have been found acceptable by CG&E. Allegation of bad welds seem inaccurate. CG&E action and attitude was appropriate.
7. Peter Moore(5)	CG&E (MES)(3)	~7/'81-12/'81	CG&E QA inspector	Harassment and intimidation by HJK QC personnel	None, insofar as known						Harrassment by HJK, only.	Conflict appeared due principally to "double inspection".	Directly	Yes	Yes	N/A	CG&E QA manager discussed the complaint with HJK personnel and latter assured any harassment discovered would be disciplined.
8. David Williams	CG&E	~'81	CG&E QA inspector	Improper QC inspection by HJK. Improper processing of NRs.	None, insofar as known						None	Conflict between CG&E and HJK inspectors. Sager regarded Williams as a good inspector.	Directly	Yes	Yes	N/A	CG&E QA manager discussed the complaint with Williams and HJK QA and resolved the problems. CG&E supported Williams.
9. Michael Indino	CG&E	~'81-'82	CG&E QA inspector	Harassment and intimidation by HJK welding engineer.	None, insofar as known						None	Conflict between CG&E inspection and HJK welding engineer.	Directly	Yes	Yes	N/A	CG&E QA manager discussed attitude problems with HJK management and resolved the conflict. CG&E supported Indino.
10. Steve Sikorski	CG&E (MES)(3)	~'81-'82	CG&E QA inspector	Harassment and intimidation by HJK welding engineer.	None, insofar as known.		X				Intimidation by HJK only	Conflict between CG&E inspection and HJK welding engr.	Directly	Yes	Yes	Yes, insofar as is known, but conflict was resolved. See comments.	CG&E QA manager discussed attitude problems with HJK, and resolved the conflict. CG&E supported Indino. HJK welding engr. was instructed not to harass the CG&E QA inspectors.
11. Dan McLaughlin	CG&E	~'82	CG&E QA inspector	Intimidation by HJK ironworker craft foreman.	None, insofar as known.		X				Intimidation by HJK only	Conflict between CG&E inspector and HJK ironworker foreman.	Directly	Yes	Yes	Yes, insofar as is known, but conflict was resolved. See comments.	Action by CG&E was not recorded, but conflict was resolved. CG&E supported the inspector.

TABLE 8-1 (Continued)

Name	Employed By	Dates Employed	Position	Type of Complaints	Testimony/ Affidavit	Type of Reprisal Alleged[1] (a)	(b)	(c)	(d)	(e)	(f)	Whistle Blower Action: Comments on Allegations	CG&E Action and Attitude Regarding Whistle-Blowers: Was CG&E Involved Directly or Indirectly?	Did CG&E Take Action?	Was CG&E Action Appropriate?	Does Reprisal Allegation Appear To Be Valid?	Comments on CG&E Action and Attitude
12. F. C. McKelvey	CG&E	~'82	CG&E QA inspector	Harassment and intimidation by HJK craft foremen.	None, insofar as known.						Threat of bodily harm.	Conflict between CG&E inspector and HJK ironworker foremen.	Directly	Yes	Yes	Yes, insofar as is known, but conflict was resolved. See comments.	HJK meeting with McKelvey and foremen resolved conflict. CG&E attitude appeared appropriate.
13. Jeff Greatorex	HJK	~'82	CG&E QA inspector	Improper use of NR system.	None, insofar as known.						None	Resigned 1982.	Complaint was made directly to CG&E management.	Yes	Yes	N/A	Apropriate corrective actions were taken to remedy the problems of the NR processing. Action was slow but appropriate.
14. L. Q. Handley	CG&E (SAI)	~'82	CG&E QA inspector	Intimidation by HJK QA	None, insofar as known.		X				Intimidation by HJK only	Conflict between CG&E inspector and HJK QA supervisor.	Directly	Yes	Yes. See comments.	See comments.	CG&E QA manager discussed the complaint with Handley, and with HJK QA and concluded that Handley's actions were inappropriate. Handley was provided additional job instructions.
15. Victor Griffin	HJK	10/72-2/76	QC Engr.	Lack of vendor QC. Deficiencies in QA prog., CRD pump storage uncontrolled.	GAP[2] att 6/83						None	Claimed NRC whitewash. No claim of mistreatment.	Indirectly	Not insofar as known.	No. See comments.	N/A	CG&E's lack of action in investigating and correcting quality deficiencies was inappropriate.
16. George Kreidler	Foothill El. HJK	10/81-10/82	Electrician	Deficiencies in tools and workmanship on elect. conduit.	Unknown						None	Kreidler alleged no mistreatment but feared dismissal would result if deficiencies were stated.	Indirectly	Not insofar as known.	No. See comments.	N/A	CG&E should have discovered and corrected the quality problems.
17. Sam Yates	HJK	11/75-3/80, 10/80-5/81	Pipefitter, and const. records.	Lack of mgmt control. Lack of security, waste.	GAP att 33:-Ohio, 12/81						None	Claimed CG&E failed to enforce stds. for performance and workmanship.	Indirectly	Not insofar as known.	No. See comments.	N/A	CG&E should have discovered and corrected the quality problems.
18. Richard Reiter	HJK (GP assoc) and CG&E (Belcan)	~5/79--11/80, 2/82-6/82	HJK QA records, CG&E NED	Deficiencies: QA records, training, NR sys., falsification of records.	GAP att 16:- GAP att 23:-						None	Claimed NRC whitewash.	Indirectly initially, then directly.	Not insofar as known.	No. See comments.	N/A	CG&E should have discovered and corrected the quality problems.
19. Nathan Dycus	CG&E (NES)	~'79-4/83	Level II NDE Insp.	Claimed Stacy Mfg used bad RT methods.	None, insofar as known.	X			X		Termination by NES	Dycus was terminated by NES recently, but whistle blowing caused dismissal.	Directly	Yes	Yes	No. Termination was not due to Dycus' allegations.	CG&E actions and attitude with regard to Dycus appear to have been appropriate.
20. Thomas Applegate	CG&E	12/79-1/80	Investigator	QA prog. deficiencies	GAP prog. deficiencies.	X					Harassment: phone calls followed on road, etc.	Claimed reluctant law enforcement regarding his civil rights.	Directly	No	In part, only. See comments.	No evidence was found that dismissal was due to whistle blowing. See comments.	CG&E's actions and attitude with respect to Applegate appear to be appropriate, but CG&E management's attitude and lack of corrective actions for quality deficiencies he reported was inappropriate.
21. Chuck Weaver	HJK	5/82-11/82	QC Inspector	QA prog. deficiencies, e.g., improper welder qualif. and inadequate QC inspector training.	Reportedly gave testimony to NRC-OIA and FBI.			X				Claimed CG&E and HJK managements willfully violated QA reqmts, and NRC Region III did require compliance.	Indirectly. See comments	Not insofar as known.	See comments.	See comments.	Weaver alleged reprisal only regarding reassignment of duties that prevented access to areas of QA deficiencies. Due to late date of contact, the facts as to treatment by HJK and any involvement by CG&E could not be determined.

Notes: (1) Type of reprisal alleged:
(a) Terminated
(b) Threat of termination
(c) Reassigned to other work
(d) Demoted
(e) Salary cut
(f) Other reprisal as shown
(2) GAP Government Accountability Project's complaint to NRC.
(3) Job-shop personnel indicated by parentheses.
(4) "Q" and "R" said they have made statements to NRC and to FBI but gave no further details.
(5) Subjects numbered 7 through 16 were not available for interview. The cases were investigated and discussed with CG&E QA Mgr., because it appeared appropriate to determine what CG&E actions and attitudes resulted from the record complaints.

January 12 to October 9, 1981. In that report the NRC reviewed, among other findings, the circumstances of the water-dousing incidents of several QA inspectors.

TPT selected for review the cases of several inspectors (Nos. 7 through 14 in Table 8-1) who complained of incidents of intimidation or harassment. Because most of these were CG&E inspectors, the occurrences provided an opportunity to determine what actions CG&E management took to investigate or resolve the issues in each case.

CG&E Management's Role and Behavior

As indicated above, Table 8-1 contains brief notes regarding CG&E management's actions and attitudes with respect to each of the 20 cases reviewed. Without exception, for those cases in which CG&E was directly involved, the documents located and the information obtained in interviews indicate that the actions and attitudes of CG&E management were appropriate with respect to the personal treatment of the whistle blowers. However, it appears that CG&E was slow to act to investigate and correct the quality deficiencies that were cited by the whistle blowers.

In a notice that was posted at the site and dated August 10, 1979, CG&E President Dickhoner declared the company's commitment to give urgent and careful consideration to safety concerns expressed by site personnel, and to treat them confidentially. The notice specifically promises freedom from reprisals, penalties, or discrimination for any individual providing information or asking questions about safety standards of the construction and operation of the plant.

During this case study several knowledgeable individuals were questioned to determine whether a CG&E policy or procedure exists which defines the internal handling of allegations concerning the quality or safety of the plant to ensure the appropriate attention, investigation, and follow-up. While a formal procedure evidently does not exist, it seemed clear that recent investigations were handled appropriately.

As noted in Table 8-1 (lines 7 through 14), the actions and attitudes of CG&E's management with respect to the QA inspectors who encountered conflicts with construction personnel appear, generally, to have been appropriate. In the cases cited some of the discord appears to have been due to the usual differences in personalities or perspective. The records show that CG&E's current QA manager has provided good support to the inspectors. In four of the cases described, the resolutions included alerting the HJK construction personnel that the freedom of the inspectors to identify nonconforming conditions must be respected.

A further aspect of the attitude of CG&E's management, with respect to quality inspection personnel, that was investigated in this task was the questions that have been raised following the publication of a report designated as "Henry J. Kaiser Co. Analysis Report for Zimmer Project, May 24, 1982." This report relates to CG&E and HJK cooperative efforts underway at that time to investigate and make disposition of the large number of nonconformance reports that remained open. Two statements in that report were cited by the Government Accountability Project (GAP) in the "Miami Valley Power Project Petition to Suspend Construction of the Zimmer Station." In allegations numbered 165 and 208, the intervenors alleged that the selected statements show that HJK and CG&E QA managers planned to apply pressure against the writing of NRs by having "heart-to-heart" talks with inspectors, and by analyzing trends to "identify habitual NR writers for corrective action."

In its responses to the allegations, CG&E pointed out that the intervenors used the words out of context and had distorted the meaning of the terse statements. TPT reviewed and discussed the report with the CG&E QA manager and found no basis for the alleged intent to restrict the inspectors' actions.

The very opposite seems true. The May 1982 Analysis Report was a progress report of the task force's work toward improving the effectiveness of the NR system, and as a working document it included a planning table of options with abbreviated wording.

In summary, the conclusions that were reached from this case study of CG&E's treatment of whistle blowers are:

1. There appeared to be no credible information or factual evidence that reprisal actions were taken by CG&E management against those who reported quality deficiencies.

2. TPT concludes there was an inappropriate lack of action on the part of CG&E management to promptly investigate the quality deficiencies reported and to pursue corrective measures in a timely fashion.

8.3.2. Structural Steel in the Control Room

A number of problems were identified regarding structural steel. They are in three major categories: (1) upgrading of structural steel from nonessential to essential application, (2) material traceability, and (3) welding of structural steel. For purposes of this case study, upgrading of structural steel from nonessential to essential application was selected for investigation.

This case study is concerned with the alleged procurement of structural steel to nonessential PO procedures and subsequently issuing the material as acceptable for use in essential structures. Some of the POs were for structural beams typically used for the construction of conduit and cable tray hangers in the Control Room, as well as other locations throughout the plant.

Case History

Three HJK POs were selected as examples in this case study. The first two of these were placed in 1974, and the third in 1976. Each PO clearly states that the material is to be certified A-36 steel and that mill certificates are required with the shipment; also that all material must be marked in accordance with the requirements of ASTM A-6. In all cases, the end use of the material was indicated to be nonessential and the material was to be received to nonessential procedures.

Warehouse material issue slips indicating the intended use of the material, including a record of the heat number, were issued with the material from mid-1975 through 1977 with some material still being issued as late as 1981 against the 1974 POs. When the material was determined to be for use in essential structures, it appeared to be common practice for the HJK QA manager to sign the issue slip as "OK for use in essential structures" even though the material had been procured to nonessential procedures from unapproved suppliers/manufacturers. This fact was clearly indicated on the issue slip.

The HJK QA Manager, who was signing the issue slip as "OK For Use In Essential Class 1 Structures," expressed his concern in February 1977, to CG&E, regarding the large number of structural steel manufacturers who were not on the AVL, and who had supplied materials that were subsequently used in essential structures in the Zimmer plant. He also indicated that at the time the purchases were made it was not clear from the requisition just where the material would be used. Therefore, to ensure that the material could be used for essential applications, HJK requested certified mill test reports. This still does not meet the requirements for maintaining an AVL, but it does meet the specification requirements (ASTM A-6) for traceability. HJK claimed that the reason the manufacturers were not on the AVL was because HJK's earlier requests for surveys were denied by CG&E. HJK's claim was confirmed by TPT's review of correspondence between the two companies.

In TPT's attempt to trace the use of "upgraded" nonessential steel in essential structures to the Control Room, the manager of the HJK Materials Management Department was interviewed and he provided the store issue slips and their associated Field Work Orders (FWOs) which indicate the end use in the plant of the materials issued against the subject POs. One issue slip indicated that the end use was for the construction of Class 1E hangers, and although no direct reference to use in the Control Room was made, this would be a typical application for Class 1E hangers for supporting conduit and cable trays in the control room as indicated in an interview with CG&E QCP personnel.

A Corrective Action Request (CAR) was issued in December 1982, by CG&E to HJK, indicating there were 758 nonessential POs written on material to be used on nonessential systems. The CAR further states that of these, 118 have been conclusively determined to be issued to essential structures. Investigation has also shown that the HJK QA Manager had been approving nonessential material to be upgraded for use on essential work without a procedure or controls to do so. The HJK reply indicated that the procedures or guidelines for reclassification of material were not clear but from available letters, memos, etc., this was done by the HJK QA Manager, with the full knowledge and consent of CG&E.

CG&E did not fully accept HJK's response to the CAR and subsequently reissued the CAR to HJK in February 1983. HJK's response to the reissue of the CAR stated that material upgrade accomplished prior to April 1977 did not occur in accordance with an approved procedure, but that it was accomplished with the full knowledge of CG&E management. HJK also indicated in their response that even though the material was processed to nonessential procedures, the POs contained all the requirements which applied to essential purchases, with the exception of Vendor Qualification. CG&E accepted HJK's response to the reissued CAR.

CG&E set up Task III of the Quality Confirmation Program (QCP) to investigate potential problems related to the traceability of material installed in safety-related systems and structures of the plant.

As part of QCP Task III, POs which procured nonessential steel that cannot be postively identified as being installed in nonessential applications are being reviewed by CG&E and HJK on a case-by-case basis. Appropriate action is being taken, where required, in the form of NRs which are subsequently dispositioned and corrected.

The present policy concerning the procurement and traceability of structural steel requires that all structural steel material shall be purchased as essential, with all QA requirements clearly stated. The requirements include transfer of the heat number to the fabricated piece. Exceptions to this policy must be justified and clearly documented. This policy does not add any extra procedural requirements to existing procedures except for that of the transfer of heat numbers to the site-fabricated piece. This more than satisfies the requirement of ASTM SA-6 paragraph 10.2, which only requires that structural materials shall be marked with the heat number, size of section, length, and mill identification marks on each piece by the manufacturer.

CG&E Management's Role and Behavior

The root cause of the problem is indicated to be a standard reluctance by CG&E, during the early part of the program, to authorize HJK to carry out source evaluations of structural steel suppliers/

manufacturers. The reason for this reluctance is unclear; apparently CG&E believed it was not necessary. CG&E was aware of the upgrading practice by the HJK QA Manager since he had expressed his concern to them on several occasions concerning the large amount of material purchased from unapproved suppliers/manufacturers. HJK apparently did not believe this to be improper or, at a minimum, they were doing what they could under the circumstances. Apparently CG&E condoned this activity as a cost-savings method. This was also suggested by HJK management personnel in interviews, and inferred in the report by HJK corporate QA auditors who specifically investigated the subject of supplier QA at the Zimmer station.

CG&E's reluctance to authorize surveys of suppliers caused the HJK QA Manager to take the next best action, which was to require the material to be supplied with Certified Material Test Reports (CMTRs) in accordance with the ASTM requirements for the material, and to subsequently upgrade the material for use in essential structures on that basis.

In an interview with HJK project management, it was pointed out that the AWS requirements for structural steel material only require material identification as to the material type. On the other hand, the Field Construction Procedure, effective in the 1974 through 1976 era, required both mill certificates and traceability to heat numbers up to the point of fabrication. This indicates that HJK was using conservative practices back in 1974 and that the problem was not so much traceability but the verification of supplier/manufacturer qualification.

CG&E exhibited an apparent lack of sense of responsibility and initiative in not initiating corrective action in the form of corrective action requests to HJK until December 1982. In an interview with CG&E QA management, it was indicated that CG&E has now recognized this deficiency and is actively engaged with HJK in the review of vendors.

This is evidenced by the Vendor Audit Survey Status Report June 1983, which indicates the status of NRs, including those concerning structural steel material installed in essential plant structures, and the number of vendor audits performed. This is positive indication that both CG&E and HJK are working together actively to correct any former inadequacies relating to vendor qualification.

Individual cases are still being resolved, primarily through the QCP. The QCP program is vigorous and well managed and its policy of investigating structural steel procurement on a case-by-case basis to qualify nonessential steel procurements, previously issued for essential use, should satisfy NRC safety considerations.

8.3.3. 2400 Feet of Small Bore Pipe

Approximately 2400 feet of small bore piping was purchased in 1977 for use in safety related systems of the CG&E Zimmer Unit 1 Nuclear Power Plant and was subsequently installed. In 1982, a documentation review by HJK indicated that the HJK Procurement Specification invoked an ASME Code, Section III paragraph, to which the Certified Material Test Reports (CMTRs) did not comply with respect to definition of relevant heat treatments. Subsequently, the Code reference to heat treatment definition was determined by CG&E to be erroneously stated and the CMTRs were determined by CG&E to be acceptable since they met the ASME Code and Design Specification requirements that were applicable. As a conservative measure, CG&E further elected "to add confidence to the actual quality of the pipe" by cutting out samples of piping from the plant and subjecting them to chemical and mechanical destructive tests to verify their chemical composition and mechanical properties.

This investigation also addressed the concern expressed during NRC public meetings on Zimmer that the specific location of the subject pipe within the plant could not be initially traced, but then "somehow" was found, implying doubts regarding the legitimacy of the traceability procedure used.

Case History

A PO was generated by HJK (in accordance with the CG&E policy to delegate the purchase of materials to HJK) in October 1977, for approximately 2400 feet of small bore piping to ASME Code Material Specification SA106, Grade B. The requirements on the HKJ procurement specifications included:

1. Material and certificates in accordance with ASME Section III, NC-2000.

2. The need for CMTRS in accordance with ASME Section III, Paragraph NA 3766.4.

3. Material to be marked with manufacturer's name or brand, heat number, specification, and grade. The marking to run continuously along the length of the pipe.

4. Color code marking on the opposite side of the pipe to manufacturer's marking.

5. The material to be purchased from an approved vendor.

NOTE: The Code edition and addenda were not specified for any of the Code callouts.

The subject piping was subsequently supplied in December 1977 by Mutual Manufacturing and Supply Company of Cincinnati, and had been manufactured by the Leyland Tube Company of New Jersey. Four heats were associated with the supplied piping material, which was subsequently installed in various safety-related systems in the Zimmer plant.

Over four years later, during the course of a documentation review by HJK, an HJK NR was generated in February 1982, which stated that the CMTRs did not include a description of the applicable heat treatments as required by Paragraph NA 3766.4 of the ASME Code, and to further complicate matters, the manufacturer, Leyland Tube Company, was no longer in business and no information concerning heat treatments could be obtained from other sources.

A notification of a Potentially Reportable Item [a 10CFR50.55(e)] Report was prepared by CG&E Quality Control in March 1982 covering the same topic, and issued to the CG&E QA organization for evaluation. The CG&E QAD Manager determined that Paragraph NA 3766.4 of Section III of the ASME Code was nongoverning since it did not appear until the Winter Addenda of 1973, whereas the design had, in accordance with regulations applicable to the complete plant, to conform to the requirements of the ASME Section III Code for 1971 through the Winter Addenda of 197[illegible]. That earlier edition and addenda of the ASME Code do not require statements of the heat treatment to be given on the CMTR. Hence, the purchased material fully conformed to the applicable ASME Code requirements. In the me[illegible]ntime, a comprehensive review of other related POs was made by H[illegible], 90% of which made the same reference to NA 3766.4. This resulted in a further CAR being initiated by HJK in April 1982, in order to correct the erroneous Code reference. Notwithstanding the QAD Manager's decision that the material was acceptable, the original 10CFR50.55(e) report was submitted to the NRC in April 1982.

The original disposition of the NR was to rework by replacing all of the subject heats that had been installed in safety-related systems of the plant. Subsequently this disposition was changed to accept-as-is by HJK in April 1982, who claimed that all the material was in compliance with the Code requirements.

It was now felt by CG&E that, for all practical purposes, the problem was resolved. In the meantime CG&E "in order to add confidence to the actual quality of the pipe," because of the defunct Leyland Tube Company, elected to cut out four heat samples for testing, which would close out both the NR and the 50.55(e) report.

Eventually, Revision 2 to the HJK NR was issued on May 3, 1983, and approved by the HJK Authorized Nuclear Inspector (ANI) in May 1983. The disposition instructions were to remove sample pieces of piping. "All pieces were to be sent to approved independent test facility and tested for chemical and mechanical analysis. After verification, all piping associated with heat samples that fail chemical/mechanical testing shall be replaced with new approved traceable materials to be performed in accordance with approved site procedures."

Subsequent to this CG&E commitment to cut out samples, there appears to have been some breakdown in communication between CG&E and HJK which resulted in delays so that the SCO was issued by the NRC on November 12, 1982 before the samples could be cut out.

The four heats were located in the plant systems by reference to the material take-off data located in the top right-hand corner of the HJK Isometric Piping Drawings (ISKs) which, in turn, reference the warehouse stock number of the material which is also on the Material Received Report in the HJK PO files. Both the stock number and the corresponding heat number are referenced on the Material Received Report. Four CG&E Construction Work Approval Requests (CWARs) were submitted to the NRC in April 1983, requesting NRC approval to remove pipe samples in order to carry out destructive tests to determine the heat treatment of the 2400 feet of pipe. Each CWAR has an ISK for small bore piping attached indicating the sample to be removed.

CG&E Management's Role and Behavior

The root cause of the problem relating to this 2400 feet of small bore piping was the reference in the HJK Procurement Specifications to a section of the ASME Section III Code that was not applicable to the piping system design of the Zimmer plant. The reference in the HJK procurement specification was apparently taken from an indirect reference in the S&L design specification to a later Code edition. Management action to follow-up and correct the design specification, and amend the FSAR, is still outstanding.

CG&E management has shown consistency and diligence in following up, in writing, the interim reports on the status of the 50.55(e) to the NRC Region III Office. Their current position seems both rational and conservative with respect to the intent of removing samples of the four heats to add confidence in the actual quality of the material.

Additionally, the four heats were located in the plant safety-related systems via the ISKs and the PO, which indicates traceability does exist. The amount of the 2400 feet of pipe that exists in the plant safety systems has not been determined at the present time; the important fact is that it appears to be traceable through the ISKs and PO documentation and as demonstrated by location of the samples.

The present CG&E QCP program includes a walkdown of ASME Section III piping involving 2681 ISKs and related documents, of which 140 have been done. NRs generated by this task will be resolved on a case-by-case basis. This is being followed by CG&E and HJK on a regular basis. The status of the AVL and the status of all NRs are reviewed at the same meetings.

However, the long delay in obtaining a final disposition on this particular NR, and particularly in getting HJK to cut out the four heat samples, is indicative of poor communication and a lack of a sense of urgency or perspective on behalf of CG&E management. This is corroborated through interviews with HJK construction management, who were "not aware" of any open NRs relating to small bore piping. They indicated that typically CG&E did not communicate well with HJK, and this had resulted in a large backlog of NRs. A management review board is now operative to deal with this situation and meets weekly to update an action item list. A further observation by HJK project management was that CG&E did not allow HJK to "talk" directly with S&L; it was their strong opinion that construction should deal directly with the design organization and, in this case, CG&E had acted as a bottleneck resulting in inordinate delays and confusion. Interviews with CG&E management also indicated communication problems and "CG&E's inability to get HJK to 'go do it'."

8.3.4. Welding Procedure and Welder Performance Qualifications

Section IX of the ASME Boiler and Pressure Vessel Code requires that each manufacturer or contractor shall record in detail the procedure specifications for all welding procedures that are used in the construction of weldments done in accordance with the Code. Both the procedure and each welder who uses it shall be qualified by tests defined by the Code. Each manufacturer or contractor shall maintain a record of the test results obtained in welding procedure and welder performance qualifications. These records shall be certified by the manufacturer or contractor and shall be available to the Authorized Inspector.

Case History

Somewhat prior to the date of the IAL (April 1981), cases were noted such as NRC's cable-tray investigation, wherein welding procedures used by HJK or their subcontractors were allegedly not properly qualified. Welder performance qualification records were also alledgedly not properly executed. Review and investigation by the NRC, as well as subsequent checks made by CG&E QA, brought to light that the problems in these areas during the period prior to mid-1982 were numerous. They had considerable significance, because doubt then was cast upon assurance that welding done on safety-related systems, such as that done on components specified to be constructed in accordance with the rules of Section III of the ASME Code, was actually of the requisite quality.

Audit logs reviewed by TPT show that no audits were performed by the CG&E QA Audit group prior to 1979 which addressed the adequacy of HJK's welding procedure and welder performance qualifications. The first audit including it, and two supplements thereto, was done in May 1979. It covered qualification records of welders and welding inspectors who installed T quencher components in the suppression pool. A review of this audit report and its attachments indicates that:

1. The audit appears to have been very limited in scope and the report lacks thoroughness; it is unclear what specific documents were reviewed by the auditor.

2. The deficiencies discovered were resolved by changing the procedure specification requirements; i.e., the deviations were accepted and made part of the procedure.

3. Evidently, because no nonconformances were reported, the audit report was not transmitted to CG&E management.

Similarly, a CG&E QA audit performed in March 1979 related to welding done by a subcontractor, Waldinger-Young & Bertke (WY&B). The audit report states that it included verification: (1) of procedure qualifications, (2) of AWS and ASME welder performance qualifications and maintenance records, and (3) that welding done by WY&B was performed according to the procedure. Again, the audit appears to have been rather superficial; e.g., verification of procedure qualification was limited to checking that S&L Design Engineers approved the procedure specifications. No deficiencies were reported, and the report was evidently not sent to CG&E management.

Another CG&E audit, performed in July/August 1980, was more thorough. It included verification of the performance qualification records of four welders who worked on pipe supports. The audit report was routed to CG&E upper management (Culver and Borgmann), but apparently not to top management (Dickhoner). In this audit a discrepancy was identified, which consisted of an erroneously designated filler material on the Welding Procedure Qualification Record executed in April 1976. Because a pipe material specification was shown, instead of a filler material specification, the error should immediately have been obvious to capable and experienced Welding Engineers and QA auditors. Unfortunately, it was not recognized as a clerical error by the involved CG&E, HJK, and S&L personnel. The correct filler material was apparently actually used in all of the welds. However, needless communications ensued for nearly two months as an attempt was made to rationalize a corrective action for use of the supposedly incorrect weld filler material. There were no site personnel available who had well-founded expertise in nuclear QA, materials, welding engineering, and in construction according to the ASME Code in order to readily make a determination. Staff with adequate qualifications were not available at Zimmer until August 1980.

Although the issue of unsatisfactory qualification of welding procedures and welder performance qualifications received some attention by both CG&E and HJK personnel during 1981, it appears that relatively little progress was made during that year to correct the specific errors and omissions in the documents, or to establish and correct the root causes of the problems. Clearly, the cause was the lack of capable, experienced Welding Engineers and QA Engineers on the on-site staffs of both HJK and CG&E.

On December 8, 1981, the Assistant Director of Inspections of the National Board of Boiler and Pressure Vessel Inspections and the Chief Inspector for the State of Ohio performed a preliminary investigation which resulted in establishing, on a continuing basis, the on-site audit and surveillance of Zimmer construction by a three-man team of the National Board of Boiler and Pressure Vessel Inspectors. The team began its activities in 1982, and submitted its first Interim Report of audit findings to the State in May 1982. A second Interim Report dated July 1982, and subsequently monthly reports, listed additional deficiencies and provided a view of the status of the problems. Included in the findings were specific deficiencies in the documentation of welding procedure and welder performance qualifications.

The National Board's work is concerned only with components built to the requirements of the ASME Code, whereas the welding procedure/performance qualification problems are common to substantially all safety-related components and structures.

By July 1982, both HJK and CG&E had begun substantial work toward tabulating past records for welder performance qualifications and were attempting to correct some of the qualification document deficiencies then existing. A meeting of CG&E and HJK with NRC Region III personnel was held on July 9, 1982, to discuss the status of the documentation. Subsequently, NRC Region III was advised of allegations that relevant documentation on the qualification of welders, which was reviewed at a preparatory meeting between CG&E and HJK on July 8, was not discussed or made available to the NRC at the July 9 meeting. Allegedly, the discussions on July 8 showed that the problem of unsatisfactory welder qualification records was extensive. On the other hand, the general flavor of the July 9 meeting was that the concerns were being addressed satisfactorily. By a letter of October 27, 1982, the NRC required CG&E to provide written statements under oath detailing documents prepared for, or reviewed at, the July 8 and July 9 meetings.

CG&E submitted the required information and statements to the NRC by a letter dated November 15, 1982, and its attachments. The CG&E letter affirmed that no reports or documents other than those already made available to NRC Region III were prepared for the July 8 or July 9 meeting. It should be noted that G. Fones, HJK QA, had a one-inch-thick stack of "Welder Status" sheets, together with a summary and index, at the July 9 meeting. Fones told the NRC about these sheets, but the NRC representatives said they did not want a copy at that time. TPT obtained, through interview of the on-site NRC representative, direct confirmation of the acceptance by the NRC of that position. The NRC also confirmed that substantial information on the status of welder qualifications, which may have been discussed at the July 8 meeting, had already been discussed with the on-site NRC representatives several weeks prior to the meetings. Then on July 12, 1982, Gywnn and Shapker of the NRC met again with Fones and were given a complete set of all the "Welder Status" sheets.

<u>CG&E Management's Role and Behavior</u>

Two important aspects of this topic that TPT evaluated are whether CG&E's management became aware of the documentation deficiency early enough and whether they caused timely corrective action to be taken. TPT did not investigate the veracity of the statements made concerning the data provided to the NRC.

Several points seem evident based on the documents reviewed and information obtained in interviews:

1. Throughout most of the construction period, CG&E upper management was, apparently, not aware of the lack of satisfactory records on welding procedure and welder performance

qualifications. This appears to have been caused by the following conditions:

(a) There was a notable lack of CG&E staff having expertise in welding engineering and compliance with the ASME B&PV Code. Hence, deficiencies were seldom discovered or reported. Evidently, CG&E's management did not recognize the personnel deficiency, and took no noticeable action to correct it until 1980.

(b) The small CG&E QA group performed some audits and surveillance activities of HJK and the subcontractors, but they were inadequate in both quantity and thoroughness and few nonconformances were identified.

(c) The CG&E upper management (either the GCD Department Manager or the Vice President) apparently did not take action on its own to become involved to an appropriate degree in implementing the QA program for the Zimmer Nuclear Power Station, with respect to such items as welder performance qualification records.

2. After the IAL in April 1981, CG&E began to take actions to have the welding records accumulated. These actions appear to have been slow for nearly a year. In December 1981 the first of the NRs on deficient welder performance qualifications was written. By July 1982 there is evidence of substantial involvement by CG&E in achieving corrective action.

3. CG&E upper management was aware of and responded appropriately in providing sworn statements to the NRC refuting the allegation of withholding of information on requalification of welders at a July 1982 meeting.

4. By the time of the SCO, in November 1982, CG&E management had instituted cooperative actions with S&L and HJK for the review and correction of welding procedure qualification deficiencies. The task force effort includes the writing and qualification of new procedures which will consolidate the coverage and reduce the number of procedures from 91 to 21.

In summary, CG&E middle and upper management were apparently unaware of the deficiencies in the welding procedure qualifications and welder performance qualifications of HJK and its subcontractors until about April 1981. Had they had more involvement in the Zimmer QA program and maintained an awareness of the status and adequacy of quality-related matters, they should have recognized the situtiion at least as early as 1976. It was at that time that CG&E moved additional personnel to the site and began to assume greater responsibility for construction.

There was little evidence found, dated prior to December 1981, that CG&E had taken steps to require corrective action with respect to deficient qualification records or to prevent recurrence. The Welding Procedure Task Force effort and the welder performance records evaluation under the Quality Confirmation Program, both of which are now making good progress to correct past deficiencies and prevent recurrences, appear to have the complete attention and support of CG&E's management at all levels.

8.4. COMPARISON WITH THE CONCLUSIONS IN OTHER TASKS

A comparison was made of the CG&E management role and behavior in each of the four case studies, with the results and conclusions from the other tasks within this overall review. It was found that, in each of the case studies, similar management deficiencies existed which were consistent with the problems found in the other tasks in this report. For example, the other tasks in this review cited examples of CG&E management's lack of experience in nuclear construction, lack of emphasis on quality commitment, lack of procedures and records control, and, fundamentally, lack of understanding of the importance of thorough documentation required on the construction of a nuclear plant.

The problem of upgrading nonessential quality to essential quality structural steel involved the purchasing of structural steel by HJK from suppliers who were not on HJK's AVL. As noted in Task D, a basic philosophy of CG&E was to meet the minimum QA requirements. Throughout Zimmer's construction HJK had to request permission from CG&E to perform surveys, vendor audits, and source inspections. On occasion, CG&E would not grant permission to HJK to perform these surveys and inspections on the grounds that surveys were not necessary for placing vendors on the AVL.

This reluctance of CG&E to allow HJK to survey suppliers, and place the ones who successfully passed the survey on the AVL, caused the routine placement of POs for steel as nonessential because it appeared to be a simple matter to upgrade the material to essential use after receipt. In later years, of course, these earlier CG&E decisions caused and continue to cause, delays and considerable expense involving the upgrading of structural steel issue.

The welder qualification study indicated a similar management attitude; that is, one in which lack of experience and cost pressures kept the CG&E staff at such a minimal level that they were unable to detect and recognize the significance of the welder record qualification deficiencies in a timely manner. In addition, records were inadequately maintained.

The CG&E organization which should have detected, recognized the significance of, and followed up on ensuring the correction of the HJK welder qualification deficiencies was the QA organization. Task C and D pointed out that CG&E had an extremely small and relatively inexperienced QA staff that were not free generally from cost and schedule pressures. As organized and staffed, the QA organization was not well equipped to detect the problems early, then follow up to assure satisfactory resolution. Instead, CG&E relied upon HJK to a great extent and were somewhat unaware of the consequences of the irregularities in welder qualification. These same management characteristics and attitude were also shown in other tasks in this overall evaluation.

In comparing the role and behavior of CG&E management that was observed in the whistle blower case study with that found independently in the several other tasks, notably Tasks C, D, E, and F, it was noted that there are significant similarities. For example, when the initial whistle blowers provided information to CG&E in 1980 that quality program deficiencies needed attention, CG&E concluded that such concerns had already been identified by QA so there was no need for further investigation. CG&E then apparently did little or nothing to correct nonconformances for more than a year. The same attitude of pushing ahead with construction, and downplaying the importance of quality program observance, has been noted in each of the tasks in TPT's study.

As pointed out in the discussion of the 2400 feet of small bore piping, it appears that, once the problem was recognized in 1982, CG&E approached the problem properly, with the proper attitude. However, the delay in identifying the problem (over four years) arose from the lack of timely audits and the delayed attention to adequate document records. The subsequent delays in removing the pipe samples and communication disconnects between CG&E, HJK, and S&L reinforce the observations in Tasks D and F.

The final conclusion common to all case studies, which was also corroborated by observations in all other tasks B through J, was that since the SCO, there has been a significant change in approach toward project management and, in particular, the attitude toward quality. As CG&E strengthens the Zimmer project organization by hiring experienced external personnel, this improvement in management attitude should continue.

9. TASK J - EVALUATION OF ALTERNATE PROJECT MANAGEMENT ORGANIZATIONS

9.1. OBJECTIVES AND SCOPE

The objectives of Task J were to evaluate the advantages and disadvantages of various alternate organizational structures for the management of the Zimmer 1 Nuclear Project and to provide a basis for recommending the one most likely to ensure that the high standards of nuclear power plant design, procurement, and construction are met.

The scope of Task J is defined by the following review subtasks:

1. Review of the results of Tasks A through H to determine what problems occurred in the management and QA programs of the Zimmer 1 project. Emphasis was placed on identification of organizational structure or elements which could (a) negatively affect such things as communication between the various groups and top management, (b) result in any missing, diffused, or unclear lines of responsibility and authority, and (c) limit the proper implementation of procedures to control the work.

2. Interview of cognizant personnel, in conjunction with Task A, to obtain and assess ideas and evidence concerning potential management and organization changes that would improve project performance.

3. Evaluation of at least the four alternatives for the management of the Zimmer 1 project as called out in the NRC SCO. An evaluation was included of procedural and organizational changes that have been implemented and/or proposed by CG&E since the SCO. The

following alternatives were among those reviewed to see what advantages and disadvantages would exist if applied to the Zimmer project:

(a) Comparison with approaches to the management of other nuclear projects in evaluating the alternatives for the Zimmer 1 plant.

(b) The NRC requirement in Appendix B of 10CFR50 that requires CG&E as the owner of the plant to be ultimately responsible for all activities associated with its design, construction and operation.

(c) The implications of major organizational change on project continuity.

9.2. CONTEMPORARY NUCLEAR PROJECT ANALYSIS

Selected contemporary nuclear power projects were examined to provide a basis for evaluating the Zimmer project management and for evaluating the alternatives to determine the appropriate organization to recommend for the Zimmer 1 project. A summary of the observations and conclusions that can be drawn from this examination is as follows:

1. Corporate management must make an across-the-board commitment, in both word and deed, to quality. In today's complex environment, this is the foundation upon which a successful project is built.

2. Comprehensive integrated planning, commencing well before the project is initiated and continuing to its completion, is mandatory to avoid major problems during project implementation.

3. Careful development of contract terms that clearly spell out the responsibilities and authorities of the owner and the contractor is of major significance to avoid misunderstanding of duties later in the project.

4. Top management must be continually concerned with preventing the development of adversarial relationships within the project and the company and between the company and interested parties, such as the NRC and the public. When such relationships exist, the successful implementation of the project can be significantly impeded. It usually takes direct involvement by the top management to deal adequately with this problem.

5. Virtually all projects end up with a corporate officer dedicated solely to and responsible for all major nuclear activities at project end. Projects are more successful when a corporate officer is involved early in the project.

6. All owner responsibilities for design, procurement, construction, and licensing are normally drawn together into one group managed by a project manager, who is frequently a corporate officer.

7. There is clearly no one way for the owner to organize for implementation of a nuclear power project. Although those studied all tend to delegate a majority of activities, there still were significant differences in approach. One project delegated virtually all design, procurement, and construction to contractors. Another project delegated all activities except procurement. A third project delegated design and construction initially, but also maintained procurement. At a point late in this same project, a joint construction management group was formed to finish the plant. All these approaches seem to work provided the arrangements with the contractors are carefully developed and the owner staffs adequately to perform his duties.

8. Constant change in the project organization and scope of its activities has a detrimental effect on the implementation of the project.

9. Project organizations, regardless of the level of delegation have more than 100 technical and administrative staff. The number of staff can range in excess of 500 where major functions such as construction management and first-line QA activities are the responsibility of the owner. In recent years, staff have been fully dedicated to the project; thus intracompany interfaces are reduced and the need for large coordination efforts is minimized. Intercompany relationships and communications are also simplified.

10. Where all design and construction responsibility is delegated, the owner's QA organization, which provides a quality overview by audit and surveillance, is typically small, with six to ten field auditors and six to ten quality systems engineers. The lower end of the range in both cases is believed to be marginal and places heavy reliance on the contractor to see that the plant is built correctly.

11. The internal interface, where the project turns systems or components over to an operating organization for testing, startup, and operation, causes significant problems in many nuclear power projects. The exact point of turnover, whether at the completion of construction, the completion of prerequisite testing, preoperational testing, or startup, is an issue that is frequently debated and sometimes changed during the life of the project. Considerrble planning for this turnover is necessary to minimize major inefficiencies in project implementation. This is particularly true of procedures for handling documents turned over with the systems and for the handling of additional construction or equipment modification after turnover has occurred.

9.3. REVIEW OF TASK RESULTS

This section presents a review of the results and conclusions of the other tasks in this independent review and the statement of the major tasks that will confront the new Zimmer project management organization.

9.3.1. Results of Tasks B through H

A review was performed of the results and conclusions of Tasks B through H with an emphasis on providing recommendations to correct major deficiencies in the Zimmer project management organization. These recommendations should be implemented in conjunction with the recommended reorganization in Section 10. Additional detailed recommendations are provided in Section 11.

The key organizational changes to correct deficiencies perceived by TPT in the Zimmer project organization are summarized below.

9.3.1.1. Project Management Organization (Task B)

1. Increase the number of qualified, experienced personnel by hiring additional permanent staff and also by using temporary help. Particular emphasis must be placed on obtaining people with prior nuclear power plant construction experience.

2. Adjust assignments so that essentially all personnel assigned to Zimmer have no other responsibilities and are dedicated to the project.

3. Establish a comprehensive, integrated system of clearly defined project policies and procedures. These policies and procedures should be prepared, revised, and issued by a centralized organization that integrates the input of all users. The policies and procedures should define the scope, responsibilities, and

procedural steps in sufficient detail to prevent misinterpretation and misunderstanding.

4. Publish all project policies and procedures, and make copies available to all project personnel. Establish training/information classes, conducted by line managers, to ensure that the project staff understands the requirements of the procedures they will be using in performing their jobs.

5. Establish a centralized, integrated project management system that defines authorities, responsibilities, and interfaces. This system should include planning and scheduling, budgeting, configuration management, document control and records management, material control, and performance measurement. The central records system should be implemented immediately.

9.3.1.2. Management Policies Toward QA (Task C)

1. CG&E Management must demonstrate a QA policy that shows a strong commitment to quality at all employee levels (e.g., from the President to craftsmen). The commitment to quality must be seen to emanate from the top in both word and deed and must be promulgated at all staff levels in the organization.

2. Centralize all QA related responsibilities, including the licensing QA, construction QA, startup QA, operations QA, and standards QA activities (e.g., audits, training, procedures, records, corrective action, etc.) under a single CG&E QA manager. Hire a CG&E QA manager with extensive utility construction QA management experience and a proven track record working for a utility that has completed a nuclear power plant project. This individual would report on the same level as all other CG&E managers having responsibility for a major function (e.g., Construction, Operations, and Engineering).

3. Revise the CG&E personnel policies and salary ranges for Zimmer to facilitate obtaining an adequate number of permanent CG&E QA personnel with sufficient nuclear QA experience. Consider replacing certain of the existing QA management personnel who lack the experience and broad perspective needed to satisfactorily manage the Zimmer QA program. Consideration should also be given to immediately hiring the full complement of permanent QA staff that CG&E will need for long-term operation of the Zimmer plant.

9.3.1.3. Management of the QA Program (Task D)

1. When Appendix C of the FSAR, which itemizes the exceptions to be taken to the Codes and Standards identified in Chapter 17.1 of the FSAR, has been approved by the NRC, the CG&E QA Manual and procedures and other subcontractor safety-related procedures must be modified to reflect the Chapter 17.1 commitments and exceptions. When this is accomplished, it is recommended that the following be implemented as a minimum:

   (a) The OPP should be modified to provide explicit instructions for the dissemination of Chapter 17.1 changes to the QA Department, as well as instructions for notification to LEAD when changes in quality practices may require changes in the FSAR.

   (b) OPP 9.3, which is referenced in OPP 3.7 but is not on the latest OPP index, should be developed in order to describe the applicable regulatory requirements and commitments to codes, standards, correspondence, and FSAR statements.

(c) Internal audits of the Zimmer quality program should include a periodic verification that the criteria of the working level quality-related procedures of CG&E and its subcontractors conform to the FSAR commitments and the OPPs.

2. Assimilate all experienced QA instructors on site into the centralized training organization (functionally, if not physically). Instructors must themselves be subjected to an established training program in their respective fields of instruction.

3. Add or assign an experienced staff of QA personnel whose primary responsibility is to plan and implement an effective system for tracking problem areas, performing comprehensive and meaningful evaluations, and initiating action to obtain effective corrective action.

4. Ensure that a sufficient number of auditors who are qualified according to ANSI N45.2.23 are available to provide CG&E's quality control an effective overview of the design control function.

5. Transfer the responsibility for tracking and evaluation of 10CFR50.55(e) reports, NRC Inspection Reports, CERs, MCARs, etc. from the Quality Engineering group to a separate branch established within the QA Department to handle all open item tracking, problem evaluations, corrective action followup, and NRC concerns/findings followup.

6. Provide a clear-cut delineation of CG&E and HJK responsibilities and authorities in the area of procurement QA control. Clarify when vendor surveys/audits/inspections should be performed and an Approved Vendor List developed.

7. Ensure that quality-related documents to be maintained as records are complete, accurate, valid, and readily retrievable.

9.3.1.4. Quality Confirmation Program (Task E)

1. Although the present QCP management appears to have an organizational structure that includes adequately defined responsibilities and authorities, further effort is required to adequately define some tasks and achieve improved progress in others.

2. The treatment of audits, audit findings, root cause identification, corrective action, and overall management assessment of the QCP through audits requires improvement.

3. As defined, the QCP is only a limited portion of a thorough QVP. A comprehensive and logical plan is required to define scope and objectives to provide assurance of design and construction in other areas. The QVP will require a strengthening of organization and additional staffing, as well as a definition of responsibility, authorities, and interfaces, in order to accomplish the program in a credible manner.

9.3.1.5. Contractor Interfaces (Task F)

1. The Engineering Department should have increased capability to fulfill its charter of interacting with and monitoring S&L, GE, and any other engineering organization outside CG&E. Included in this group should be control and responsibility for design at the time of turnover, control of further design changes, and assurance that the as-built plant condition is accurately and properly documented technically.

2. The Engineering Department should provide stronger support to the project in the areas of ECR, DDC, and NR evaluation and approval; verification analysis; engineering of changes required by the QVP; and compliance with the FSAR, industry standards, etc.

3. The Engineering group should participate with NPD, GCD, and S&L in the planning and coordination of the transition from construction to operations for the purpose of evaluating the effects of changes on system function and plant safety.

4. NED staffing should be increased to perform the foregoing duties effectively. Permanent CG&E staff should be hired to the level projected as necessary for future Zimmer plant operations. Additional temporary staff should be hired as required. Staff should have appropriate prior nuclear experience.

5. Individuals in the Construction and Engineering Departments who interact with external organizations should emphasize the need for cooperation between the owners, the project office, and the contractors. A spirit of teamwork, a mutually agreed upon task definition, including manpower requirements and schedule, should be promoted and used in day-to-day activities so that desired tasks will be performed willingly and with a commitment to quality and schedule. All directives across the boundaries between the project and contractors should ultimately be in writing to prevent confusion, improper implementation, and misinterpretation of scope and schedule.

6. A construction package system should be developed that is uniform for all organizations, properly procedured, and with tracking control through the document center at all times. Ensure that individuals using the system are adequately trained. The system recently developed by HJK should be used as a basis for the

preparation and control of work packages. Packages should not be issued until all documentation is completed and included.

7. CG&E and the major contractors should use project schedule and critical path network techniques as a frame of reference for establishing priorities and due dates for completion of punch list items consistent with the system priorities established by NPD. This will help organize the work flow.

9.3.1.6 Transition to Operations (Task A)

1. To avoid repetition of the situation that existed at the time of the SCO, management must enunciate and enforce a strong policy aimed at the orderly completion of the transition program. This policy must ensure that systems are permitted to be turned over to NPD for testing only when they have been brought to a stage of construction completion (including all necessary documentation with appropriate QA verification) where preoperational testing can actually be performed. It must be anticipated that such testing will uncover certain deficiencies. Management's commitment to the program must be such that needed resources are made available to promptly rectify such deficiencies as they are uncovered.

2. Management must be committed to a high level of involvement in directing and evaluating performance of the system "teams," if this approach to construction completion and plant startup is to be successful.

9.3.1.7. Case Studies (Task H). The results and conclusions of the four case studies were related to procedural matters and management behavior and confirm the observations in the other tasks. They do not offer any particularly different guidance correction of deficiencies in the Zimmer project organization.

9.3.2. Major Goal and Task Considerations

The major goals of the Zimmer project must now be to establish corporate credibility, establish the quality of the design and construction to date, rectify any deficiencies, and complete construction and startup fully in accordance with regulatory requirements.

It is with this background, and based on the investigation of CG&E management, including its QA Program, that TPT recommends the management organization changes discussed in the last section of this report.

Before specific organizational arrangements and responsibilities of each organizational unit are discussed, some overall considerations deemed appropriate to the anticipated continuation of the Zimmer project are presented.

9.3.2.1. Work Scope. In order to recommend an appropriate organization, the major tasks that need to be performed must first be identified. Key among these tasks are:

1. Defining and completing a comprehensive QVP to evaluate the quality of the Zimmer plant from the start of construction to the present.

2. Rectifying any deficiencies found in the QVP, including modification of hardware consistent with design requirements and rework or replacement to be performed in areas where the quality is indeterminate.

3. Completion of remaining construction, including outstanding design modifications, final construction checkout, preoperational testing and startup testing, performed fully in accordance with NRC regulations, and after startup, ongoing operation of the plant.

4. Confirmation of operator selection, training, and qualification in preparation for plant startup and operation.

5. The development of a comprehensive and integrated program plan, a schedule, and the management information systems needed to execute the foregoing.

6. The establishment of an effective QA and audit program to ensure that all activities are performed to the appropriate regulatory requirements and standards this program should include and its actions taken in a timely manner to identify and correct problems and their causes.

9.3.2.2. Policy Toward Quality Assurance. A key consideration in completing the Zimmer plant is management's policy and attitude toward QA. Quality assurance must start at the top executive, and permeate everyone and everything that is done. This across-the-board commitment to quality and QA should not be made under duress. The commitment should be made because it is good business and good management.

As noted in the previous section, TPT's recommendation is to centralize and elevate the status of the QA management. However, all management functions must accept the responsibility and commitment to perform work of acceptable quality. The QA group should not (as has perhaps been the case at Zimmer) be regarded as the organization that controls the work to ensure it is right. The commitment to quality, and the basic control of and responsibility for the work, is fairly and squarely in the hands of the Construction, Operations, and Engineering groups. QA must be independent and provide assurance through the inspection, surveillance, and audit functions that quality is built into the product, but the *a priori* responsibility is with the performing organization. In addition to holding the performing organizations responsible and accountable for the quality of the work they do, upper management must get timely feedback on its own QA performance.

9.3.2.3. The Quality Verification Program. The QVP is seen as the next project phase for the Zimmer plant. This QVP is considerably broader in scope than the existing QCP. It affords CG&E the opportunity to make its QA and QC objectives evident. The immediate effort should be directed toward the scoping, planning, and scheduling of activities, staffing, procedure preparation, etc.; organizing of related documentation; and the execution of inspection activities, including walkdowns to check compliance between actual construction and design requirements. Implementation of hardware changes during this project phase would be initiated only as required to satisfy the QVP and would be completed prior to commencing the additional work necessary to complete construction, plant checkout, and preoperational testing.

It is recognized that, in practical terms, addressing corrective actions/changes as required on individual systems will result in a phased and partially overlapping transition to construction (i.e., the QVP of some systems will be completed earlier than others, and it may be more efficient to complete construction on those systems for which the QVP may be completed early).

From the initial definition of its scope to its eventual successful completion, the QVP will require the support of every organization involved in the Zimmer project. The day-to-day leadership of each QVP activity and its organizational relationship must be clearly defined as the responsibility of a single organization, but the overall management responsibility of the QVP is placed squarely with the Senior Executive having overall management responsibility for the Zimmer plant, as it is with any other project phase. In this context, various elements of the QVP may result in conflicting demands on available CG&E resources. Only the strongest commitment of CG&E's management to coordinate, schedule, and monitor QVP activities and maintain staff morale can result in the successful completion of this program.

9.3.2.4. Staff Availability and the Role of an Architect Engineer/Constructor. Another overall consideration must be the practicality of quickly getting, on an individual basis, the right type, quality, and quantity of management and support staff considered necessary to complete the Zimmer project in accordance with regulatory requirements. To mitigate this problem, a fully qualified and experienced architect engineering/constructor (AE/C) type company should be retained to provide the quality and quantity of qualified staff required in the short term to manage construction and provide an oversight of the QVP and construction completion.

9.4. SELECTION METHODOLOGY AND CRITERIA

9.4.1. Methodology

The decision methodology employed in selecting the recommended Zimmer project management utilized a modified Kepner-Tregoe type analysis* method and criteria developed by TPT. This decision-making methodology involves the following fundamental elements:

1. Defining the decision to be made (e.g., selecting a preferred project management organization from several alternatives).

2. Defining the primary, or MUST, criteria against which the alternatives will be evaluated (e.g., the organizational structure must facilitate completion of the Zimmer project in accordance with all NRC regulations).

3. Specifying the secondary, or WANT, criteria against which alternatives having met the MUST criteria will be further evaluated and ranked (e.g., it is desired that the candidate organizational

*Kepner-Tregoe, Inc., "Executive Problem Analysis and Decision Making," Princeton Research Press., Princeton, New Jersey, May 1973.

structure facilitate the transition from construction to operations with a high degree of confidence).

4. Evaluating the WANT criteria to determine their overall relative importance or weight in the final selection result (i.e., on a scale of one to ten, with ten points representing the highest ranking importance).

5. Identifying and defining each alternative or candidate organizational structure sufficiently to enable evaluation of how it meets each of the criteria.

6. Evaluating each candidate organizational structure and invalidating any alternative that will not meet one or more of the MUST criteria.

7. Ranking each candidate against each of the WANT criteria on a scale of one to ten, multiplying the ranking times the weighting factor to obtain a weighted score for each candidate. By adding the weighted scores, a figure of merit or numerical ranking for each candidate with respect to the WANT criteria is obtained.

The results of this numerical ranking process provide only an indication of the most promising alternative organizations, rather than any absolute measure of the merits of one candidate versus another. TPT gave additional detailed consideration to the front-running candidates to identify ways in which detailed requirements or characteristics (e.g., credibility) could be improved. On this, a final selection was made by TPT and is presented in Section 10.

9.4.2. Decision Statement

The selected decision statement is:

"Recommend a project management organization that ensures completion of the Zimmer plant in accordance with NRC regulations."

9.4.3. Selection Criteria

The selection criteria developed by TPT are listed in Table 9-1 and are discussed in the subsections that follow.

9.4.3.1. MUST Criteria. Any selected organizational structure must:

1. Meet all legal requirements. The organizational arrangement selected must meet all legal requirements and relationships to the PUC and licenses with the NRC. This requirement could only be violated by the most broad ranging concepts, which might contemplate significant changes in the corporate structure having responsibility for the Zimmer plant.

2. Complete construction to NRC Regulations. Clearly, the basic objective of the review, i.e., to recommend an organizational structure that will facilitate completion of construction of the Zimmer plant in accordance with NRC regulations and the construction permit, is a MUST criterion. Any organizational structure not satisfying this criterion would be eliminated.

3. Form a basis for the QVP. In TPT's opinion, a comprehensive QVP that is much broader in scope than the current QCP is required at Zimmer. Consequently, any selected organizational structure must be such that it can effectively accomplish a QVP with credibility and integrity.

TABLE 9-1
ZIMMER PROJECT MANAGEMENT SELECTION CRITERIA

	Weight
MUST Criteria	
Meet all legal requirements	-
Complete construction to NRC Regulations	
Form a basis for the QVP	
WANT Criteria	
Increase external credibility	10
Independence from prior management	
Third party involvement	
Improve certain organizational characteristics	9
Exclusive Zimmer plant authority	
Clarity in organizational relationships	
Organizational balance	
Policy/procedures	
Integrated planning	
Documentation/records control	
Management information systems/feedback	
QA commitment/support visibility	
Base the organization on practicality	9
Use of existing structures	
Organizational relationships	
Complexity	
Economics	
Facilitate the transition to operations	8
CG&E responsible/involved	
Staff training	
Improve resource availability	7
Ability to get needed expertise	
Need to hire	
AEC support	
Improve project continuity	6
Contractor relationships	
Documentation, procedures	
Staff experience	
Records	
Schedule	

9.4.3.2. WANT Criteria. The following six categories of highly desirable WANT characteristics were identified, against which all organizational structures were ranked:

1. Increase external credibility. The more credible a proposed organizational structure is perceived to be by external organizations such as the NRC, Congressional oversight committees, the Ohio State Division of Boiler Inspection, Intervenor Groups, and the public at large, the more readily such an organization would be allowed to function to satisfactorily complete the Zimmer project. From an organizational viewpoint, increased credibility could be achieved by attaining independence from prior management and/or by increased involvement by a qualified independent organization. These were, in effect, the thrust of three of the four NRC organizational suggestions in the SCO.

2. Improve certain organizational characteristics. Inherent in any organizational structure should be certain characteristics that allow it to function effectively. Previously identified shortcomings in the Zimmer organization expecially need to be rectified. Some desirable qualities or organizational characteristics are abstract, such as an improved QA commitment support and visibility; balance between organization elements, allowing each to satisfactorily perform its function without excessive pressure; clarity in organizational relationships and responsibilities through formality of structure, such as exclusive senior management authority; and clearly established policies and procedures. Others are more pragmatic management requirements such as integrated planning, document control, and management information systems. Each characteristic was evaluated to differentiate between the relative desirability of alternatives.

3. Base the organization on practicality. Relative practicality must be considered when evaluating organizational alternatives. For example, in the case of Zimmer, the advanced state of construction precludes consideration of some of the more esoteric organizational philosophies. At this point, it is more desirable and practical to base a Zimmer organization on more conventional concepts of organization and build, to the extent possible, on the existing framework and resources. The selected organizational alternative must also be practical in its working relationships both within CG&E and with external organizations. The aspect of predictable economic consequences resulting, directly or indirectly, from any organizational change must also be considered.

4. Facilitate the transition to operations. It is highly desirable that the selected organization facilitate transition from completion of construction to operations. CG&E will have the ultimate responsibility for operation of Zimmer; therefore, the extent to which an organizational alternative allows CG&E staff to remain involved in construction completion and the startup operation, the better it will serve that transition.

5. Improve resource availability. Consideration of the availability of resources may also be used to distinguish between various alternatives. For example, the need to hire large numbers of highly qualified staff may in certain cases be less desirable than the use of temporary resources from a qualified external organization. The ability to obtain needed resources with appropriate qualifications and expertise is a desirable characteristic.

6. Improve project continuity. At this point in the Zimmer plant construction, extensive records and documentation exist that must be preserved. Accordingly, organizational alternatives that

facilitate retention of this data and use existing staff for this purpose are preferable. Consideration of the extent to which company project activities are disrupted and the resulting effect on costs and schedules to completion are also measures of merit in this category.

9.5. EVALUATION OF ALTERNATIVE ORGANIZATIONS

To accomplish the tasks identified above, various alternative organizations were evaluated by TPT. In all alternatives, sufficient authority, resources, and management experience and capability at all levels must be available to perform the required activities needed to complete the Zimmer project in accordance with the design requirements and NRC regulations.

A total of sixteen alternative project management organizations, as listed below, were evaluated. Four were specified by the NRC, six were suggested by TPT, one was proposed by CG&E, and one was suggested by BPC.

1. Strengthening the present CG&E organization.

2. An organizational structure where the construction management of the project is conducted by an experienced outside organization reporting to the chief executive officer of CG&E.

3. An organizational structure where the quality assurance program is conducted by an experienced outside organization reporting to the chief executive officer of CG&E.

4. An organizational structure with both quality assurance and construction project management conducted by an experienced outside organization reporting to the chief executive officer of CG&E.

[Each of the these alternatives could be effected in conjunction with the CG&E organization that was in place at the date of the SCO or with the CG&E organization as revised since the SCO (i.e., the organization of April 1983). This latter case provides four additional alternatives (1A, 2A, 3A, and 4A) for evaluation.]

5. Creation of a new company organized and owned by the present owners [CG&E, Dayton Power and Light Co. (DP&L), and Columbus and Southern Ohio Electric Co. (C&SO)], which would function virtually autonomously to complete and subsequently operate the Zimmer plant.

6. Strengthening and reorganizing the Zimmer project organization within CG&E whereby all aspects related to the Zimmer project are directed by an experienced senior officer of the company (effectively the ZPM), who had no involvement with Zimmer prior to the SCO. The ZPM would report to the Chief Executive Officer of CG&E. In addition, construction management and management of the QVP are performed by an experienced outside organization reporting to the senior officer responsible for the Zimmer project.

7. Creation of an organizational structure whereby an experienced outside organization co-manages the project with CG&E and assigns personnel to all key management positions. Initial responsibility for Zimmer activities would rest with the outside organization with a gradual transition to giving CG&E prime responsibility.

8. Delegation of all activities on the Zimmer project to an experienced outside organization on a turnkey basis.

9. Establishing a Zimmer Project Oversight Committee (ZPOC) so that the majority of the members have had no prior Zimmer line management involvement. The ZPOC would report to the Board of Directors. The organizational structure discussed in Alternative 6, including the ZPM, would report directly to the ZPOC. The ZPM would have a line of communication to the Chief Executive Officer of CG&E to report progress and status.

10. Establishing a ZPOC reporting to the Board of Directors of CG&E as in Alternative 9. The organizational structure discussed in Alternative 6, including the ZPM, would report to the Chief Executive Officer of CG&E and have a line of communication to the ZPO to report progress and status (i.e., the reverse relationship of Alternative 9).

11. Strengthening and reorganizing the CG&E Zimmer project organization, whereby all aspects related to Zimmer are the responsibility of the Senior Vice President for Nuclear Operations (who had no involvement with Zimmer prior to the SCO). BPC, as an experienced external organization, will be responsible for management of the QVP and construction. BPC's precise scope is not yet finalized. BPC will report to a CG&E Vice President under the Senior Vice President. CG&E co-managers are planned for all BPC project management positions. (Note that this is similar to TPT's Alternative 6, except for some differences in detail at the lower levels of the organization.)

12. Alternatives proposed by BPC. BPC proposed one additional alternative to the four suggested by the NRC. However, BPC interpreted the NRC alternative "Strengthening the present CG&E organization" differently. Its interpretation of that alternative appeared to be essentially the same as TPT Alternative 7; accordingly, the same evaluation would be applicable.

The fifth alternative proposed by BPC appeared to be substantially the same as TPT's Alternative 8; thus the same evaluation would be applicable.

Each of the sixteen alternative project management organizations for Zimmer was evaluated in accordance with how well it would satisfy the MUST criteria and the WANT criteria. A detailed description of each alternative and a discussion of the important points in each evaluation are provided in the following sections. The discussion is summarized in tabular format in Tables 9-2 and 9-3 for the MUST and WANT criteria, respectively.

9.5.1. Strengthening the Present CG&E Organization (Alternative 1)

9.5.1.1. Description. This alternative, shown in Fig. 9-1, is defined as retaining the CG&E organizational structure that was in place at the time of the SCO. That structure would be strengthened by replacing the current staff where required and by hiring additional personnel and contracting for qualified temporary help from job-shop companies. There would be no significant changes in the Zimmer organizational structure (i.e., the Zimmer project organization would continue to report to the Senior Vice President, Energy Services and Electrical Production as it did at the time of the SCO).

9.5.1.2. Evaluation of MUST Criteria. It would be legal for the CG&E organization of November 1982 to continue on the Zimmer project. However, the ability to meet the NRC criteria applicable to Zimmer would depend heavily upon how the proposed strengthening is effected. Recruiting knowledgeable people with prior nuclear project experience as either permanent employees or consultants, and extensive training of the existing staff would be necessary.

Provided that all areas of the CG&E organization are adequately strengthened, it is feasible that this organization could complete the

TABLE 9-2

ORGANIZATION ANALYSIS WORKSHEET (MUST CRITERIA)

Objective	1 & 1A. Strengthening the Present CG&E Organization		2 & 2A. Construction Management by Experienced Outside Organization		3 & 3A. Quality Assurance Conducted by Experienced Outside Organization		4 & 4A. Construction Management and Quality Assurance Experienced Outside Organization	
MUST	Information	Go/No*	Information	Go/No*	Information	Go/No*	Information	Go/No*
1. Organization must meet all legal requirements and relationships to the PUC and licenses with the NRC.	No problem, since only increasing staff of existing organization.	Go	No problem, since contracting construction management to an outside firm.	Go	No problem, since constracting quality assurance to an outside firm.	Go	No problem, since contracting construction management and quality assurance to an outside firm.	Go
2. Organization must facilitate completion of construction in accordance with all regulations and NRC requirements.	Dependent on strengthening all areas adequately. Reassignment of personnel may be required.	(Go)	Inbalance created by strengthening construction management only. Concern about QA and Engineering remaining as-is.	(Go)	May ensure QA requirement are met, but concern exists regarding maintaining current construction and QA organizations.	(Go)	Concern about engineering organization remaining as-is.	Go
3. Organization must provide a credible basis for the Quality Verification Program (QVP).	Dependent on strengthening all areas adequately. QVP must be responsibility of the senior VP responsible for Zimmer.	(Go)	Must put QVP under construction manager to assure credibility and proper implementation. Without strengthening other CG&E organizations.	(Go)	No place to manage QVP and assure credibility.	(Go)	QVP must be under the outside organization.	Go

TABLE 9-2 (Continued)

Objective MUST	5. New Company to Complete and Operate Zimmer Information	Go/No*	6. New Organization Within CG&E Information	Go/No*	7. Co-Management by Experienced Outside Organization Information	Go/No*	8. Full Responsibility for Zimmer Delegated to Outside Organization Information	Go/No*
1. Organization must meet all legal requirements and relationships to the PUC and licenses with the NRC.	Difficult, legal problems in forming a new company.	(Go)	No problem, since only reorganization of current project.	Go	Can be implemented by contract. Continued participation by CG&E satisfies owners ability to attest to the quality of the plant.	Go	Potential contract problems with A/E and construction contractors.	Go
2. Organization must facilitate completion of construction in accordance with all regulations and NRC requirements.	Additional experience must be obtained by hiring and/or the use of contract personnel.	Go	Additional experience must be obtained by hiring and/or the use of contract personnel.	Go	Participation by experienced outside firm provides assurance.	Go	Some work may have to be repeated due to incomplete transfer of records from current contractors.	Go
3. Organization must provide a credible basis for the Quality Verification Program (QVP).	Must obtain additional staff to assure credibility of QVP.	Go	Must obtain additional staff/latent to assure credibility of QVP.	Go	Participation by experienced outside firm provies assurance.	Go	Participation by experienced outside firm provides assurance.	Go

TABLE 9-2 (Continued)

Objective MUST	9. Oversight Committee Formed Project Reports to Oversite Committee Information	Go/No*	10. Oversight Committee Formed Project Reports to CG&E CEO Information	Go/No*	11. Reorganization Proposed by CG&E Information	Go/No*	12. Reorganization Proposed by Bechtel Information	Go/No*
1. Organization meet all legal requirements and relationships to the PUC and licenses with the NRC.	Possible impact on corporate constitution by detracting from CEO's responsibilities.	Go	No problem since internal organization only.	Go	No problem, since internal reorganization only. No contractual/license implications.	Go	Two alternatives proposed: 1) Identical to alternative 7. 2) Identical to alternative 8.	 Go Go
2. Organization must facilitate completion of construction in accordance with all regulations and NRC requirements.	Additional expertise must be obtained by hiring and/or the use of temporary personnel.	Go	Additional expertise must be obtained by hiring and/or the use of temporary personnel.	Go	Additional expertise must be obtained by hiring and/or the use of temporary personnel.	Go		
3. Organization must provide a credible basis for the Quality Verification Program (QVP).	Assume management will obtain permanent or temporary expertise to accomplish QVP.	Go	Assume management will obtain permanent or temporary expertise to accomplish QVP.	Go	Assume management will obtain permanent or temporary experitse to accomplish QVP.	Go		

*Go = acceptable; (Go) = marginal, additional qualifications must be met.

TABLE 9-3

ORGANIZATION ANALYSIS WORKSHEET (WANT CRITERIA)

Objective		1 & 1A. Strengthening the Present CG&E Organization			2 & 2A. Construction Management by Experienced Outside Organization			3 & 3A. Quality Assurance Conducted by Experienced Outside Organization			4 & 4A. Construction Management and Quality Assurance by Experienced Outside Organization		
WANT	Wt	Information	Sc	Wt Sc	Information	Sc	Wt Sc	Information	Sc	Wt Sc	Information	Sc	Wt Sc
1. External Credibility	10	Poor - utilizes current organization with little or no third party involvement. Perception that current CG&E management remains in charge.	2	20	Poor - construction performed by third party but QA and engineering remain essentially unchanged. Current CG&E management remains in effect.	3	30	Poor/medium - QA performed by third party but construction and engineering remain essentially unchanged. Current CG&E management remains in effect.	4	40	Medium - construction and QA performed by third party engineering remains essentially the same. Current CG&E management remains in effect.	5	50
2. Sound Organizational Characteristics	9	Poor - deficiencies in existing policies, procedures, planning, reporting and QA awareness need correction. CG&E key personnel still have other responsibilities in addition to Zimmer.	2	18	Medium - third party will provide experience regarding deficiencies in area of construction. Overall organization has increased imbalance.	6	54	Medium - third party will provide experience regardiing deficiencies notes in Option 1 in area of QA. CG&E key personnel still have other responsibilities in addition to Zimmer.	6	54	Medium/high - third party will provide experience regarding deficiencies notes in Option 1 in two major areas, construction and QA. CG&E key personnel still have other responsibilities in addition to Zimmer.	8	72
3. Practicality of Implementation	9	High - minimum change required. Additional staff would be added to existing organization.	10	90	Medium/high - Significant change in construction function only. Potential delay to transfer information. Remaining functions within CG&E remain unchanged except for additions to staff.	7	63	Medium/high - significant change in quality assurance function only. Remaining functions within CG&E remain unchanged except for additions to staff.	6	63	Medium - significant change in two major areas, construction and quality assurance. Remaining functions within CG&E remain unchanged except for additions to staff.	6	54
4. Facilitate Transition to Operations	8	Medium - existing CG&E staff will participate in the start-up test program. Lack of adequate procedures and prior start-up experience must be overcome.	7	56	Medium - current staff will not receive experience and training associated with the completion of construction.	5	40	Medium - current staff will not receive experience and training associated with quality assurance functions.	6	48	Poor/medium - current staff will not receive experience and training associated with remaining quality assurance and construction activities.	4	32
5. Resource Availability	7	Medium - difficulty in getting experienced personnel on board immediately by CG&E.	6	42	Medium/high - third party will furnish needed construction management resources.	8	56	Medium/high - third party will furnish needed quality assurance resources.	8	56	High - third party will furnish needed construction management and quality assurance resources.	9	63
6. Project Continuity	6	High - maximum continuity of prior history and knowledge by retaining current personnel as a resource.	9	54	Medium - continuity and experience will be impacted by having a third party take over construction management.	6	36	Medium - continuity and experience will be impacted by having a third party take over quality assurance activities.	6	36	Medium - continuity and experience will be minimal in areas of construction management and quality assurance.	5	30
Total				280*			279*			297*			301*

TABLE 9-3 (Continued)

Objective		5. New Company to Complete and Operate Zimmer			6. New Organization Within CG&E			7. Co-Management by Experienced Outside Organization			8. Full Responsibility for Zimmer Delegated to Outside Organization		
WANT	Wt	Information	Sc	Wt Sc	Information	Sc	Wt Sc	Information	Sc	Wt Sc	Information	Sc	Wt Sc
1. External Credibility	10	High - maximum independence from prior Zimmer management staff, but credibility in terms of practicality is questionable.	9	90	Medium - Project will repor to the CEO, who has had prior involvement with Zimmer without the benefit of external involvement.	5	50	Medium - project will report to the CEO, who has had prior involvement with Zimmer. Third party provide management support.	6	60	Medium/high - project will report to the CEO, who has had prior involvement with Zimmer. Third party responsible for construction, engineering, QA and all other project related functions.	7	70
2. Sound Organizational Characteristics	9	High - exclusive Zimmer authority. Balanced organization with high QA awareness and support. Clear relationships between functions.	10	90	High - exclusive Zimmer authority. Balanced organization with high QA awareness and support. Clear relationships between functions.	10	90	Medium - depends on strength of co-managers. Same CG&E personnel policies and procedures remain. Relationship between co-managers may be a problem area.	6	54	Medium/high - third party responsible for Zimmer. CG&E performs oversight function only. Same CG&E top management in control of project.	8	72
3. Practicality of Implementation	9	Poor - time required to establish new company could significantly impact plant schedule which will affect costs.	2	18	High - reorganization within CG&E relatively easy to accomplish. New organization will require some amount of time to function efficiently.	9	81	Medium - requires responsibilities and authorities of co-managers to be clearly defined contractually. May impact project ability to function efficiently.	5	45	Poor - will require time for third party to become familiar with current plant status in order to proceed with the remaining work. Contractual responsibilities and authorities must be negotiated.	3	27
4. Facilities Transition to Operations	8	High - new organization with proper procedures will participate in remaining construction and start-up activities.	10	80	High - new organization with proper procedures will participate in remaining construction and start-up activites.	10	80	Medium/high - co-management approach may dilute CG&E management participation in start-up program.	8	64	Poor - CG&E staff will not be involved in start-up program.	3	24
5. Resource Availability	7	Medium - experienced personnel must be brought on board immediately by CG&E.	6	42	Medium - experienced personnel must be brought on board immediately by CG&E.	6	42	High - co-managers will provide valuable experience to existing CG&E staff.	9	63	High - third party will furnish all additional personnel required to complete Zimmer.	10	70
6. Project Continuity	6	Medium - retaining a majority of the existing staff will maintain knowledge of history of Zimmer. Proper procedures will facilitate continuity of records and documents.	7	42	Medium/high - new organization that utilizes prior, experienced staff and reporting to the current CG&E CEO will assure project continuity.	8	48	High - maximum continuity of prior history and knowledge will be coupled with a management team with nuclear plant experience.	10	60	Poor - CG&E will not obtain significant knowledge or experience regarding the remaining construction activities and start-up program.	2	12
Total				362			391			346			275

TABLE 9-3 (Continued)

Objective		9. Oversight Committee Formed *Project Reports to Oversite Committee			10. Oversight Committee Formed Project Reports to CG&E CEO			11. Reorganization Proposed by CG&E			12. Reorganization Proposed by Bechtel		
WANT	Wt	Information	Sc	Wt Sc	Information	Sc	Wt Sc	Information	Sc	Wt Sc	Information	Sc	Wt Sc
1. External Credibility	10	High - project reports directly to independent oversight committee. Potential conflict in responsibilities between ZPOC and CEO.	9	90	High - project reports to CG&E CEO but has a line of communication to the independent oversight committee.	10	100	Medium - project will report to the CEO, who has had prior involvement with Zimmer without any external overview.	5	50	Two alternatives proposed: 1) Identical to alternative 7 2) Identical to alternative 8		
2. Sound Organizational Characteristics	9	High - exclusive Zimmer authority. Balanced organization with high QA awareness and support. Clear relationships between functions.	10	90	High - exclusive Zimmer authority. Balanced organization with high QA awareness and support. Clear relationships between functions.	10	90	High - exclusive Zimmer authority. Balanced organization with high QA awareness and support. Clear relationships between functions.	10	90			
3. Practicality of Implementation	9	Medium - ability of a committee to respond to project needs will be slower than an individuals response time. Potential difficulties in decision making at Board level.	6	54	Medium/high - reorganization within CG&E relatively easy to accomplish. Establishing the oversight committee and defining its responsibilities will take time.	8	72	High - reorganization within CG&E relatively easy to accomplish. New organization will require some amount of time to function efficiently.	9	81			
4. Facilities Transition to Operations	8	High - new organization with proper procedures will participate in remaining construction and start-up activities.	10	80	High - new organization with proper procedures will participate in remaining construction and start-up activities.	10	80	High - new organization with proper procedures will participate in remaining construction and start-up activities.	10	80			
5. Resource Availability	7	Medium - experienced personnel must be brought on board immediately by CG&E.	6	42	Medium - experienced personnel must be brought on board immediately by CG&E.	6	42	Medium - experienced personnel must be brought on board immediately by CG&E.	6	42			
6. Project Continuity	6	Medium/high - new organization will utilize prior, experienced staff.	8	48	Medium/high - new organization that utilizes prior, experienced staff and reporting to the current CG&E CEO will assure project continuity.	8	48	Medium/high - new organization that utilizes prior, experienced staff and reporting to the current CG&E CEO will assure project continuity.	8	48			
Total				404			422			391			346 or 275

*Some increase in rating would be realized for the 1A, 2A, 3A, and 4A cases relative to the corresponding 1, 2, 3, and 4 value listed. The increase is judged not to be sufficiently significant to affect relative rankings.

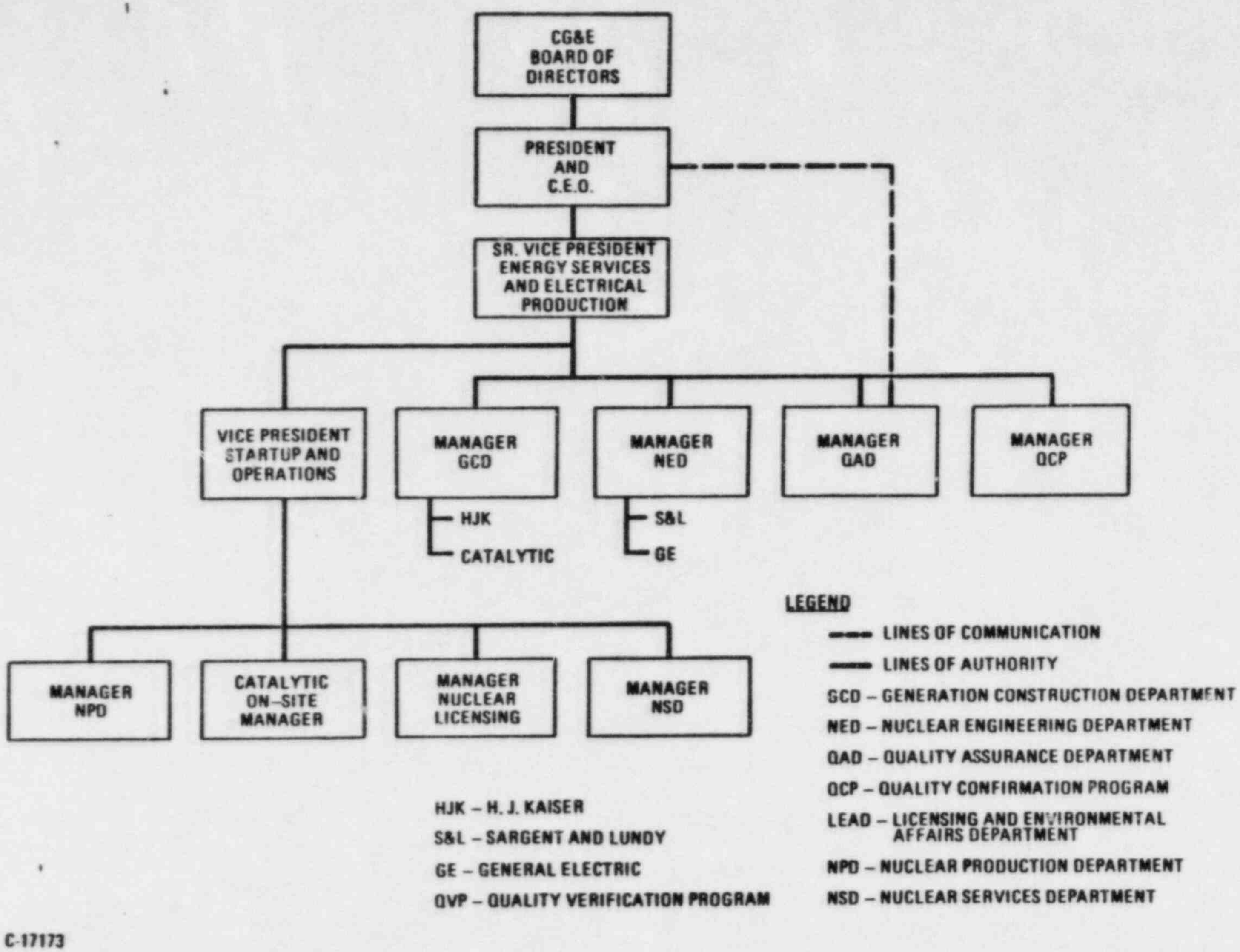

Fig. 9-1. Proposed organization alternative 1

Zimmer project in accordance with all regulations and requirements. However, some personnel in the Zimmer organization may need to be reassigned in CG&E.

The QVP would have to be run under the Senior Vice President responsible for the Zimmer project in order to coordinate resources from the various CG&E groups. It is likely that implementation of the QVP would be regarded as tainted by previous activities at Zimmer.

9.5.1.3. Evaluation of WANT Criteria. Retaining the old management structure would have the least credibility with the NRC and the public because it would seem that little or nothing had changed at Zimmer, that those who created the problems would still be running the project.

A weakness in retaining the old organizational structure remains in that the cause of past problems may still exist within the new structure. Deficiencies in policies, planning, and control would need to be corrected. Many of the same attitudes and policies of the previous management (e.g., cost effectivenss and adherence to schedule are more important than quality and QA) might be retained, although somewhat improved upon by the addition of new personnel.

Because this alternative has a minimal impact on the overall organization, it would be practical to implement given the availability of the personnel needed to strengthen the organization.

The continued involvement of the existing NPD staff with little or no perturbation of that organization would benefit the transition to operations, assuming the prior deficiencies in turnover of incomplete systems for testing are rectified. However, procedural shortcomings that caused many problems for the previous transition efforts would not necessarily be resolved by the addition of a few new managers to the project organization.

Recruitment and hiring of new employees may be difficult in the face of low morale and uncertainty within the project. Thus, in practice, it may be difficult to recruit qualified staff in sufficient numbers to make strengthening the current organization meaningful.

On the positive side, retaining the old organization structure should maximize the transfer of knowledge, history, records, and procedures to new employees and aid in the transition to operations, provided strengthening is effective. Because the existing staff is very familiar with the existing problems, finding solutions to these problems using added staff should take less time than solving the other organizational problems.

9.5.2. Strengthening the Present CG&E Organization (Alternative 1A)

9.5.2.1. Description. This alternative, shown in Fig. 9-1a, involves retaining the CG&E organizational structure that was in place in April 1983 when Mr. J. Williams, Jr. became the Senior Vice President and ZPM. As in Alternative 1, strengthening would be accomplished by replacing current project staff and/or by hiring additional personnel and contracting for qualified temporary help from job-shop companies. There would be no significant changes in the present organizational structure reporting to the Senior Vice President and ZPM; that officer would continue to report directly to the President and Chief Executive Officer of CG&E.

9.5.2.2. Evaluation of MUST Criteria. There would be some improvement in the way this alternative would satisfy the MUST criteria relative to Alternative 1. The addition of new vice president, and other changes to strengthen the organization, would improve the ability of the project organization to facilitate construction in accordance with the regulations and to provide a credible basis for the QVP.

9.5.2.3. Evaluation of WANT Criteria. This alternative would have the same strengths and weaknesses regarding the WANT criteria as the preceding alternative with one exception. The new Senior Vice President, having had

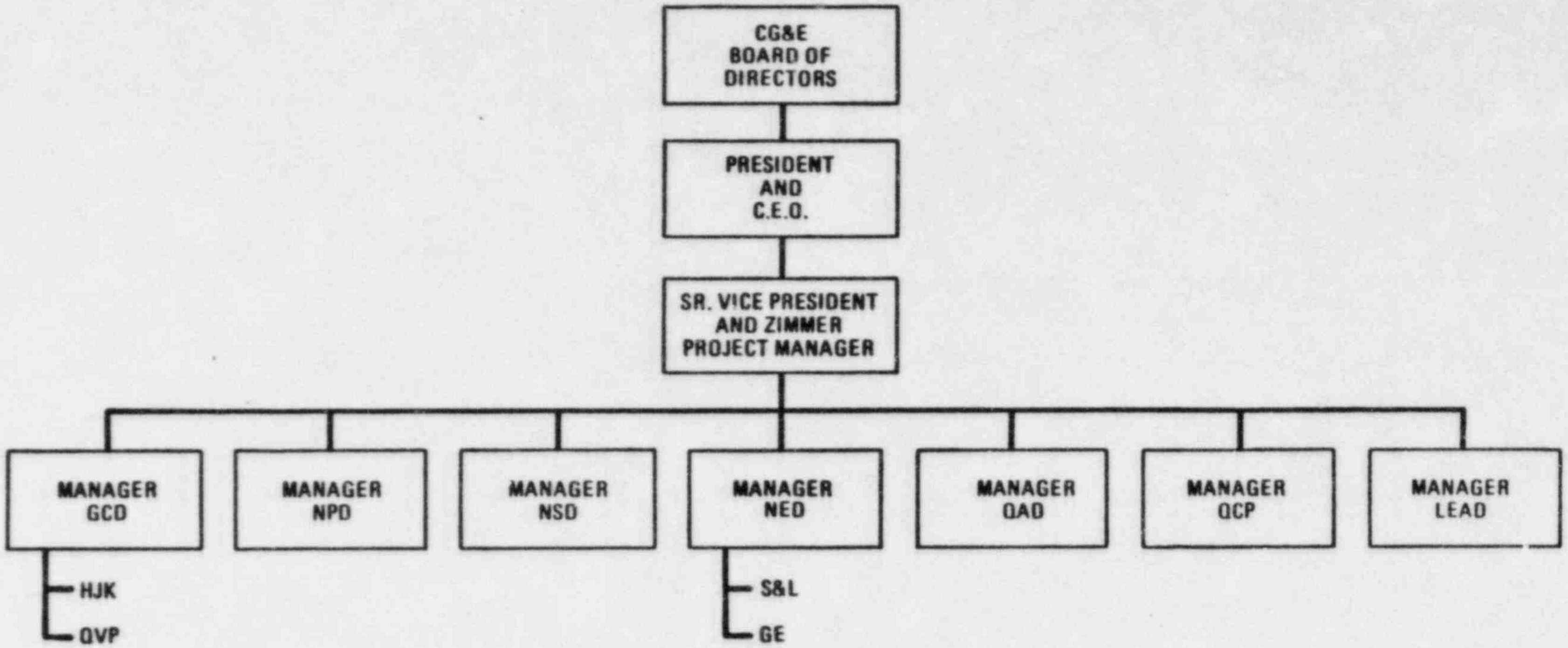

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Fig. 9-1a. Proposed organization alternative 1A

no prior involvement with Zimmer, would probably improve the credibility of the organization in the eyes of external parties.

9.5.3. Construction Management by Experienced Outside Organization (Alternative 2)

9.5.3.1. Description. This alternative, shown in Fig. 9-2, would involve retaining a qualified third party that is experienced in nuclear power plant construction to assume management responsibility for the completion of all construction at the Zimmer project. The organization would furnish the necessary personnel to carry out this management function. HJK would continue to perform the craft work and would direct the QA/QC function under the supervision of this third party. CG&E would continue to provide the QA overview, engineering, licensing, and operations functions. The third party would report to the Chief Executive Officer of CG&E and have a line of communication with the Senior Vice President, Energy Services and Electrical Production. The CG&E functions would continue to report to the Senior Vice President, Energy Services and Electrical Production.

9.5.3.2. Evaluation of MUST Criteria. This management structure would be legal since CG&E, having already assumed the construction management responsibility from HJK, can contract with a new construction management firm to perform that function. However, since, in this alternative, the Engineering, Operations, QA, and Licensing organizations stay the same as prior to the SCO, it is doubtful that this organization would be able to meet the NRC requirements since the deficiencies were project-wide.

The QVP would best be managed by the new construction manager to give it credibility with the NRC and other outside interests. However, it would be difficult to implement a comprehensive QVP review if the other organizations were not substantially strengthened.

9.5.3.3. Evaluation of WANT Criteria. The public perception of this organization alternative might improve because it would appear as if the

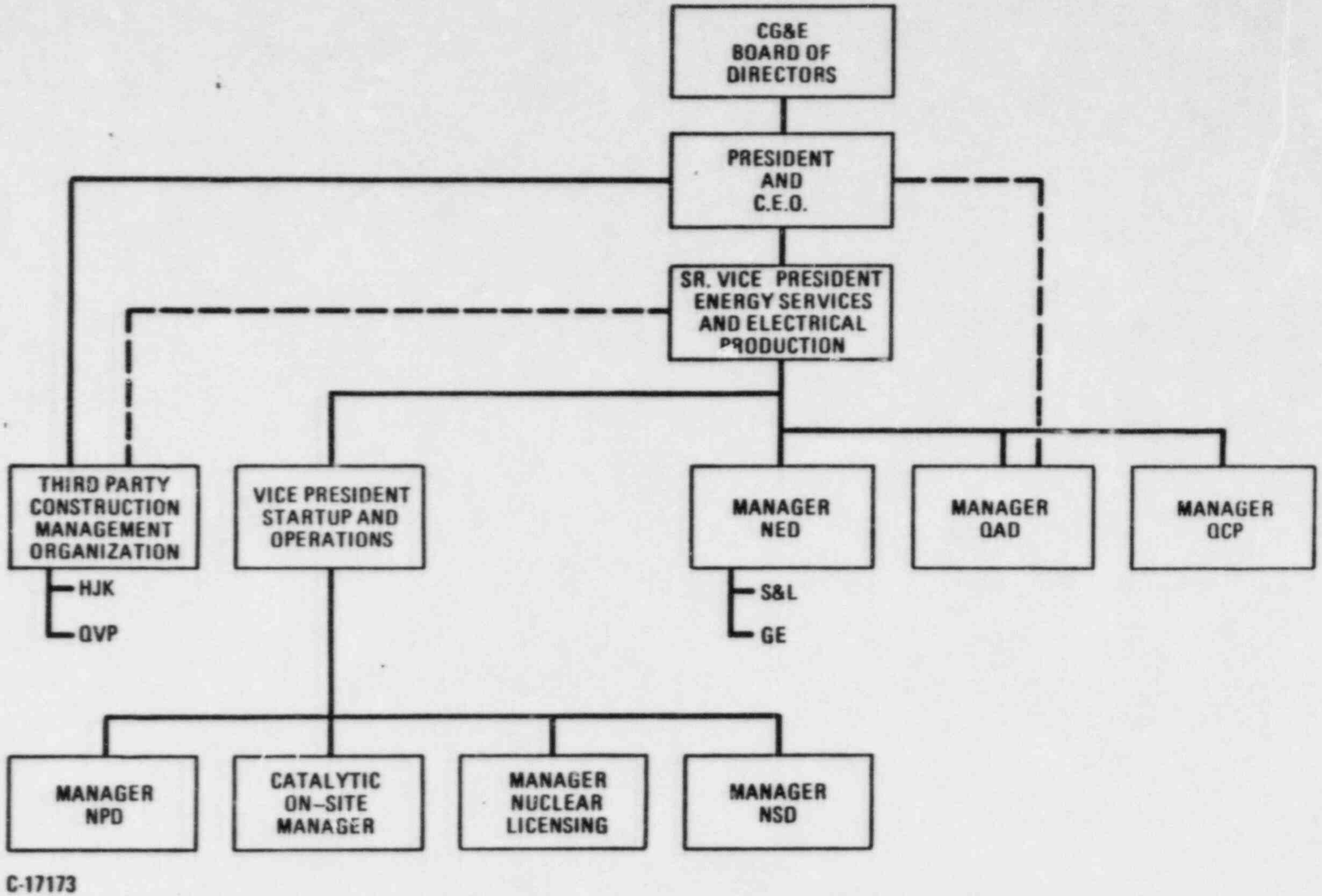

Fig. 9-2. Proposed organization alternative 2

organization structure had changed dramatically. However, this organization might encounter difficulties because Engineering, QA, and Operations would not have been strengthened and brought to the same level of capability as Construction.

This alternative exacerbates an already existing imbalance within the CG&E Zimmer organization in that the Construction department is too strong relative to Engineering and QA. A balanced organization with respect to Construction, Engineering, QA, and Operations, which this alternative does not offer, is necessary.

An important aspect of any organization change is the transfer of experience from the old organization to the new one. There would likely be reluctance by the replaced construction management organization to pass on information in a way that would make the transition meaningful. The new organization would need a considerable learning period before it became effective, creating a significant delay in construction.

This initial lack of familiarity could also cause a difficult transition to operations. However, with time, the transition might improve because it is assumed the new construction manager would do a better job than his predecessor.

With the decline in the nuclear power market and the still-depressed economy, there are several experienced, reputable nuclear construction firms who should be able to provide a ready supply of the resources necessary to implement this alternative.

Project continuity would be disrupted while the new construction management team became familiar with Zimmer's problems. However, the new organization would be aided in this effort by the Engineering, QA, and Operations organizations, which have maximum continuity because they would be unchanged.

9.5.4. Construction Management by Experienced Outside Organization (Alternative 2A)

9.5.4.1. Description. This alternative, shown in Fig. 9-2a, would also involve retaining a qualified third party that is experienced in nuclear power plant construction to assume management responsibility for the completion of all construction at the Zimmer project. This alternative is different in that the line of communication would be to the Senior Vice President and ZPM, who would have all of the Zimmer project organizations reporting directly to him.

9.5.4.2. Evaluation of MUST Criteria. This alternative would satisfy the MUST criteria in basically the same way but with increased credibility compared with Alternative 2. Although the remaining project organizations would now report to a new senior officer, there would be virtually no change in the lower level organizations.

9.5.4.3. Evaluation of WANT Criteria. This alternative would have the same strengths and weaknesses regarding the WANT criteria as the preceding alternative with one exception. The addition of a new Senior Vice President would probably add some credibility to the new organizational structure.

9.5.5. Quality Assurance Conducted by Experienced Outside Organization (Alternative 3)

9.5.5.1. Description. This alternative, shown in Fig. 9-3, would involve retaining a qualified third party to assume responsibility for and provide the necessary qualified staff to manage the QA function at the Zimmer project. This third party would report to the Chief Executive Officer of CG&E and have a line of communication to the Senior Vice President, Energy Services and Electrical Production. CG&E would continue to provide the engineering, construction management, licensing, and operations functions, with those functions reporting directly to the Senior Vice President, Energy Services and Electrical Production.

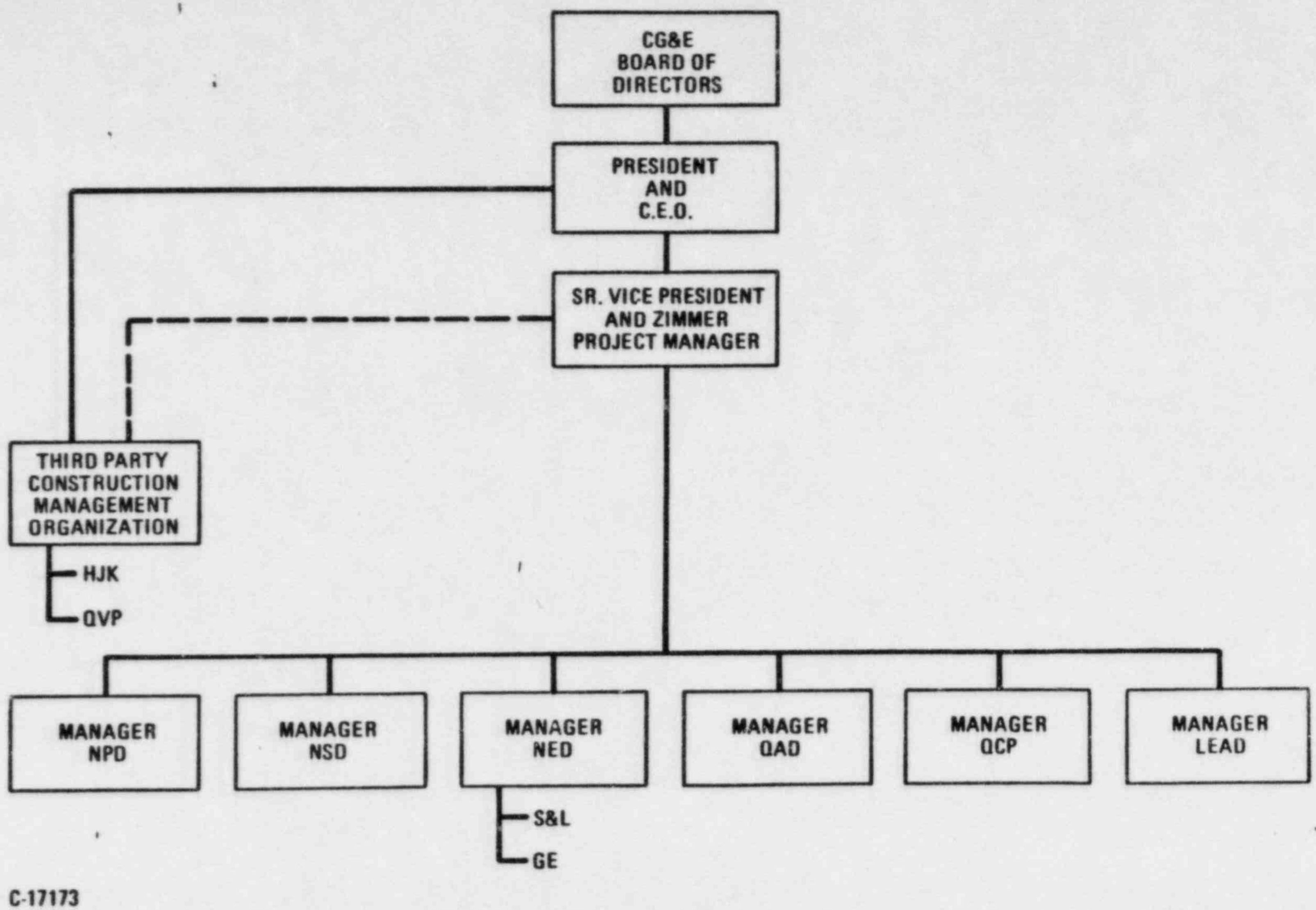

Fig. 9-2a. Proposed organization alternative 2A

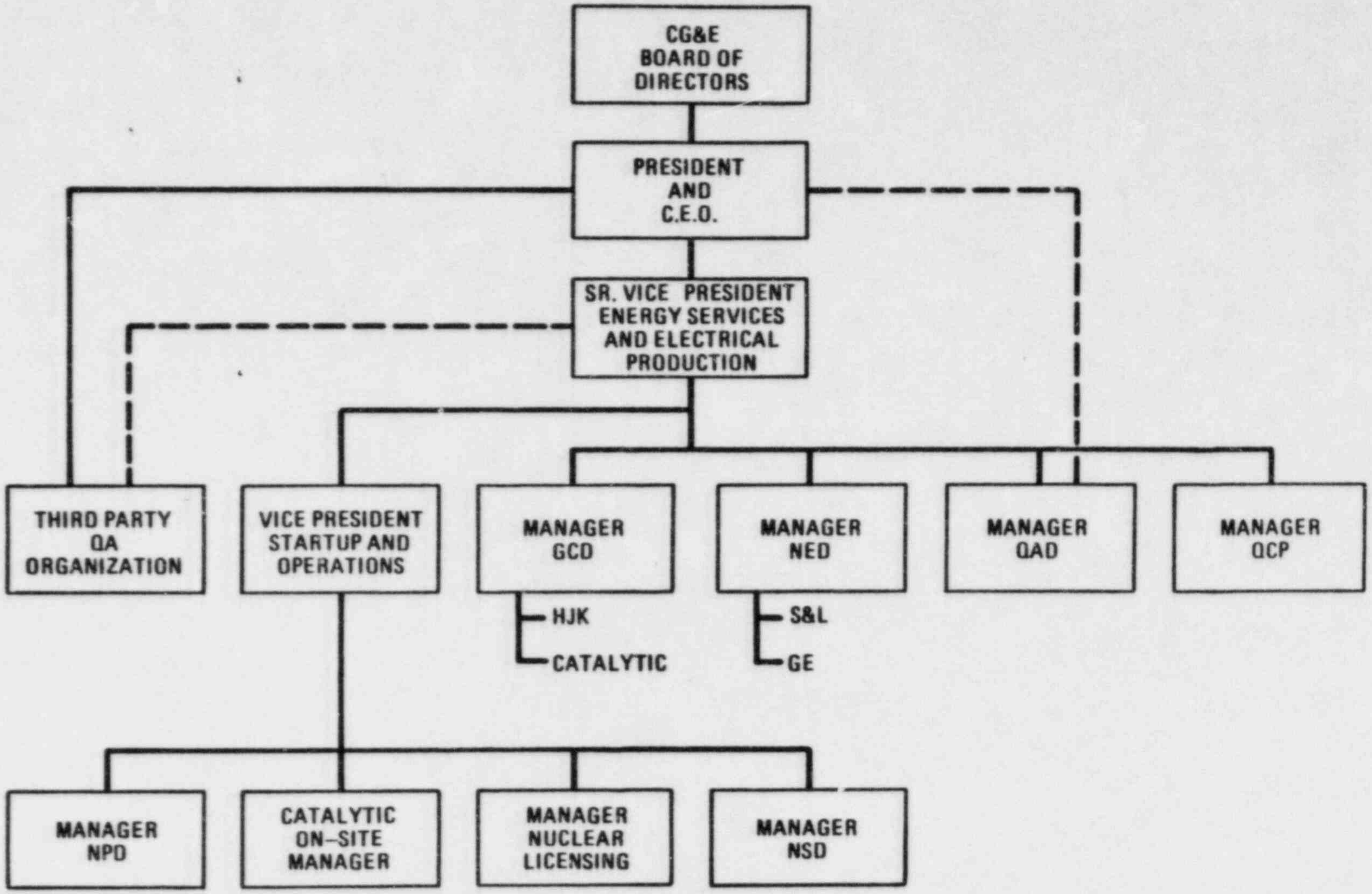

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Fig. 9-3. Proposed organization alternative 3

9.5.5.2. Evaluation of MUST Criteria. This management structure would be legally possible because CG&E, as owner, is subject to no contracting restrictions for the QA function and can have the contractor report to the Chief Executive Officer. The NRC will likely see this as a positive step.

However, the quality of the hardware is dependent upon how well the engineering and construction activities are executed, as well as the adequacy of the QA program. If the attitude toward QA remains poor among the designers and constructors, there will be poor quality hardware in the plant. Thus, while it is necessary to have an adequate QA team, it is insufficient; the other organizations must also be strengthened.

The QVP should be managed by the Construction and Engineering and not by the QA organization. The QA organization should independently ensure that construction is performed to the proper requirements. Thus, with Construction management and the Engineering organization still weak, where to manage the QVP remains a question. If the QVP were managed by either Construction or Engineering, this organizational structure would lose credibility (e.g., the possibility of a coverup would exist).

9.5.5.3. Evaluation of WANT Criteria. The public perception of this alternative may be favorable since the breakdown of QA has been alleged as one of the major problems at the Zimmer project. Using an objective, qualified, third-party QA organization could be seen as the solution to a major problem. However, as stated above, unless the Construction, Engineering, and Operations organizations are also strengthened, the quality of the product could still be adversely affected.

The experienced third party QA organization would improve on QA shortcomings at the Zimmer project. However, the remainder of the CG&E organization would essentially remain unchanged, with unbalanced organizational strengths; key personnel would presumably still have responsibilities other than the Zimmer project.

This alternative would be relatively easy to implement because it would involve assigning a new party a defined piece of work and leaving the remainder of the project organization essentially untouched. It is assumed that the CG&E organizations would also add staff where understaffing has been identified as a problem.

This alternative provides for a smooth transition to operations because the original Construction and Engineering organizations remain intact. Thus, familiarity with the software and hardware would be retained. However, the Operations QA organization would require extensive training because these staff members would not be involved in the construction of the plant.

There are many qualified firms available to take on the responsibility of the QA program at the Zimmer project. However, CG&E would have to carefully evaluate the candidates to select one that would commit the level of expertise and number of disciplined personnel needed to correct the QA problems at Zimmer without significantly increasing the owner's (and future ratepayers') cost.

This alternative provides for maximum project continuity for Engineering and Construction; however, replacing much of the old QA staff with a new organization would affect project continuity. Some personnel might resent being replaced and might give only minimal cooperation to the new QA organization. The old Engineering and Construction organizations could aid in helping the new one; however, this hardly seems appropriate when QA is supposed to police Engineering and Construction.

9.5.6. Quality Assurance Conducted by Experienced Outside Organization (Alternative 3A)

9.5.6.1. Description. This alternative, shown in Fig. 9-3a, would also involve retaining a qualified third party to assume responsibility for and provide the necessary qualified staff to manage the QA functions at the Zimmer project. This alternative differs from Alternative 3 in that the QA

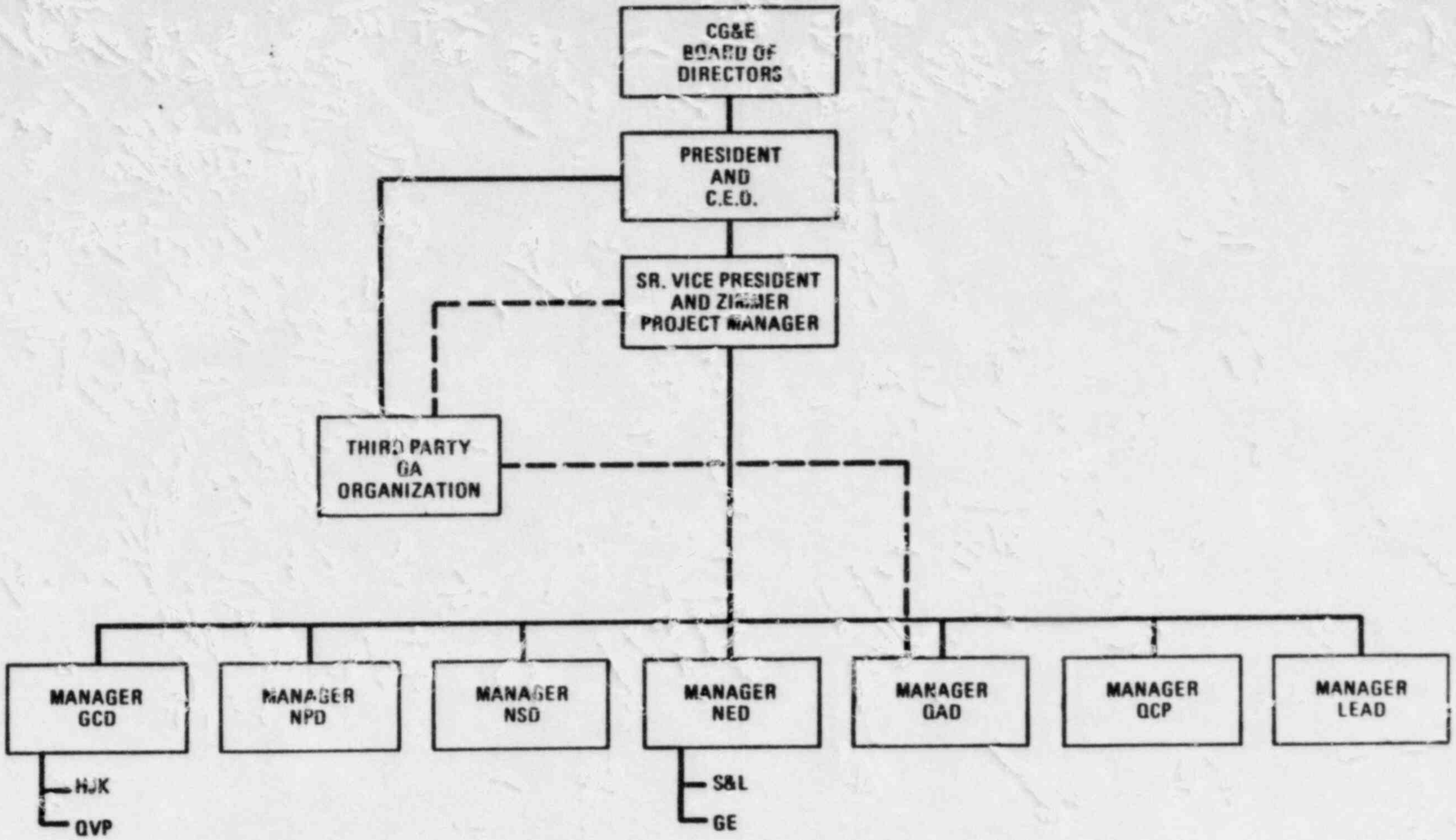

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Fig. 9-3a. Proposed organization alternative 3A

organization would have a line of communication with the Senior Vice President and ZPM, who would have all the Zimmer project organizations reporting directly to him.

9.5.6.2. Evaluation of MUST Criteria. This alternative would satisfy the MUST criteria in basically the same way as Alternative 3, but with increased credibility. The remaining project organizations would now report to a new senior officer, but there would be virtually no change in the lower level organizations.

9.5.6.3. Evaluation of WANT Criteria. This alternative would have the same strengths and weaknesses regarding the WANT criteria as Alternative 3 except that the new Senior Vice President, having had no prior involvement with Zimmer, would probably lend some credibility to this organizational structure in the eyes of external parties.

9.5.7. Construction Management and Quality Assurance Conducted by an Experienced Outside Organization (Alternative 4)

9.5.7.1. Description. This alternative, shown in Fig. 9-4, involves retaining a qualified third party or parties to assume responsibility for and provide the necessary qualified staff to manage the completion of construction and QA functions at the Zimmer project. The management of construction and the management of QA would be independent of each other. Each would report to the Chief Executive Officer of CG&E and have a line of communication to the Senior Vice President, Energy Services and Electrical Production. CG&E would continue to provide the Engineering, Licensing, and Operations functions, which would report to the Senior Vice President, Energy Services and Electrical Production.

9.5.7.2. Evaluation of MUST Criteria. This proposed organization meets the three MUST criteria, assuming the QVP is the assigned responsibility of the qualified third party. The CG&E engineering function should be strengthened to ensure full compliance with the NRC requirements.

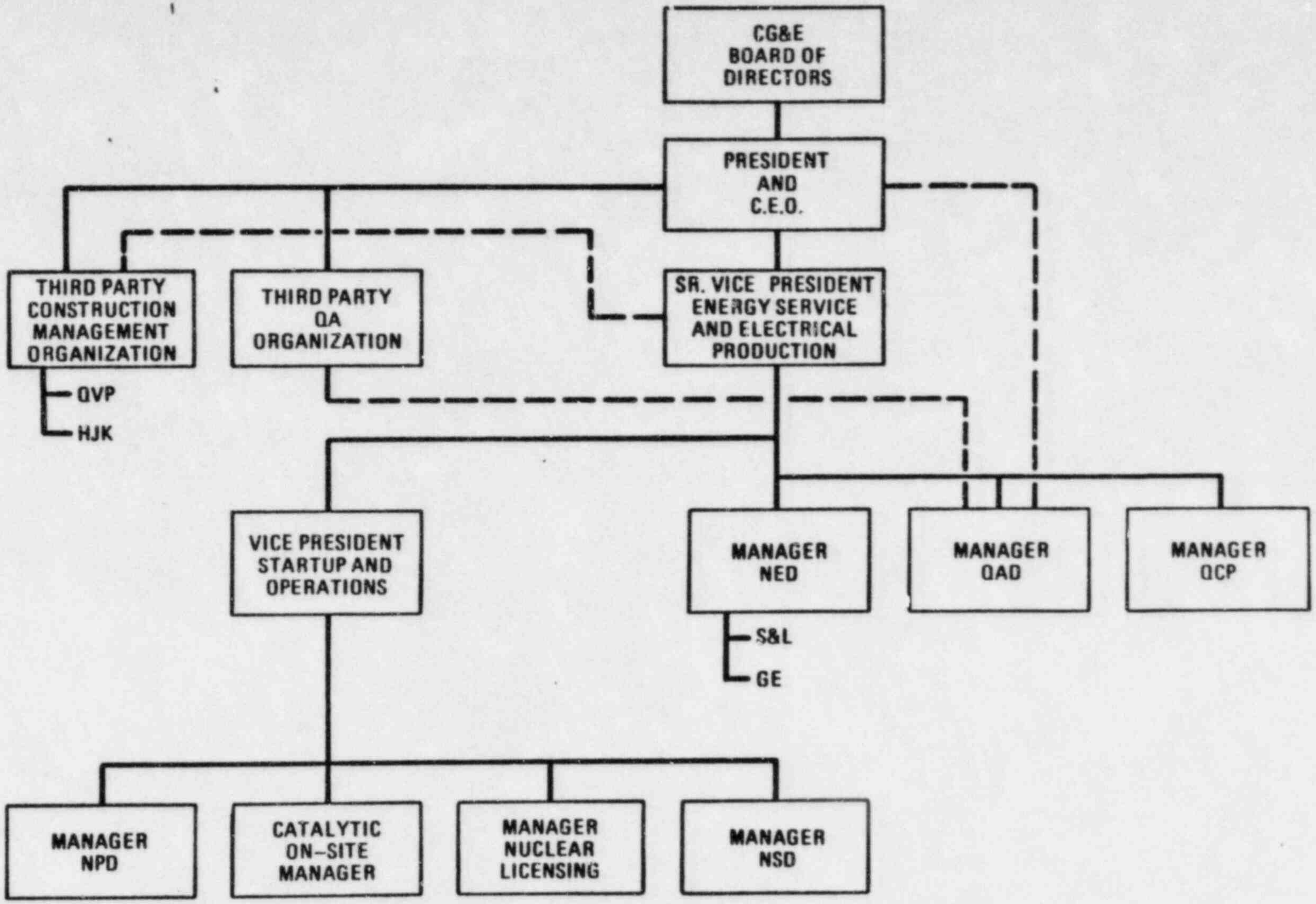

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Fig. 9-4. Proposed organization alternative 4

9.5.7.3. Evaluation of WANT Criteria. Credibility would be improved because qualified third parties would be responsible for the two major areas of concern: construction and QA. However, continued management by CG&E would have some residual negative effect.

The QA awareness/support and organizational balance would be improved, but organizational relationships would remain ambiguous unless they were defined in detail in the contractual arrangements with the third parties. In this proposed organization, key Zimmer personnel would still have responsibilities outside the Zimmer project.

This proposed arrangement would require a major change in that Construction and QA would report to the CG&E Chief Executive Officer with a communication line to the Senior Vice President, but the remaining functions would still report to the Senior Vice President. The working relationships within QA and Construction would be significantly affected.

The transition to Operations would be poor because the CG&E staff would have minimal involvement with QA and the completion of construction and, thus, would require training. This would also result in poor continuity when the plant is turned over to CG&E.

Resource availability would depend on the ability of the third parties to furnish or obtain the required talent. No great difficulty is expected in this regard.

Project continuity will be impacted because these third parties would be introducing new procedures and management systems. The relationships between the current contractors and the new management would also affect continuity.

9.5.8. Construction Management and Quality Assurance Conducted by an Experienced Outside Organization (Alternative 4A)

9.5.8.1. Description. This alternative, shown in Fig. 9-4a, would also involve retaining a qualified third party or parties to assume responsibility for and provide the necessary qualified staff to manage the completion of Construction and QA functions at the Zimmer plant. The features of this alternative are the same as for Alternative 4 except that the outside party or parties would have a line of communication to the new Senior Vice President and ZPM, who would have all the Zimmer project organizations reporting directly to him.

9.5.8.2. Evaluation of MUST Criteria. This alternative would satisfy the MUST criteria in basically the same way as Alternative 4, with the same reservations, but would improve credibility to some extent. Although the remaining CG&E organizations would now report to a new senior officer, there would be virtually no change in the lower level organizations of Operations and Engineering, which would continue to be managed by CG&E.

9.5.8.3. Evaluation of WANT Criteria. This alternative would have the same strengths and weaknesses regarding the WANT criteria as Alternative 4, but the Senior Vice President, having had no prior involvement with Zimmer, would lend some additional credibility to the new organization.

9.5.9. New Company to Complete and Operate Zimmer (Alternative 5)

9.5.9.1. Description. This alternative, shown in Fig. 9-5, would require the creation of a new company organized and owned by the present owners that would function autonomously to complete and subsequently operate the Zimmer plant. The Chief Executive Officer of this new company would report to a new Board of Directors representing CG&E, DP&L, and C&SO. Current CG&E project staff considered properly qualified would be transferred to the new company. Those considered not qualified would be replaced by new personnel and/or temporary help.

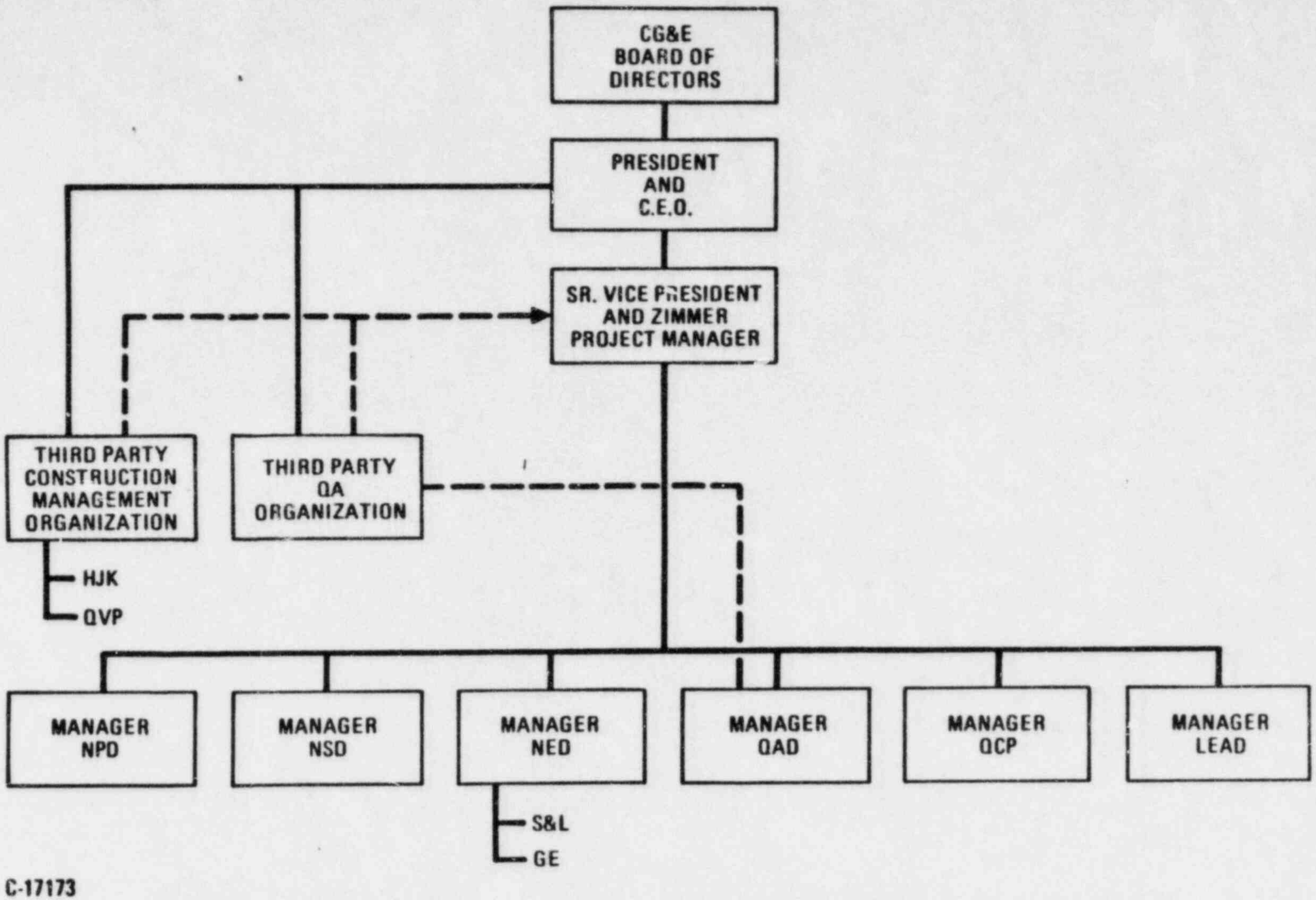
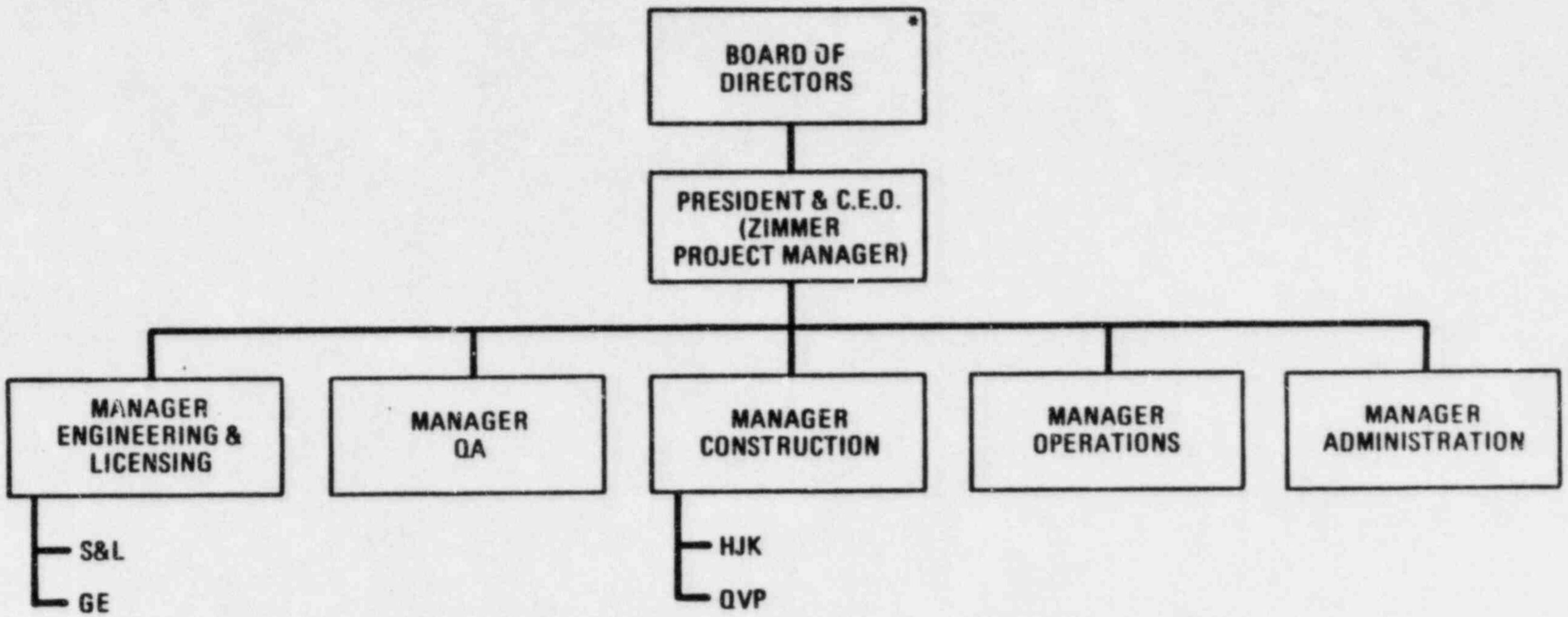


Fig. 9-4a. Proposed organization alternative 4A



*NEW CORPORATION
(SUBSIDIARY OF CG&E, DP&L, C&SO).

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Fig. 9-5. Proposed organization alternative 5

9.5.9.2. Evaluation of MUST Criteria. The creation of a new, autonomous company to complete the Zimmer project may encounter difficulty in meeting the MUST criteria regarding compliance with all legal requirements. These difficulties could prevent this option from being a practical and viable alternative. Time did not permit a thorough study of the legal implications involved with this option; however, no unsurmountable obstacles were identified.

The new company would have to recruit a substantial number of new, qualified key managers and support personnel in order to facilitate completion of the plant in accordance with the regulations. Given the necessary personnel, this criterion could be met.

Provided the necessary technical and managerial capabilities can be obtained, the new company should be able to complete the QVP.

9.5.9.3. Evaluation of WANT Criteria. External credibility on the part of public groups would be maximized because the new company would be completely independent from prior CG&E management. Key managers in the new company would not have had prior involvement with the Zimmer project. However, the credibility in terms of practicality of setting up a new company with new staff may be questioned by some. There are no satisfactory precedents of this type in the utility industry.

This organization would have exclusive responsibility for the Zimmer project, and with clear, well-defined interorganizational relationships, QA awareness/support and organizational balance would be improved. However, management systems and procedures would have to be developed and implemented, which could delay the overall project schedule.

The practicality of implementing this organization is questionable because of the potential logistic and legal problems (MUST criteria) and the time required to resolve these issues. It is also probable, if not certain, that such a major change would result in the reopening of the licensing hearings with extensive attendant delays and significantly increased cost to the ratepayers without a comparable benefit or a demonstrated need.

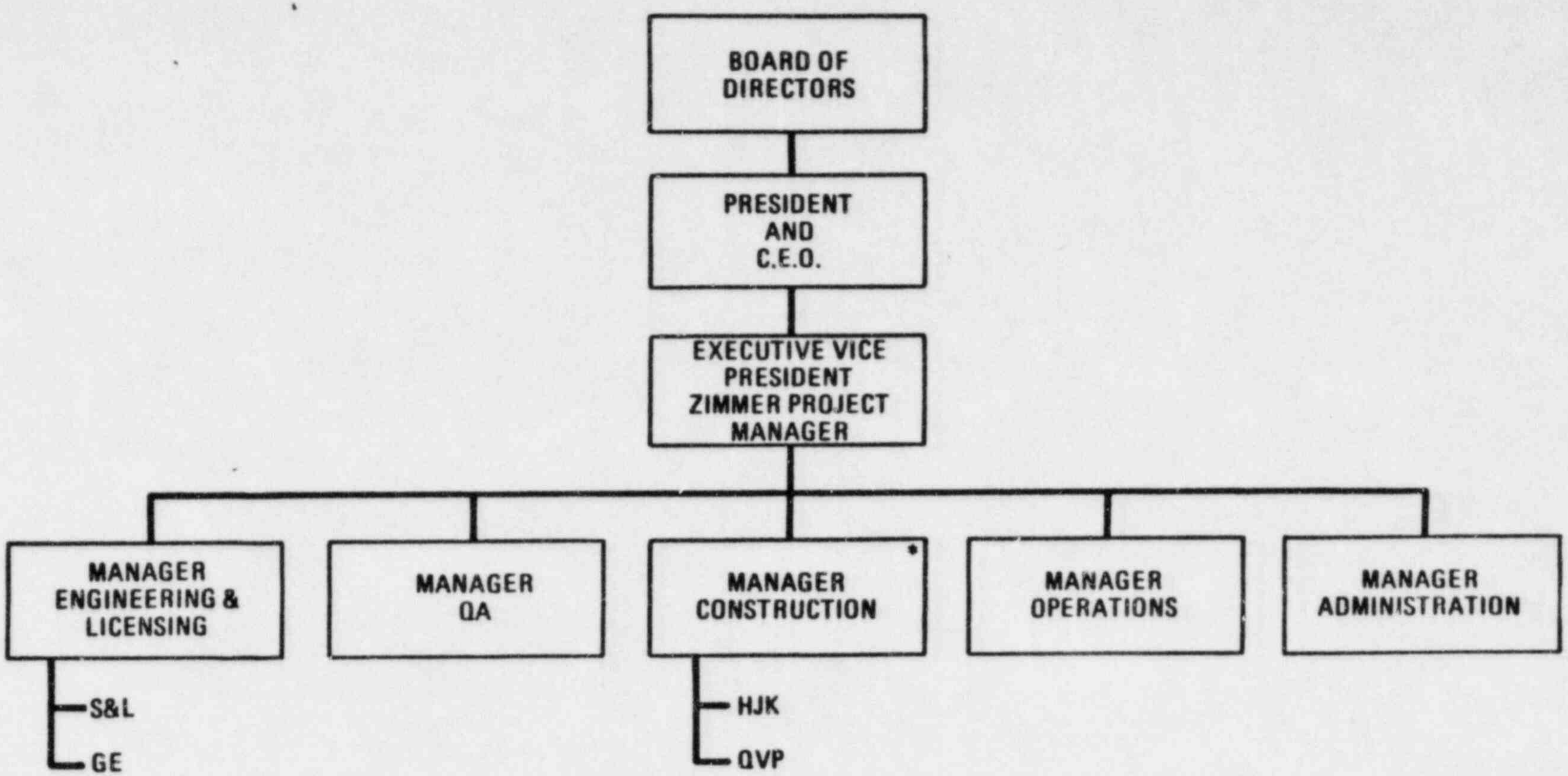
The involvement and responsibilities of the carryover CG&E staff and the overall improved organization would ensure a satisfactory transition from the construction phase into operation. The staff would receive valuable training and experience by participating in the construction, testing, and startup.

The new company would have to recruit many experienced people in order to assemble an adequately sized staff to complete the project. This additional staff could be obtained by direct hiring and/or the use of contract personnel.

Continuity would be affected in the near term because the new management would have to establish new relationships and overcome loyalty/resentment problems in the remaining staff.

9.5.10. New Organization Within CG&E (Alternative 6)

9.5.10.1. Description. This alternative, shown in Fig. 9-6, requires the creation of a new organizational structure within CG&E whereby all aspects related to the Zimmer project would be managed by an experienced senior officer (effectively the ZPM) of the company, who had no involvement with Zimmer prior to the SCO. The senior CG&E officer would report directly to the Chief Executive Officer of CG&E, and the project staff would be significantly strengthened as required by hiring and/or the use of temporary personnel. Construction management and management of the QVP would be performed by an experienced outside organization reporting to the Senior Officer responsible for the Zimmer project.



*EXPERIENCED OUTSIDE ORGANIZATION.

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Fig. 9-6. Proposed organization alternative 6

9.5.10.2. Evaluation of MUST Criteria. Creation of a new organization within CG&E is very similar to Alternative 5, except that it would eliminate the potential problem in meeting all legal requirements.

9.5.10.3. Evaluation of WANT Criteria. Similarly, the evaluation of the WANT criteria is the same as for Alternative 5 with the exception of credibility and practicality. In the view of CG&E critics, this alternative would elicit less credibility than setting up a new company (Alternative 5). Although the new management team in this alternative organization would have had no prior involvement with Zimmer, there would still be a link between the old and new management because the new organization would report to the CG&E President and Board of Directors.

This alternative is practical and realistic and should work because this approach should cause minimal disruption in current contracts and in relationships with the contractors.

9.5.11. Co-Management by Experienced Outside Organization (Alternative 7)

9.5.11.1. Description. This alternative, shown in Fig. 9-7, involves the creation of an organizational structure that would use an experienced third party to co-manage the Zimmer project with CG&E. This third party would assign personnel to all key management positions within the organization, including the Senior Vice President and ZPM. Since the CG&E employees were able to perform their duties, both from a technical point of view and from an external credibility point of view, the outside co-manager would be deleted from the organizational structure. This organization would report to the Chief Executive Officer of CG&E. Additional experienced personnel required to properly staff the project would be furnished by the third party co-manager.

9.5.11.2. Evaluation of MUST criteria. The co-management concept should satisfy the MUST criteria. The arrangement could be set up and implemented

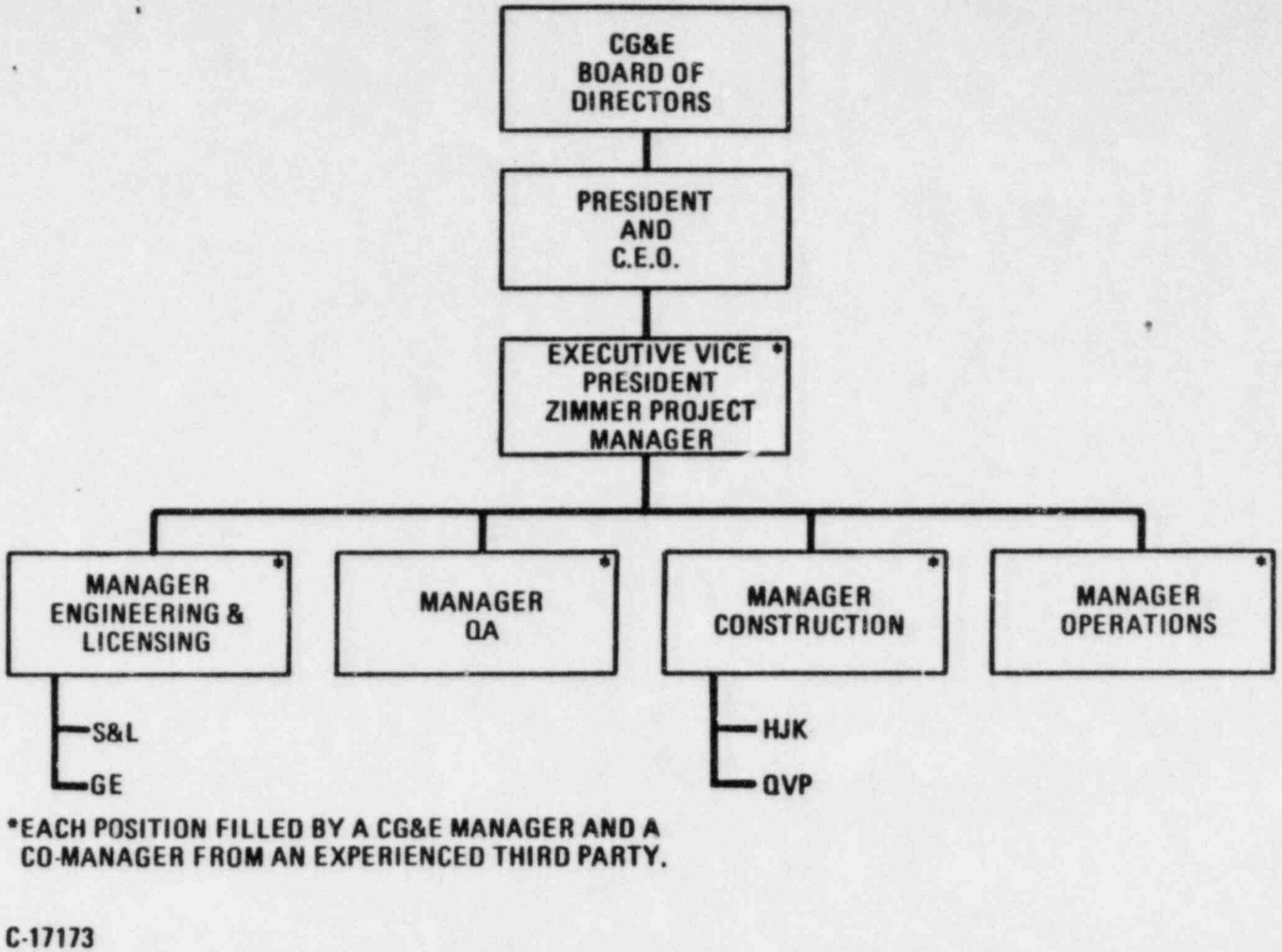


Fig. 9-7. Proposed organization alternative 7

by contract between CG&E and the selected third party; the continued participation of CG&E should satisfy the requirement to attest to the quality of the plant in order to obtain an operating permit license.

The assurance that the plant would be completed in compliance with NRC regulations would be provided by the experience and capabilities of the co-manager, who would have a particular incentive to ensure compliance due to the visibility inherent in this unusual position. These same factors should also provide a reasonable basis for the QVP direction and management.

9.5.11.3. Evaluation of WANT criteria. The external credibility of this new organization should be considerably enhanced by the experience and capabilities of the selected co-manager. However, some doubt will remain because of the continued direct involvement of remaining CG&E personnel. Some uncertainty will continue to exist about who will have the ultimate decision-making authority in case of disagreement between the CG&E and third party co-managers in any given position.

The organizational characteristics regarding policies, procedures, document control, and QA awareness/support should be substantially improved by the new co-manager. However, this organizational plan does not provide an exclusive, self-sufficient authority to complete the Zimmer project. Difficulty would also be expected in making the authorities and relationships clear to all parties; thus an effective organizational balance would be difficult to achieve.

A question concerning the practicality of the co-management scheme arises primarily because of the difficulty in establishing and enforcing the relative authorities of the CG&E and third party co-managers in the various positions. Not only would the co-management arrangement provide automatic competition within each key management position, but CG&E/HJK employees might resent following orders that conflicted with policies and or views of CG&E/HJK managers.

Although the transition from Construction to Operations may be difficult because of the aforementioned problems concerning organizational characteristics, the continued involvement of the CG&E personnel would enhance the transition and subsequent operations. The necessary training would be provided to CG&E staff by their associated co-managers.

This proposed organizational arrangement would reduce the requirement for CG&E to recruit and absorb the number of experienced individuals needed to complete and effect a successful transition in the Zimmer plant. The co-manager could provide the temporary expertise needed for these activities; however, CG&E would still need to recruit several qualified people for the long-term operation of the plant.

Project continuity would be enhanced by the co-management scheme in that the CG&E managers and staff would continue their involvement through completion of construction, transition, and operations. Relationships within the CG&E organization and with the contractors would continue, with the principal difficulty being introducing and absorbing the third party co-managers into the system. Offsetting this difficulty would be the benefits to be gained from working with and learning from the experienced personnel. Thus, when the co-management organization completed its task, the remaining CG&E organization should be stronger.

9.5.12. Delegation of all Activities on a Turnkey Basis (Alternative 8).

9.5.12.1. Description. This alternative, shown in Fig. 9-8, requires that CG&E retain a qualified third party organization to assume responsibility for the entire Zimmer project on a turnkey basis. This third party would report to the Chief Executive Officer of CG&E. CG&E would perform a monitoring/auditing overview of this third party, but would not participate in the day-to-day activities regarding completion of construction and testing of the plant.

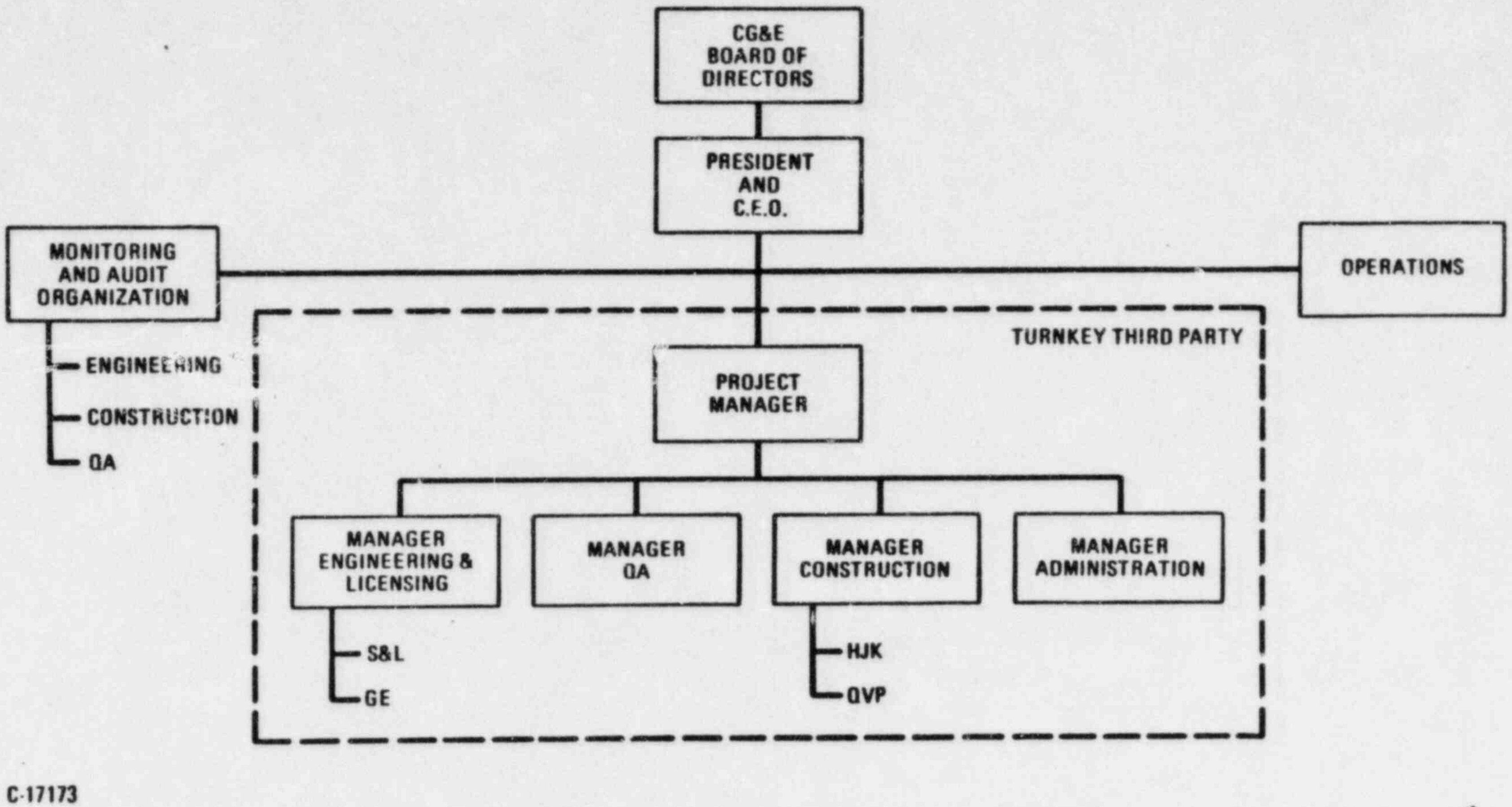


Fig. 9-8. Proposed organization alternative 8

9.5.12.2. Evaluation of MUST criteria. This alternative might entail some contractual difficulties with existing contractors who might remain on the project in some new capacity. The new outside organization would also have to keep the CG&E Chief Executive Officer sufficiently involved and informed so that he could attest to the quality of the plant. Therefore, this alternative should satisfy any legal requirements although with some predictable difficulty.

A carefully selected, experienced outside organization should be able to complete the construction of the Zimmer project in accordance with the applicable regulations. The degree to which work might have to be redone to be of verifiable quality would depend upon the degree of cooperation provided by the present contractors in transferring records.

The experienced outside organization would also be expected to satisfy the requirement to provide a credible basis for the QVP.

9.5.12.3. Evaluation of WANT Criteria. This alternative removes all active involvement in the construction of the project by CG&E with the exception of the CEO; thus it would enhance external credibility of the organization.

The new, experienced constructor should be well able to correct problems concerning QA support, planning and scheduling, procedures, etc. A drawback to this alternative is the lack of training and familiarity with procedures in the CG&E staff who would eventually operate and maintain the plant. It is expected that the transition to operations, without the continuing involvement of the CG&E staff, would be difficult.

With the nuclear power market declining, there should be several credible firms available to provide the necessary technical, managerial, and practical expertise and staff to complete the Zimmer project. CG&E would not be required to recruit experienced people to complete the plant and could concentrate on staffing the Operations organization.

Problems to be expected with the retention and transfer of documents and records, plus a questionable ability to provide a valid N-stamp for the completed hardware, make this alternative appear impractical unless HJK is retained for the purpose of finalizing reports on prior code work. Project continuity would suffer a strong, if temporary, setback.

9.5.13. Zimmer Executive Reporting to Oversight Committee (Alternative 9)

9.5.13.1. Description. This alternative, shown in Fig. 9-9, would establish a ZPOC that would report to the existing CG&E Board of Directors. The committee would be constituted such that the majority of the members would have had no line management responsibility for Zimmer prior to the SCO. The organizational structure discussed in Alternative 6, including the ZPM, would report directly to the ZPOC. The ZPM would have a line of communication to the Chief Executive Officer of CG&E to report progress and status.

9.5.13.2. Evaluation of MUST Criteria. Implementation of this alternative would require formation of a new committee by the Board, with the probable addition of new directors to meet the independence and knowledgeability of nuclear power plant criteria. The majority of the existing Board members have had no line management responsibility for the Zimmer project, but also have no prior nuclear experience. Because the change in responsibility for the plant would detract from the Chief Executive Officer's responsibility, it is possible that some restructuring of the corporate constitution will be required. However, no legal prohibitions are foreseen for this alternative.

Presuming that the necessary expertise can be hired or contracted for, this alternative should be able to complete the plant in accordance with the applicable regulations, codes, and standards.

It is presumed that the management in this alternative would obtain permanent or temporary expertise to properly accomplish the QVP.

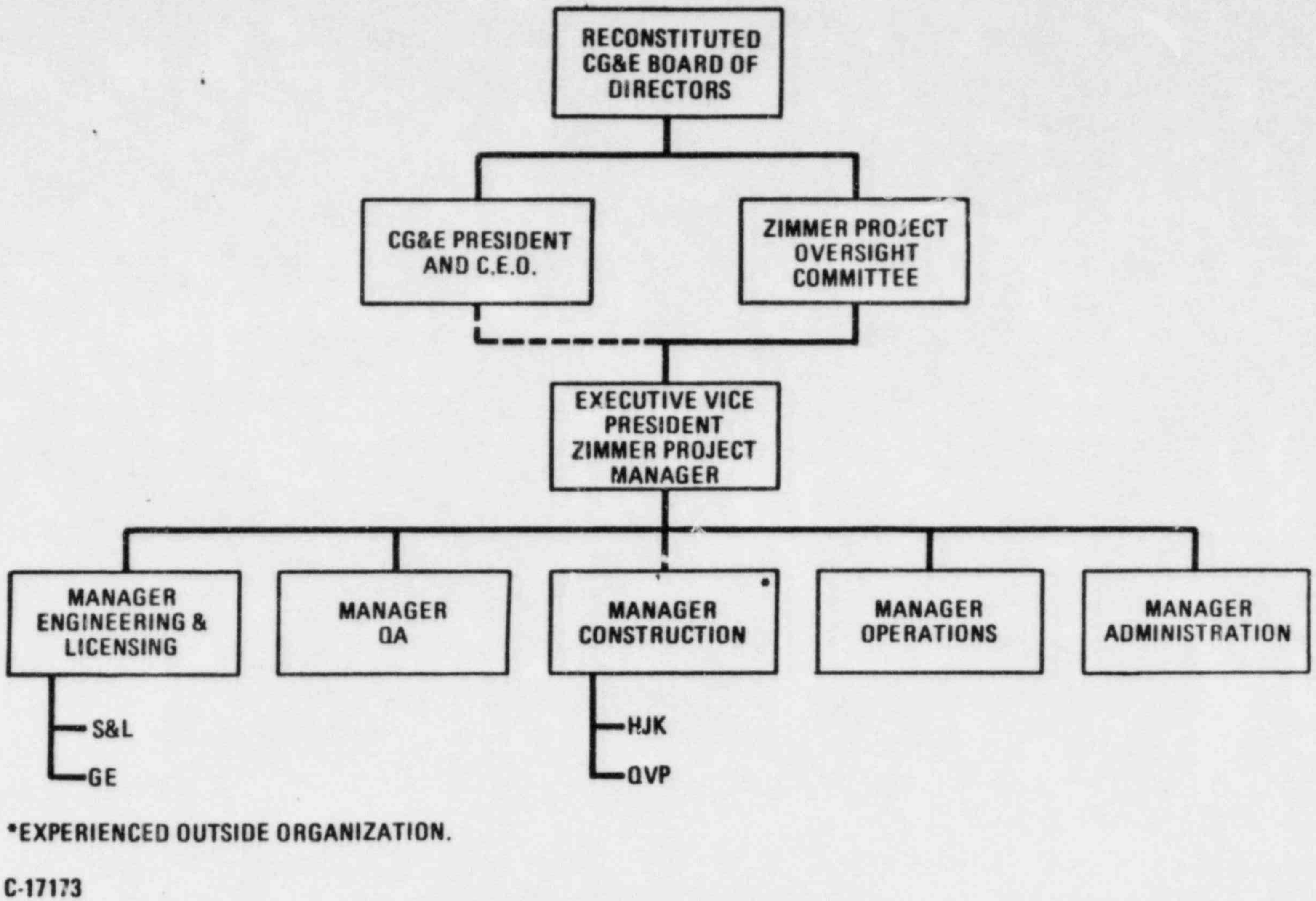


Fig. 9-9. Proposed organization alternative 9

9.5.13.3. Evaluation of WANT Criteria. An experienced new Zimmer executive, supported by more active involvement of the Board of Directors should enhance the credibility of this alternative, although some doubt could remain due to the continued involvement of many of the previous CG&E staff. A conflict in the role of the Chief Executive Officer versus the ZPOC would exist and would in part detract from credibility.

The organizational characteristics of this alternative can be presumed to be adequate on the basis that the new executive and the ZPOC would insist on QA awareness and support; organizational balance; and correction of policies, procedures, and planning/scheduling problems.

Existing work habits and attitudes about QA and procedures in a large number of continuing CG&E and contractor personnel might be difficult to overcome. Another deterrent to the practicality of implementing this alternative is that the ZPOC response to project needs would surely be slower than that of an individual Chief Executive Officer having appropriate responsibilities. Delays and difficulties in decision-making would likely result. Depending on the constitution of the ZPOC, potential legal conflicts among the present owners could result in difficulties in setting policy and making decisions in a timely manner.

This alternative should provide for a good project transition because of the involvement of the same people through the completion of construction, testing, and startup, guided by experienced managers.

CG&E is required to recruit and assimilate a number of experienced people into key positions as either permanent or contract personnel. Although many project personnel would remain, the new management would have to establish new relationships and overcome resentment problems based on loyalties to previous management.

9.5.14. Zimmer Executive Reporting to CEO of CG&E, with Communication to Board Through an Oversight Committee (Alternative 10)

9.5.14.1. Description. This alternative, shown in Fig. 9-10, would also establish a ZPOC reporting to the Board of Directors of CG&E, as in Alternative 9. The ZPM would report to the Chief Executive Office of CG&E, and would have a line of communication to the ZPOC to report progress and status to the Board of Directors. The organization reporting to the ZPM would be as for Alternative 6.

9.5.14.2. Evaluation of MUST Criteria. This alternative should satisfy the MUST criteria in the same way and with the same qualifications as Alternative 9, except that there would be no change in responsibility for the Chief Executive Officer and, therefore, impact on the corporate constitution.

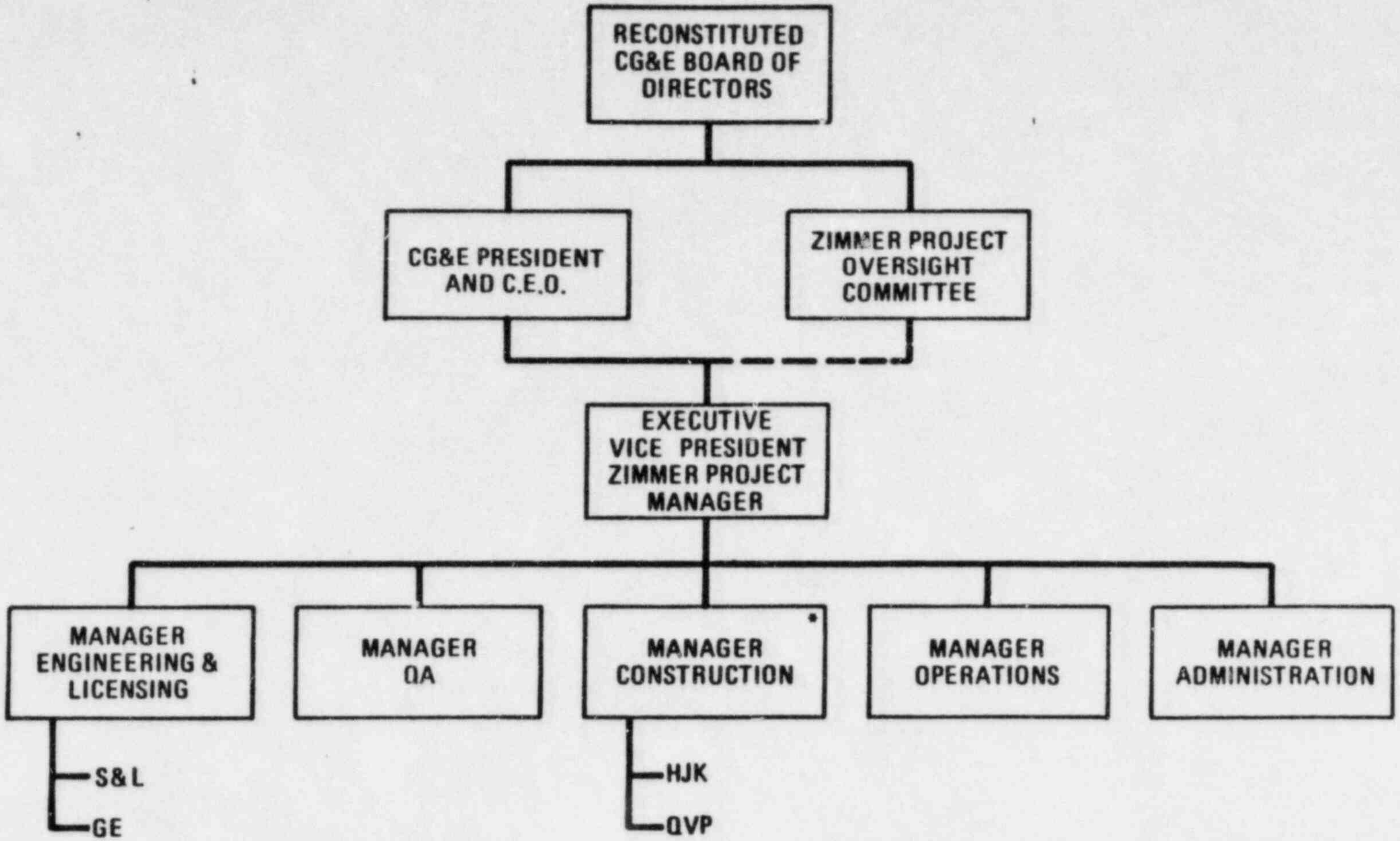
9.5.14.3. Evaluation of WANT Criteria. This alternative should meet the WANT criteria in the same way as Alternative No. 9, with the following two possible differences:

1. The ZPOC would be advisory, with right of access to information. Therefore, decision making and policy setting should be improved relative to Alternative 9. From a practical viewpoint, this alternative might evoke more credibility.

2. This alternative might be more readily implemented into the overall CG&E organizational structure.

9.5.15. CG&E Proposed Organization (Alternative 11)

This alternative, shown in Fig. 9-11, would create a new organizational structure that would be dedicated to the completion and operation of the Zimmer plant only, with no other responsibilities within CG&E. This organization would be managed by an experienced senior officer of the company who has had no involvement with Zimmer prior to the SCO. This senior



*EXPERIENCED OUTSIDE ORGANIZATION.

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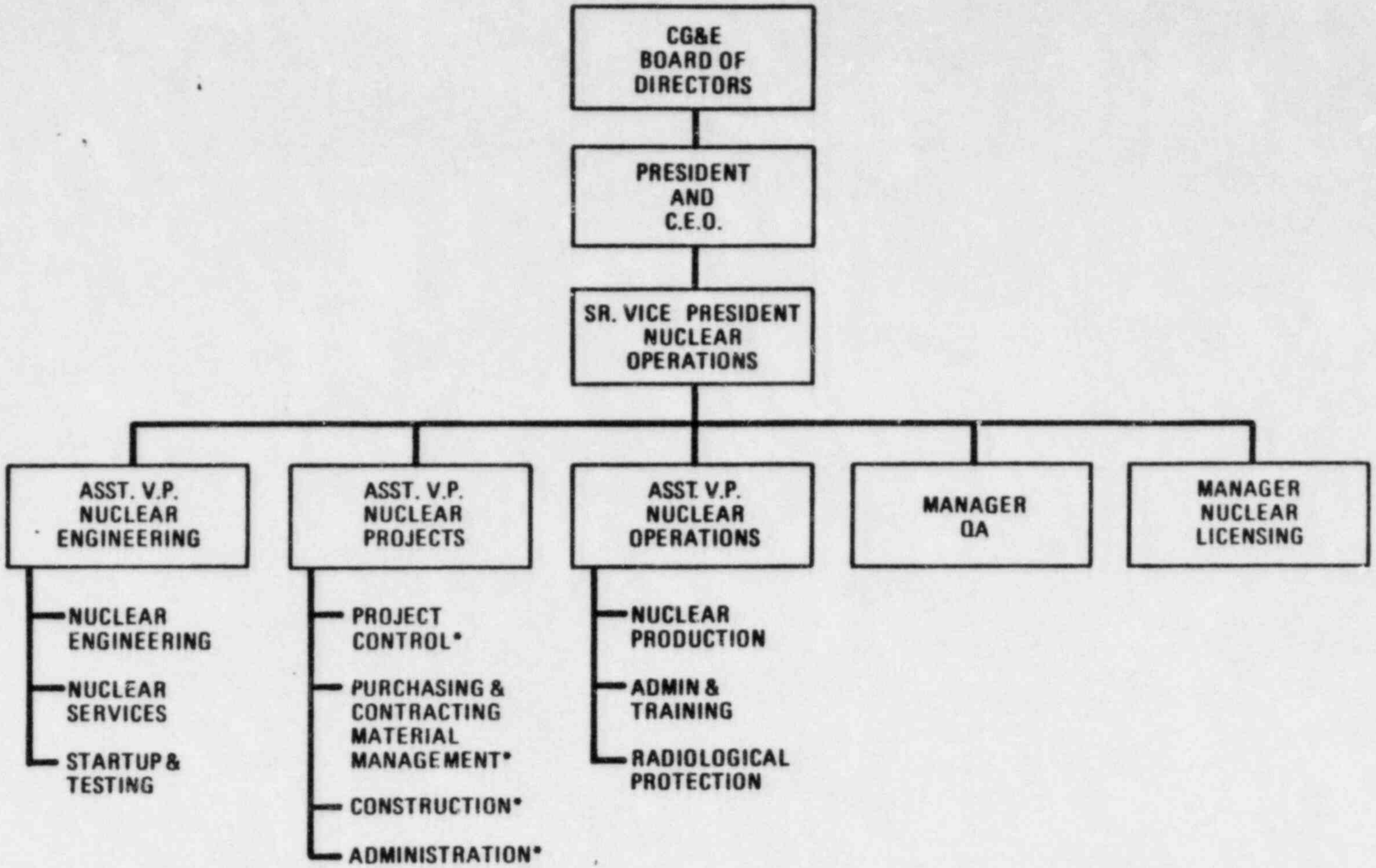
Fig. 9-10. Proposed organization alternative 10



*CO-MANAGEMENT WITH EXPERIENCED EXTERNAL ORGANIZATION INCLUDES DIRECTION OF QVP.

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Fig. 9-11. Proposed organization alternative 11

officer would report directly to the Chief Executive Officer of CG&E. Additional managers, also having no prior involvement with Zimmer, reporting to this senior officer would be added to the project staff. CG&E would use an experienced third party to manage day-to-day construction activities and manage the QVP, including scheduling the engineering activities to support the project. (Note: Conceptually, this proposal is similar to Alternative 6, with some variations at the lower levels in the organization.) The evaluation of this alternative is essentially the same as for Alternative 6.

9.5.16. BPC Proposed Organization

In its draft report, BPC proposed a fifth alternative to the four concepts suggested by the NRC. However, BPC interpreted NRC's Alternative 1, "Strengthening the present CG&E organization," differently than TPT. Their interpretation is, in fact, co-management by an experienced, outside organization and is similar to TPT's Alternative 7; the evaluation, therefore, would be the same.

The fifth alternative proposed by BPC is basically the same as Alternative 8 (proposed by TPT). Again, the evaluation would be identical.

10. RECOMMENDED ORGANIZATION

10.1. OVERALL RESPONSIBILITY

Cincinnati Gas & Electric Company (CG&E) holds construction permit No. CPPR-88 which was issued by the Nuclear Regulatory Commission (NRC) in 1972. The permit authorizes the construction of the W. H. Zimmer Nuclear Power Station, a boiling water reactor to be used for the commercial generation of electrical power.

As the governing body and policy maker, the CG&E Board of Directors is ultimately responsible on behalf of the CG&E stockholders for all policy and actions associated with the Zimmer power station. TPT believes that for a smooth-functioning, efficient organization the Board of Directors must retain full responsibility and it should not be diluted in any way. In TPT's view the CG&E Board should take a more active role in exercising this responsibility in relation to the Zimmer project.

The Board should become more involved and knowledgeable on key policy decisions and key results of those policies. The Board as a whole should be perceptive enough to identify flaws and undesirable overall results from key management policies. To assist in fulfilling these responsibilities, TPT recommends that serious consideration be given by the Board to extending membership to a nationally recognized individual who is and has been independent of the Zimmer project and who has broad experience in the commercial nuclear power industry from a business viewpoint, from a project management viewpoint, and from a QA viewpoint.

TPT further recommends that the Board, recognizing its responsibilities, carefully evaluate the capabilities and credentials of all CG&E officers having direct line management responsibilities for Zimmer and, on the basis of the evaluation, if appropriate, issue endorsement of those officers.

In TPT's view, the President and Chief Executive Officer (CEO) for CG&E must continue to have primary responsibility for the Zimmer power station as well as all other aspects of CG&E's business in order to satisfy the accountability of his office and the nuclear licensing requirements. Consideration of any alternative that formally or informally transfers responsibility to an individual or entity other than CG&E would involve the effective transfer of the nuclear license, which is prohibited under the Atomic Energy Act unless the NRC gives its consent. In TPT's view, the delays and costs involved in the requisite evaluation by the NRC, at this point in the Zimmer construction, would be prohibitive and a significant detriment to CG&E and the local populace.

IN TPT's opinion, any organization which weakens this position would be counterproductive and increase the cost of operation of CG&E, including Zimmer, to the stockholders and therefore increase the cost of electricity to the ratepayers without any counterbalancing benefit. Therefore, in this organization the President is left with the full responsibility for Zimmer. As such he must be involved in all policy decisions such as the relative priority of quality, quality assurance, cost, schedule, basic approach to regulatory requirements, reaction to whistle blowers, etc. He also must be knowledgeable of the results of these policies and the general direction of the project. Obviously he should not be involved in the day-to-day operation of the project, but he must be sensitive and perceptive of the basic direction of the project and its major problems.

Furthermore, TPT has concluded that the President of CG&E is capable of filling this position, notwithstanding the errors of the past and the widespread criticism of CG&E and its management. This conclusion applies specifically with respect to the current President, Mr. W. H. Dickhoner.

TPT's recommendation for an organizational structure for the Zimmer project is presented in the framework of CG&E's Board of Directors and the President's overall responsibility. Any committees, such as discussed below, which are formed for the purpose of ensuring that the Zimmer plant is constructed in accordance with NRC regulations must be viewed in this framework.

10.2. ZIMMER PROJECT ORGANIZATION

The following discussion of TPT's organizational recommendation is an expansion of Alternative 10 in the evaluation in Section 9.

The recommended organizational structure is depicted in Fig. 10-1.

In this reorganization, the responsibility for all nuclear activities related to the Zimmer project should be concentrated exclusively in a single senior executive who has had no direct association or involvement in the project prior to the SCO. This senior executive would report to the President of CG&E. He should have all the authority and resources necessary to implement all measures required to successfully complete Zimmer in accordance with the NRC's regulations. He will also be responsible to provide complete timely reports to the ZOC concerning progress, policies, and major problems of the Zimmer project and is responsible for providing the ZOC with any information requested by the Committee itself or its group of advisors.

This senior executive should have a proven track record in the successful management of major nuclear projects. This should include knowledge of all phases of a nuclear project, including engineering, construction, quality assurance, regulatory relations, etc. For the purpose of discussion, he is referred to on the organization chart (Fig. 10-1) as the Executive Vice President, Zimmer Project Manager (ZPM), but many other titles would also be appropriate.

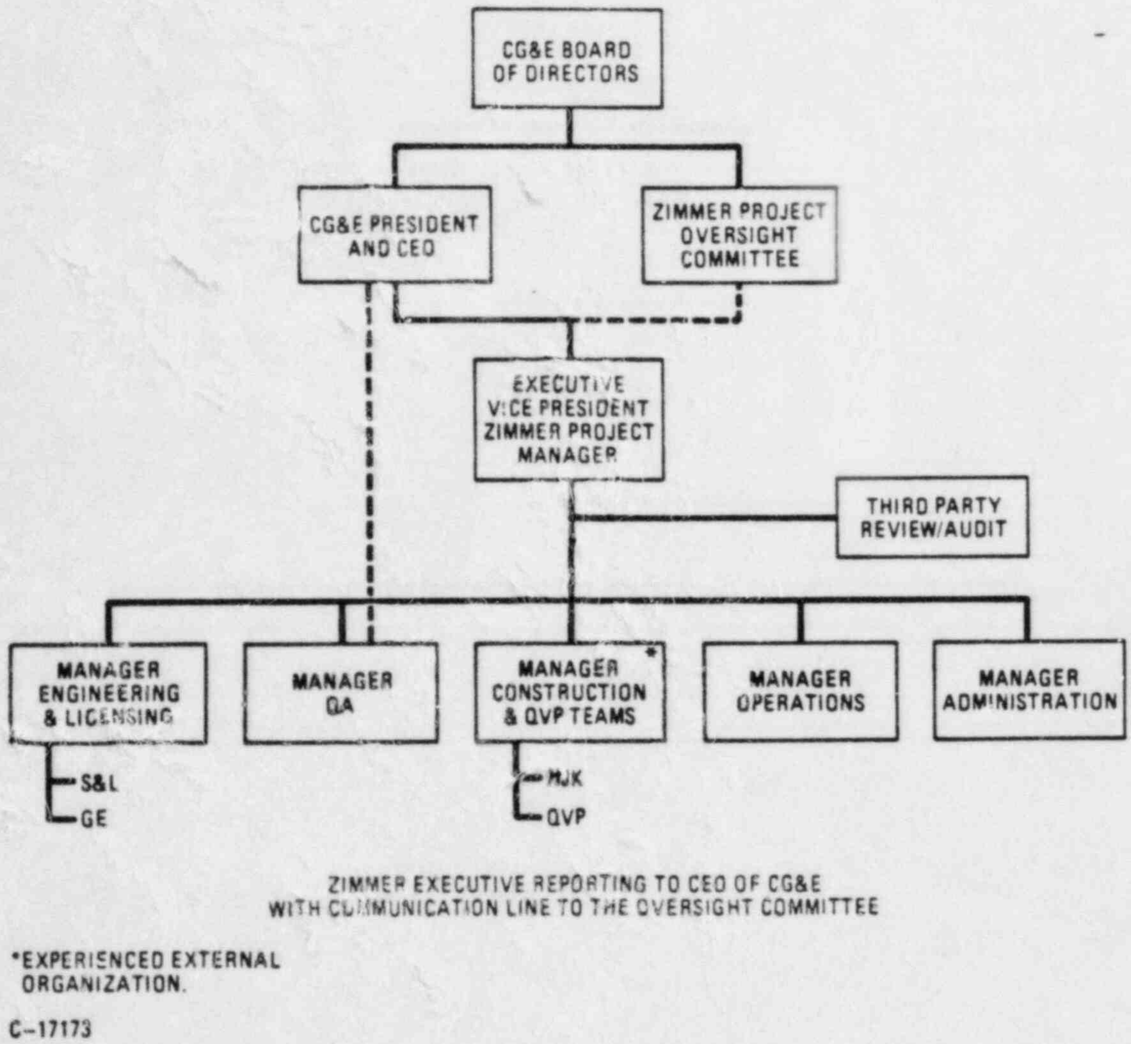

Fig. 10-1. Proposed Zimmer project organization

TPT recognizes that CG&E has hired Mr. J. Williams, Jr. as Senior Vice President, Nuclear Operations, since the SCO and that his sole responsibility is to manage the Zimmer project. In TPT's view, Mr. Williams is an appropriate selection to manage current activities at the Zimmer plant. His background and experience meet the requirements specified by TPT. His words and actions since being in office have underscored his commitment to quality and his intention to do whatever is necessary to perform a comprehensive Quality Verification Program and complete the Zimmer station fully in accordance with NRC regulations and the construction permit.

TPT also notes that Mr. Williams has hired three well-qualified persons to head various functions at the Zimmer plant. TPT has had no contact with these individuals as they have only recently joined the project. Therefore, TPT can observe only that their qualifications and experience fully meet, in TPT's judgment, the requirements of these positions.

10.3. ZIMMER OVERSIGHT COMMITTEE

To further assist the Board of Directors to fulfill its responsibilities to the stockholders, in order for the Board to demonstrate their commitment to integrity in all activities related to Zimmer and at the same time achieve the maximum credibility in the eyes of its critics, a ZOC should be appointed. This ZOC should be constituted from existing CG&E Directors (supplemented by new members if required) so that the majority of members have had no prior Zimmer line management involvement. These directors should bring business expertise; technical expertise applicable to, if not directly related with, the nuclear industry; and community awareness. The ZOC would be similar in constitution and independence to the recently formed Special Litigation Committee formed by the CG&E Board to address the Belle Efros Derivation Action Complaint.

The capability of the ZOC should be supplemented by a permanent, though not necessarily full time, staff of advisors. These advisors should provide technical, business, and community expertise. Included should be technical expertise in all phases of a nuclear project, such as engineering, construction, and quality assurance. A member of organizations such as the American Nuclear Society, the American Society of Mechanical Engineers, and the American Society of Quality Assurance would be appropriate. Also included should be a respected representative from the Cincinnati community leadership. Representatives of the two partners in the Zimmer project should also be included.

The ZOC would provide an independent oversight of Zimmer operations for the Board of Directors. Thus, they would act as a source of information and analysis independent of Zimmer line management, thereby ensuring the highest corporate visibility on Zimmer. The ZOC should have full access to any documents and records of the Zimmer project. The senior executive responsible for Zimmer would report to this committee regarding progress and status on a regular periodic basis. The ZOC would not make policy decisions but would act as an advisory group to the Board of Directors on policy matters and give the Board of Directors insight into the results of policy.

10.4. ARCHITECT ENGINEER/CONSTRUCTOR (AE/C)

An experienced external AE/C type organization would be hired to perform construction management and to manage the Quality Verification Program (QVP).

It is recommended that HJK be retained to perform all construction activities under the management of the new AE/C. Existing CG&E construction staff would be utilized to the extent required, specifically to provide continuity to prior activities and records.

The AE/C would replace the present CG&E Construction Management Group. The responsibility of the AE/C is to direct and manage all construction activities, including remedial work resulting from the QVP and subsequent completion of construction at the Zimmer site. All work is essentially hardware related, but includes all required and related documentation. The AE/C project management would report to, and receive directions from, the Executive Vice President, ZPM. CG&E relationships to the AE/C would be such as to maintain the AE/C's corporate identity, responsibility, and commitment and still maintain CG&E's management involvement. This continued involvement of CG&E (and HJK) is important due to the advanced state of completion at Zimmer, the extensive actions still outstanding from prior work (particularly in the area of ASME Code N5 reports and related documentation); the knowledge, experience, and records of existing staff; and the prospect of the transition from construction to operations (which will ultimately be the licensee's responsibility). In these circumstances, it is inappropriate to fully delegate accountability to a new AE/C. CG&E, appropriately reorganized and strengthened in the senior management functions, should remain actively involved in Zimmer project management and QA in order to properly discharge their corporate responsibilities. In this concept, the AE/C would have a clearly defined corporate role and scope under CG&E's overall management. The AE/C would provide program management resources to the extent necessary, primarily in construction activities and in leadership of the QVP Teams referred to in Section 9.3.2.3. The new AE/C would manage HJK site activities in the completion of the QVP and subsequently in the completion of construction. In addition, depending upon CG&E's ability to recruit appropriate people, the AE/C may also provide temporary staff to be integrated under CG&E direction in areas other than construction; for example, in engineering, and/or the operations area.

The AE/C Project Manager's main function should be to translate engineering information into work packages that uniquely define a specific task, prioritize the work, ensure that adequate craft support is applied to the task, ensure proper software is created and stored for each task, ensure proper inspections are made, and coordinate the functions of all parties involved. The AE/C should perform its work under clearly defined channels of communication between CG&E, the A/E constructor, and the other contractors. In addition, coordination with CG&E Operations to ensure the orderly turnover of completed systems, on schedule, should be an important part of the AE/C's responsibility. A procedure for conducting this type of work should be prepared with the agreement of both groups as to just how the turnover will be accomplished and with well-defined, mutually agreed upon areas of responsibility and authority.

The AE/C should be responsible for monitoring the progress and productivity of the constructor and reporting results of the construction and QVP performance back to CG&E. They should make sure that the QVP and construction activities are being performed on a schedule compatible with the overall project schedule and milestones. A very important aspect of construction is control of the work package at all times, ensuring that proper documents are input for construction and proper design and inspection paper work is included at completion. A standard system for feeding completion information to project planning and scheduling should be implemented.

As noted above, the AE/C is identified as being responsible to the ZPM for the management of the QVP.

The scope of the QVP is given in Section 9.3.2.3.

A team approach is proposed for implementation of the QVP. Each QVP Team would be assigned to a system, a subsystem, or other logical and existing subdivision of the plant. These teams would consist of personnel from each Zimmer organization, representing all disciplines and functions necessary for that team's assignment except QA/QC*. The numbers of active people on a team would vary from time to time depending on the status of completion and the particular requirements.

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*QA/QC would be independently performing its normal project function while reporting through an independent chain of command to the Executive Vice President, ZPM.

The reporting chain for QVP Team Leaders must be clearly defined. They would report organizationally through the AE/C Project Manager to the Executive Vice President, ZPM. The experienced external organization is perceived to have the technical and management capability, and prior experience, to assume this duty and provide the necessary qualified staff. In addition, as membership of the teams comprises representation from all other groups, all organizational units must contribute resources to the extent required. In this context it must be realized that each QVP Team may have conflicting demands on available CG&E resources. A strong commitment of CG&E's upper management to coordinate, schedule, and monitor QVP Team activities and maintain staff morale is required for the successful completion of this program.

The AE/C's activities and responsibilities are concluded when the QVP, the subsequent completion of construction, and the construction completion checkout tests and reworks identified during the transition to preoperational and start-up tests are completed and the level of effort can be handled by the permanent station start-up and maintenance crew. At this point, the AE/C, as such, is terminated and responsibility is transferred fully to the Operations Group. Thereafter, ongoing hardware-related functional activities such as materials receiving, warehousing, etc. and key craft capabilities continue as a maintenance support function for future operations. Qualified CG&E staff who have been assisting the AE/C in QVP activities are reassigned to Operations and Engineering to provide the essential carry-over of experience into those areas.

10.5. ENGINEERING GROUP

The responsibility of the Engineering Group is to direct and manage all engineering activities related to the Zimmer project. All work is essentially software- and engineering-related. The Group also provides technical support for nuclear licensing activities.

During the QVP phase of the project, the Group's primary activities will be to:

1. Participate strongly and actively in the QVP Team activities, providing the necessary technical input and guidance.

2. Provide the liaison to a third party's independent design review, which is seen as an essential requirement during the QVP.

3. Continue to be the primary technical interface between the Zimmer project organization and the original plant designer (S&L) and the NSSS supplier (GE).

4. Implement design control procedures to bring the plant's technical documentation up to the standard required.

The Group would also be responsible for all Nuclear Safety, Licensing, and Environmental Affairs.

The Group would not, as in the past, provide administrative service for the purchase of components and services. This function would be administered separately under the Administrative Group, with technical review as required by Engineering.

The Head of the Engineering Group and the majority of his key assistants should be permanent CG&E professional staff who, after the QVP and construction completion project phases, will provide complete technical services (or conduits from external sources) to the Operations Group.

The Head of the Engineering Group should hold an appropriate engineering degree from an accredited national university and have extensive experience in the nuclear industry. He should have held an engineering management position with a nationally-recognized company actively involved in the design and construction of nuclear power plants. Prior experience with BWRs would be desirable.

It is clear that existing CG&E staff must be supplemented by additional qualified staff. Also in the near-term, the number of staff required will be greater than when the plant is operational. It would, therefore, be appropriate to contract for some supplemental staff temporarily from qualified external organizations. The total staffing needs during the QVP are expected to exceed 200. However, the permanent staffing level for ongoing operations would be more in the range of about 40 to 50.

At the working level, the Engineering Group would be organized by engineering discipline as shown in the attached organization chart (Fig. 10-2). There is an additional group who function as liaison between engineering and outside organizations. Each group is discussed in the following text.

All disciplines within the Engineering Group would provide technical support services or functions as required to the project typically in the following areas:

1. Licensing technical support.
2. Operations Group construction technical support.
3. Construction Group technical support.
4. Review and approval of all ECRs.
5. Review and approval of applicable DDCs.
6. Preoperational testing technical support.
7. Quality verification program technical support.
8. Design review technical and administrative support.
9. FSAR compliance support.
10. Perform technical audits of engineering contractors.

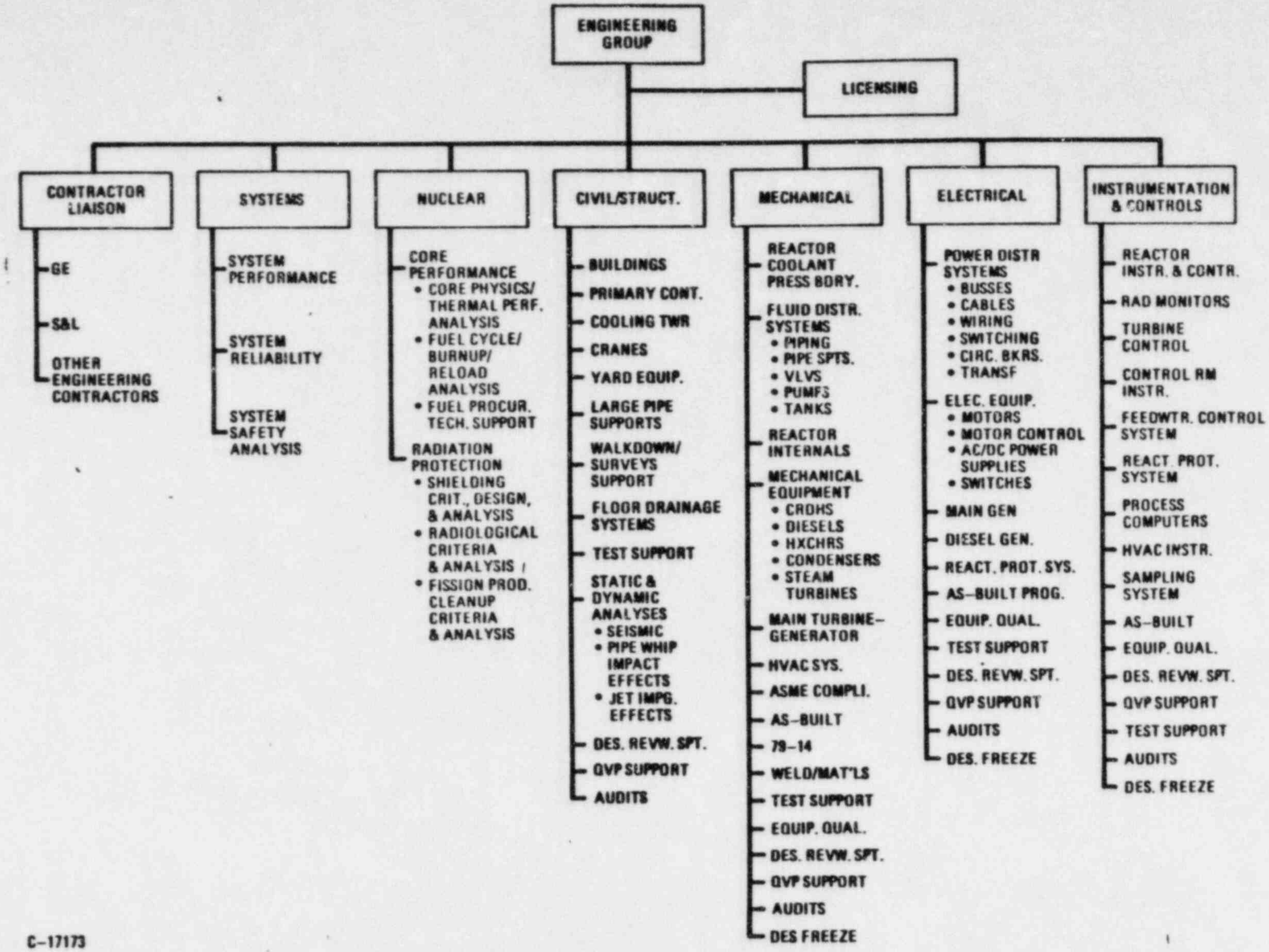

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Fig. 10-2. Proposed engineering organization

11. Bid and proposal technical review.

12. Regulatory compliance (i.e., cognizant Regulatory Guides, NUREGS, I&E Bulletins, Industry Codes and Standards).

13. Procedure writing and review for CG&E and contractors.

14. Support of CPM network scheduling/planning.

15. Review of NRs.

16. Technical input to Corrective Action Plans.

TPT recognizes that there are many acceptable ways to organize this activity in detail. The best way is largely dependent on the personnel available. However, all the functions mentioned must be covered. The subgroup structure given below is TPT's suggestion based on limited knowledge of the personnel available. Other ways could be equally acceptable.

The subgroups within the Engineering Group are defined by technical discipline to enhance the technical strength of engineering and give flexibility in assignment of manpower to the various engineering tasks needed for Zimmer. There should be lead engineers in each subgroup (capable of both project and technical management of an engineering task) who will be assigned responsibility for the planning, staffing, execution, and completion of each task. Assignment will be made based on the discipline which is most important to the particular task with engineers from the other disciplines brought in as required.

The duties of each subgroup are as follows.

10.5.1. Contractor Liaison Subgroup

The contractor technical liaison subgroup is staffed with engineers who perform a project enginering and coordination function between the Engineering Group and the major engineering contractors such as GE, S&L, and any other technical support organization outside the CG&E organization.

Their task is one principally of facilitating communication, but they need to be technically knowledgeable in the subjects handled. They ensure that criteria, specifications, costs, schedule, and technical guidance from CG&E are transmitted to the engineering contractor in a clear, concise manner and in accordance with the procedures and contract requirements. Likewise, they ensure that information to be received from the contractor is properly completed before transmittal and then fed to the appropriate people within the Engineering Group.

The contractor liaison personnel are the main contact point for communication between CG&E Engineering and the engineering contractor. In this way information is controlled in distribution to the proper people and accepted only in the appropriate format.

The contractor liaison subgroup is also the focal point for engineering audits of engineering contractors so that they ensure appropriate CG&E engineering personnel are assigned to the audit, proper procedures are used for the audit, and all parties concerned are properly notified of the audit. They also ensure that the results of the audits are distributed to appropriate organizations within CG&E for possible future action.

The contractor liaison subgroup also coordinates the engineering review and approval of all bids and proposals made to CG&E that concern Zimmer.

10.5.2. Systems Engineering Subgroup

The charter of this group of engineers is to be expert in systems performance for normal plant operation, transient behavior, and potential accident conditions to enable CG&E to monitor the design efforts of contractors meaningfully from a base of adequate technical knowledge, to assist in performance analyses and troubleshooting for the plant operators, and to give technical support to the Plant/Licensing Group.

System performance calculations should be conducted by this group to correlate with performance or preoperational test data obtained in start-up and operations as well as to check contractors' calculations.

System safety analysis capability should be available within the subgroup to analyze selected accident scenarios to enable CG&E to fully understand safe shutdown scenarios so that interaction with the the NRC is technically meaningful for start-up, answering questions from NRC about safety, and the evaluation of the need and priority for the eventual safety system retrofits NRC may require after the plant is licensed to operate. It is very important that the utility have an in-house capability in this area in order to make proper decisions on retrofitting.

The systems engineering subgroup should comprise highly skilled technical personnel who spend a large portion of their time performing systems analyses. This whole group would probably consist of about fifteen engineers and five engineering aides with non-technical support as required.

10.5.3. Nuclear Engineering Subgroup

The nuclear engineering subgroup has a charter to perform core physics calculations and core thermal performance analyses to have an in-house capability to monitor the work of GE technical people and to help make decisions on nuclear core-related matters. Fuel cycle and burnup analyses should be performed to optimize fuel burnup and reload configurations and evaluate any potential changes in core physics or fuel to improve reactor performance. This group will give technical support to the fuel management function in the Operations Engineering Group. In addition, deviations from core and fuel technical specifications can be evaluated to determine any effect on core hardware.

The nuclear engineering subgroup should also be responsible for radiation shielding within the plant. They should be cognizant of all radiation shielding criteria, design, and analysis for Zimmer. Any modifications to shielding should either be initiated by this group, or reviewed and approved by this group if they are done by a consultant. Any technical questions regarding radiological protection should be referred to this group for processing. They should be cognizant of all applicable radiological criteria and requirements, as well as being able to evaluate their effects and to approve any proposed changes during construction or later in operation of the plant. Fission product cleanup criteria, specifications, and analysis should also be part of the responsibility of this group, especially in support of the Operations Group during plant operation.

Staffing of the nuclear engineering subgroup would consist of highly specialized engineers with an analytical orientation. In TPT's view, about five engineers and three engineering aides would be required to carry out the technical function of this group, with additional nontechnical support personnel as required.

10.5.4. Civil/Structural Engineering Subgroup

The civil engineering subgroup has the charter to be cognizant of all large structures, yard equipment, and cranes.

In this capacity, they should have the capability to monitor effectively engineering contractors in these areas who are performing work at Zimmer. Any in-house engineering required in this area should be performed by them.

In addition to the generic duties of the Engineering Group, the civil engineering subgroup should have responsibility for all buildings and structures such as reactor and turbine buildings, cooling towers, cranes and hoisting devices, etc. In addition, they must provide static and dynamic analysis services to effectively monitor the contractor's analysis and provide technical assistance in interpreting the output of the seismic monitoring system.

The civil engineering subgroup would not be a heavily-staffed group at this time since most of the civil engineering work is completed. However, the group should increase its staff in anticipation of a design review and QVP to ensure that the structures are built to proper standards. A group of two to three civil engineers would probably be adequate except for the above. Therefore, additional temporary engineers should be added to the extent necessary to cope with the extra work load in corrective action planning, design review response, and NRC interaction. The total level will be determined after completion of the QVP planning.

10.5.5. Mechanical Engineering Subgroup

The mechanical engineering subgroup has the charter to be cognizant of engineering for all mechanical equipment, piping, heat exchangers, pumps, valves, tanks, reactor internals, reactor pressure vessel, HVAC equipment, steam turbines, diesel engines, and the station turbine-generator. In this capacity they should have the capability to effectively monitor the work of engineering contractors in these areas. In-house capability to perform such engineering needs to be developed to effectively take over the engineering work load as S&L and GE phase out of their Zimmer activities.

The mechanical engineering subgroup will be heavily involved in interaction with the NRC on safety issues and will most likely need to work very closely with the Systems Engineering personnel in these endeavors. The large size of this group relative to other engineering disciplines will most likely require that it be divided under the Lead Mechanical Engineer into smaller, manageable groups. This group could be built up to a staff of about 30 to 40 people depending on the extent of the in-house engineering capability and drafting manpower level needed. About one-half would be engineers and the rest would be support personnel and draftsmen.

10.5.6. Electrical Engineering Subgroup

The electrical engineering subgroup has the charter to be cognizant of engineering for all essential and nonessential electric power systems and equipment such as motors, operators, generators, and batteries. They should have the capability of effectively monitoring the work of engineering contractors and interacting with the NRC in these areas. In-house capability to perform such work should be developed because of the importance to safety of the essential electrical systems at Zimmer.

The electrical engineering subgroup should have responsibility for all electrical equipment except for instrumentation and control which is under the cognizance of the instrumentation and control subgroup.

Most of the electrical systems are completed and require staffing for changes and regulatory interaction only. However, preoperational testing support can be expected to be heavy because of the extensive nature and complication of these systems. In addition, support of a design review and QVP should be anticipated. Thus, staffing should be in the neighborhood of about 5 to 10 engineers with an appropriate number of support personnel as required.

10.5.7. Instrumentation and Control (I&C) Engineering Subgroup

The charter of the I&C engineering subgroup is to ensure that I&C systems are designed properly. The importance of the I&C systems to both operation and safety cannot be overstated. This discipline cuts across the nuclear, mechanical, and electrical engineering areas and requires an overall understanding of how the plant systems operate. There are a fairly large number of systems involved with numerous kinds of equipment.

The I&C engineering subgroup should have responsibility for all controls and instrumentation in the plant. This subgroup will work very closely with the electrical engineering subgroup.

There are a large number of systems and components involved which require interaction with many different equipment suppliers. Thus, the staffing level of this group could be fairly large depending on how much in-house capability is desired. As GE and S&L phase out of Zimmer activities, it would probably be prudent to possess an adequate in-house capability because of the inevitable regulatory changes and instrumentation improvements that will affect the I&C of the plant. It is conceivable that an I&C group of 10 to 15 engineers, plus technicians and support people, would be needed to support the completion of the plant. Furthermore, the I&C group would support operations during start-up and power operation of the plant.

10.5.8. Licensing Subgroup

The charter of the licensing engineering subgroup is to ensure that all licensing and environmental requirements are satisfactorily met so that the license to operate the plant can be obtained upon completion of construction and preoperational testing and maintained during the life of the station. The development of licensing strategy is the responsibility of this subgroup and includes maintaining an up-to-date awareness of strategies other utilities have used to solve their licensing problems. The licensing engineering subgroup must be in frequent communication with the NRC so that they can anticipate the effect on Zimmer NPS of changes in and/or new regulatory requirements.

The licensing engineering subgroup is responsible for ensuring FSAR compliance and coordinating interaction between the licensee and the NRC on matters affecting Zimmer NPS. They are responsible for answering NRC questions about Zimmer NPS and ensuring that appropriate resources are applied. They should keep the FSAR in an up-to-date status.

On issues of safety, this subgroup should coordinate and review responses to the NRC.

Any retrofits required for economic or regulatory reasons must be reviewed for licensing compliance by this subgroup.

The head of the licensing engineering subgroup should be a degreed engineer with a broad understanding of the BWR systems and have previous licensing and management experience. He must possess the personality, experience, and status which will enable him to deal with executive level personnel in the regulatory agencies on an equal footing and commit the licensee to a negotiated position with the NRC.

The licensing subgroup should maintain an up-to-date library of regulatory requirements.

The licensing engineering subgroup is expected to be heavily involved in presenting and explaining the results of the QCP, QVP, and construction and design reviews to the NRC. During this very critical time, staffing should be adequate to easily handle the high level of activity anticipated. About 10 licensing engineers plus the required non-technical support personnel should be adequate to staff this group during this time. During operation staffing may decline to about five people after 5 or 6 years, but it is expected to remain at about eight during the first few years of operation. Thus, temporary, but qualified, licensing engineers would most likely be needed to supplement the permanent CG&E staff.

10.6. QUALITY ASSURANCE GROUP

The Quality Assurance Group is responsible for establishing and implementing a Quality Assurance Program (QAP) that covers all activities on the Zimmer project. The program must be structured to ensure that all Zimmer-related activities comply with current regulatory requirements.

All Zimmer-related QA activities will be centralized under this group, including those related to the QVP, construction completion, preoperational testing, start-up, and operations. The group is expected to function in a conventionally accepted role, verifying the quality of the work accomplished by the performing organization.

The group's responsibility would include effective auditing of contractor performace, and they would also have the prime responsibility for all external relationships with Federal, State, and Code Regulatory Authorities regarding QA matters.

The Head of the QA Group and his key assistants should be permanent CG&E employees who, after the QVP and construction completion phase, will have similar responsibilities for the continuing operation of the Zimmer project. Particularly during the QVP, additional subcontractor support will be required. The Head of the QA Group should have the same status as all other group heads and report directly to the Executive Vice President, ZPM. Group staff should have a similar equality in level, status, and compensation as other functional groups. The QA group should have a clearly defined information reporting line to the CG&E President.

The qualifications of the Head of the QA Group must predominantly reflect a strong QA management background and experience in civilian nuclear power plant construction and operation. The existing permanent CG&E QA organization is understaffed and staff must be supplemented by additional qualified personnel. The total QA complement, using temporary staff, would be expected to be in the range of 225 to 250, of whom about 50 would be permanent CG&E employees.

As part of their QA activities, the QA Group must provide particular attention to the determination of actions which must be taken to identify and correct any existing shortcomings in the quality of the Zimmer plant. Accordingly, it is important that the QA group perform trending analyses of quality problems, keep track of commitments, and make timely determinations of the root causes of problems and measures to prevent their recurrence. Another key duty of the QA Group is to verify that adequate documentation is being produced and properly retained for all Zimmer safety-related QVP, construction, engineering, start-up, and operations activities.

Although individual groups may retain copies of their own records, a central file for all documents (maintained by the Administrative Group), under QA's technical overview and direction is considered essential.

TPT recognizes that there are many acceptable ways to organize this activity in detail. The best way is largely dependent on the personnel available. The subgroup structure given below is TPT's suggestion based on limited knowledge of the personnel available. Other ways could be equally acceptable. However, all the functions mentioned must be covered.

The QA Group for the Zimmer project is comprised of two subgroups and six branches as shown in the attached organization chart (Fig. 10-3). The primary function of the QA Group is to verify that the necessary controls are developed and implemented at Zimmer which, in turn, provide confidence that the applicable regulations, codes, and standards are adhered to and the resulting nuclear facility is designed, constructed, and operated in a safe manner. It is envisioned that the Construction QA Subgroup personnel will gradually be assimilated into the central QA organization, as the emphasis on Zimmer progresses from the QVP and construction to start-up and operation. The Construction QA Subgroup will eventually be phased out in its entirety, leaving the Nuclear Operations QA organization.

The duties of each QA subgroup are as follows.

10.6.1. Construction QA Subgroup

The Construction QA Subgroup is responsible for the overall QA planning and implementation during the QVP and construction of the Zimmer plant. There are two branches within the Construction QA Subgroup: the Quality Engineering Branch and the Inspection Overview Branch. The duties of each are discussed below.

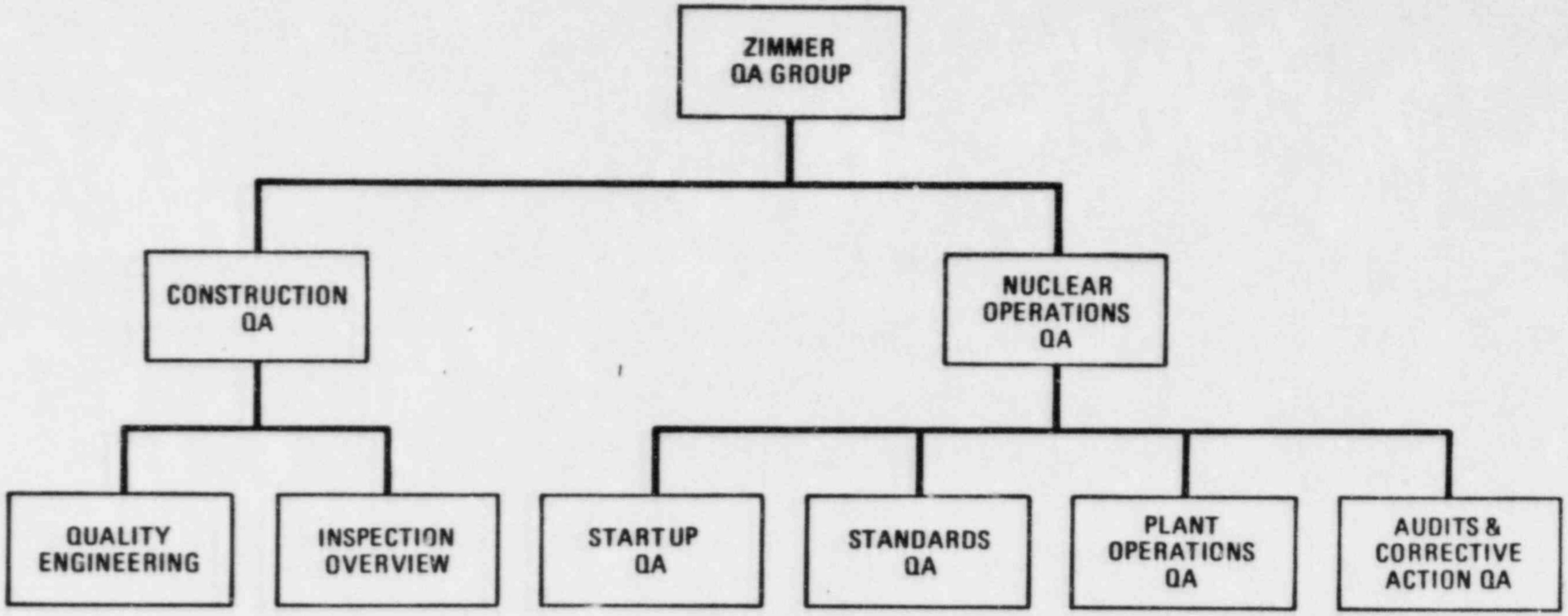

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Fig. 10-3. Proposed QA organization

10.6.1.1. Quality Engineering Branch. The Quality Engineering Branch of the Construction QA Subgroup should be responsible for the quality planning of construction-related CG&E activities. The staff consists of quality engineers who have had sufficient experience in QA during the construction of a nuclear power plant.

The Quality Engineering Branch is responsible for the planning of the quality surveillance effort. This includes the incorporation of hold points at key activities taking place during construction. In a similar manner, the Quality Engineering Branch will participate in the development of inspection planning for procurement. Input to both the construction surveillance and source inspection planning is coordinated with CG&E Engineering.

The Quality Engineering Branch is responsible for chairing the Materials Review Board (MRB) in order to evaluate nonconformances and make disposition on them. A representative from engineering should also be on the MRB. The Quality Engineering Branch is responsible for the overall control of nonconformances, assuring that there is accountability on each of them as well as seeing that they are processed in full accordance with the applicable procedure.

The Quality Engineering Branch should ensure that appropriate quality requirements, including ASME Code and FSAR commitments, are included in procurements. In a similar manner, changes to POs are reviewed and approved by the Quality Engineering Branch in order to ensure that the PO is still acceptable from a QA standpoint.

The Quality Engineering Branch should also perform trend analysis of construction data (for example, NRs, CARs, etc.) in order to identify detrimental trends that may occur in the QVP and the construction effort. This Branch is also responsible for following up to see that necessary steps are taken to correct the trend and restore adequate control. In this regard, the Quality Engineering Branch works very closely with the Audits and Corrective Action Branch of Nuclear Operations QA.

10.6.1.2. Inspection Overview Branch. The Inspection Overview Branch is responsible for surveillance of the activities of the Zimmer project during the QVP and construction program. This branch is staffed with personnel who have experience in the inspection and overview of nuclear components and equipment. The skills they represent should encompass the range of activities reviewed by the group including mechanical, electrical, civil, and structural inspection activities. Their capabilities must also include a knowledge of nondestructive examination and the ASME Boiler and Pressure Vessel Code.

The Inspection Overview Branch will implement the source and construction surveillance inspection planning developed by the Quality Engineering Branch. Accordingly, the Inspection Overview Branch will be notified of pending hold points in order to witness each identified step in the process. Results of the source and construction surveillance effort are appropriately documented in accordance with applicable procedures and are incorporated into the plans for trending the information and processing applicable nonconformances. This branch is also responsible for stopping further work during construction when considered necessary.

10.6.2. Nuclear Operation QA Subgroup

The Nuclear Operations QA Subgroup is responsible for all CG&E Zimmer QA activities other than those performed by the Construction QA Subgroup. Close coordination is required between the Construction QA and the Nuclear Operations QA Subgroups in order to assure adequate coverage of all CG&E Zimmer QA activities. There are four branches within the Nuclear Operations QA Subgroup: the Audits and Corrective Action QA Branch, the Standards QA Branch, the Start-Up QA Branch, and the Plant Operations QA Branch. The activities of each branch are discussed in the following sections.

10.6.2.1. Audits and Corrective Action QA Branch. The Audits and Corrective Action QA Branch of the Nuclear Operations QA Subgroup is responsible for the performance of quality-related audits to determine the adequacy, effectiveness, and compliance with quality systems, procedures, and surveillance activities. As such, the Audits and Corrective Action QA Branch is responsible for auditing each major contractor at a frequency commensurate with the level of activity by that contractor as well as the importance of that contractor's work to the safety of the Zimmer plant. The Audits and Corrective Action QA Branch is also responsible for performing internal audits of each department/group within CG&E. These audits should be scheduled in a manner that would reflect proper coverage of the safety-related activities being performed by these departments/ groups.

Audits of supplies are performed by the Audits and Corrective Action QA Branch or, when deemed appropriate, the Quality Engineering Branch of the Construction QA Subgroup.

The Audits and Corrective Action QA Branch is also responsible for the trending of overall QA group performance. Accordingly, the input from the Quality Engineering Branch of the Construction QA Subgroup regarding trend analysis performed by them is reviewed to assure that the appropriate decisions and corrective action were taken. Other trends regarding QA activities and quality-related performance are developed and appropriate corrective action taken to restore adequate control. The Audits and Corrective Action QA Group should also track and follow up on open items in order to prevent them from "dropping through a crack." An appropriate tickler system should be developed and employed.

Corrective action is also a responsibility of the Audits and Corrective Action QA Branch. Accordingly, the branch ensures that the necessary preventive measures have been identified and have taken on the findings resulting from internal, external, NRC, ASME, and other audits. In particular, the group assures that corrective action is achieved on significant deficiencies, including having them reported to the necessary levels of management and regulatory agencies.

10.6.2.2. Standards QA Branch. The Standards QA Branch is responsible for providing the coordination and publishing of quality standards that apply to the Zimmer project activities. The group also administers the development, modification, and issuance of the Zimmer CG&E QA Manual and its associated procedures. Similarly, the Standards QA Branch is responsible for input to other quality-related procedures during the review and approval cycle.

The quality training activities are planned and conducted by the Standards QA Branch in order to assure that all CG&E personnel performing quality-related activities have been appropriately qualified and trained in QA matters. Accordingly, the branch shall ensure that the personnel certification records (lead auditors to ANSI N45.2.23, inspection and test personnel to ANSI N45.2.6, etc.) have been properly maintained.

The Standards QA Branch also coordinates a quality record system for those records to be maintained by CG&E for the life of the Zimmer plant. Records generated by contractors and suppliers come under the control of the Standards QA Branch including their adequate storage and retrieval capability.

The Standards QA Branch is also responsible for performing calibration, maintenance, and repair of measurement equipment and devices within the control of CG&E. Typically, these would be for use by the Inspection Overview Branch. The Standards QA Branch will also provide an adequate calibration recall system.

10.6.2.3. <u>Start-Up QA Branch.</u> The Start-Up QA Branch is responsible for the planning and implementation of all CG&E QA activities related to the prerequisite testing and equipment turnover and start-up of the Zimmer plant. Initially, the Start-Up QA Branch will be relatively small, consisting of several quality engineers who have experience in the areas of construction and testing QA. In time, as the start-up effort grows, the Start-Up QA Branch will increase in size to a considerable extent. As stated previously, individuals in the Construction QA Subgroup will be assimilated into the Start-Up QA Branch.

The Start-Up QA Branch is responsible for developing the procedures and checklists which will be used during the start-up and testing program. In a manner similar to the Quality Engineering Branch, the Start-Up Branch will provide the planning of the quality surveillance effort during start-up, including incorporation of hold points within the start-up testing sequence.

The Start-Up QA Branch is also responsible for reviewing maintenance procedures, special process procedures, test procedures, calibration procedures, and other documents used in the performance of the start-up and prerequisite testing activities.

The Start-Up QA Branch is responsible for the surveillance of the start-up activities at Zimmer. This is accomplished by performing inspections and reviews associated with the mandatory hold points previously incorporated into the start-up sequence of events.

The Start-Up QA Branch participates in the preparation and review of nonconformance reports that were generated during the prerequisite and start-up testing. The Quality Engineers within the Start-Up QA Branch are responsible for chairing the MRB activities associated with the start-up process.

10.6.2.4. Plant Operations QA Branch. The Plant Operations QA Branch is responsible for all quality-related activities associated with the operation, maintenance, in-service inspection, and modification of the Zimmer Station. It is expected that individuals formally associated with the Construction QA effort and Start-Up QA activities will become a part of the Operations QA Branch as the level of effort in operations and need for support increase.

The Plant Operations QA Branch is responsible for ensuring adequate control during operation and maintenance, and compliance with applicable regulatory and licensing commitments. As such, the branch oversees the development of the necessary procedures and checklists to support the activities associated with the management and operation of the Zimmer Station.

The Operations QA Branch provides the planning and surveillance of the Zimmer Station activities including station training, chemistry and health physics, engineering, security, refueling, fire protection and prevention, storage and handling, modification, and overhaul. In addition to the development of surveillance planning, the branch is responsible for performing inspections associated with the hold points placed in the sequence of events during operation, maintenance, or overhaul.

The Operations QA Branch performs a number of associated duties including the review of amendments to the FSAR; review of changes to technical specifications and design requirements; review of POs for procurement of maintenance, spare parts, and overhaul components and equipment; review of test programs and procedures; and documenting and processing of NRs when needed.

10.7. OPERATIONS GROUP

The Operations Group is responsible for all activities related to preoperational testing, start-up tests, and subsequent nuclear power plant operations to ensure the safe and efficient operation of the facilities in accordance with all federal, state, and local regulations.

The group's responsibilities include plant maintenance (after take-over from Construction), the retention of a proper inventory of spare parts, plant security, and the procurement, management, and efficient utilization of nuclear fuel supplies. The group's responsibilities also include the training and requalification, as required, of nuclear plant operators.

During the QVP and construction completion phases of the Zimmer project, the group would assign staff to the various QVP Teams primarily to obtain exposure to the design and construction phases of the facility and to maximize the opportunity for experience carry-over. Also during these phases, the plans and procedures for effective transition from construction to operations will be finalized. Plans will also be formulated for operator training and qualification and the subsequent maintenance of these qualifications.

Clearly, the Head of the Operations Group must be a permanent CG&E employee, reporting to the Executive Vice President, ZPM, whose continuing responsibility is to provide the necessary management capability to direct the future safe and efficient operation of the facilities. His responsibilities will entail the establishment and implementation of policies and procedures relating to all aspects of operating the nuclear facility. He should have a demonstrated record of success in the professional management of nuclear power generating facilities and should have played a significant role in the start-up of nuclear plants. CG&E currently has some capable support staff in the plant operations and operator training areas. This capability should be enhanced by involvement in the QVP and continuing involvement in other reactor programs.

TPT recognizes that there are many acceptable ways to organize this activity in detail. The best way is largely dependent on the personnel available. The subgroup structure given below is TPT's suggestion based on limited knowledge of the personnel available. Other ways could be equally acceptable. However, all the functions mentioned must be covered.

At the working level, the department is envisioned to consist of the following five major subdivisions as shown on the attached organization chart (Fig. 10-4):

1. Production.
2. Maintenance.
3. Start-Up Testing.
4. Radiation Control/Chemistry.
5. Training/Services.

In addition, a Review Board is recommended to review preoperational and start-up test specifications and test results. This board will report to the manager of the Operations Department and will consist of individuals from production, maintenance, and start-up testing as well as representatives from engineering and QA. The purpose of this board is to provide an independent, knowledgeable review of the test specifications and test results to confirm: (1) that the tests fulfill the requirements of NRC Regulatory Guide 1.68; (2) that the test data obtained provides the desired level of confidence that the system under test performs in accordance with design criteria; and (3) that any exceptions or deviations to the test specification do not invalidate the test.

10.7.1. Production Subgroup

The production subgroup is responsible for the day-to-day operations of the plant. The staff consists of the licensed operators (SROs and ROs) and appropriate support personnel required to operate the equipment. They are responsible for ensuring that the plant is operated in a safe, efficient manner in accordance with the operation, license, technical specifications, and written, approved operating procedures.

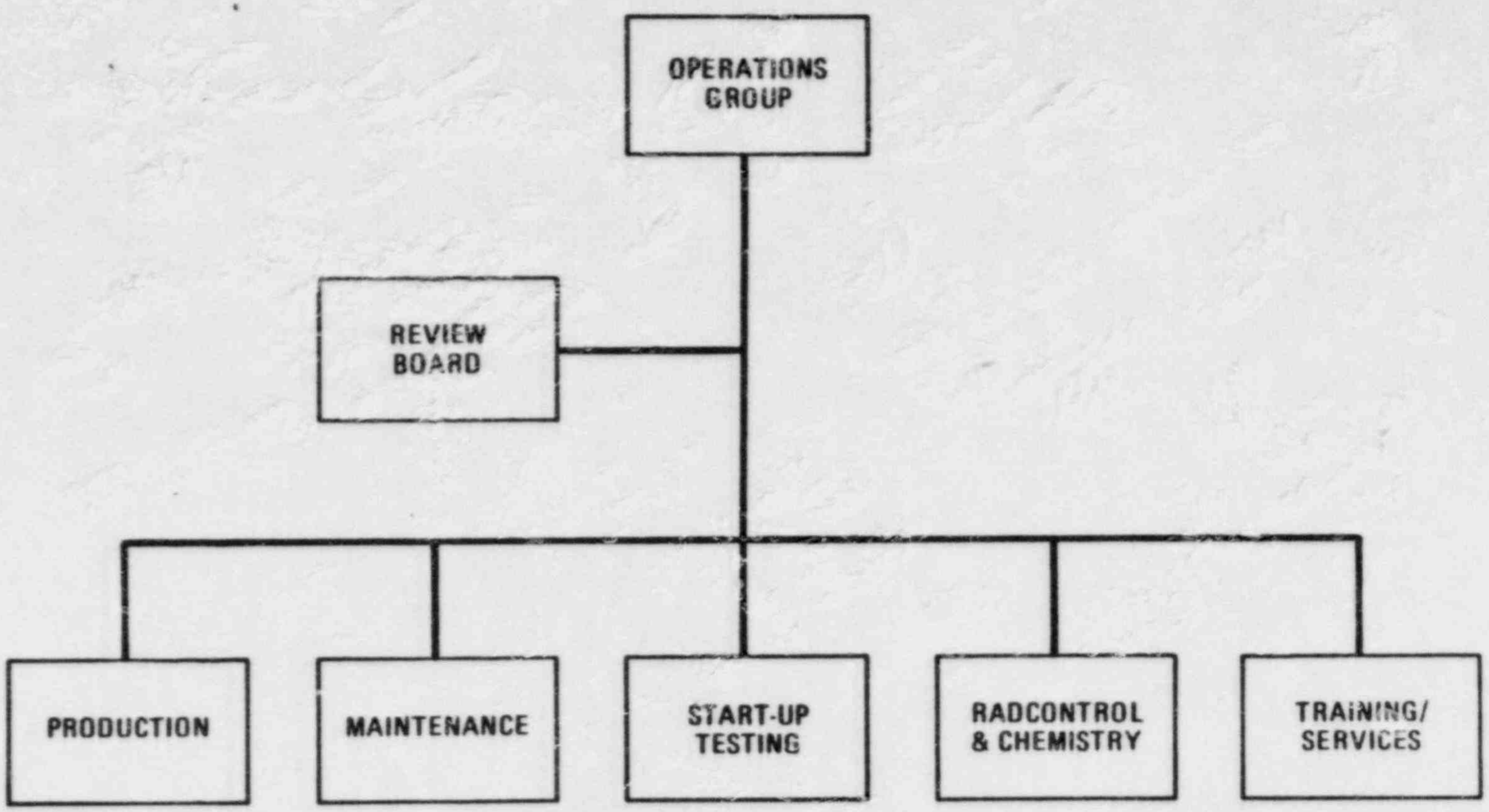

Fig. 10-4. Proposed Zimmer operations organization

This subgroup is responsible for creating and maintaining all records associated with the operation of the plant. They also will prepare, review, and revise (as required) all procedures related to plant operation.

10.7.2. Maintenance Subgroup

The maintenance subgroup is responsible for all preventive and corrective maintenance required in the plant. They shall perform surveillance testing and instrument calibrations. All records pertaining to plant maintenance shall be maintained by this subgroup. This group will control the facility warehouse and ensure that an adequate supply of spare parts and consumables are on hand and available.

Detailed planning including special equipment and tools required, manpower utilization, estimated elapsed time, etc. shall be prepared by this group for all scheduled outages. Major facility modifications and maintenance operations such as turbine overhaul may require additional temporary staff. Maintenance procedures shall be prepared, reviewed, and maintained by this subgroup.

The staff will consist of individuals skilled as electricians, machinists, welders, pipe fitters, and instrumentation/controls specialists. Technical support will be provided by the Engineering Department.

10.7.3. Start-up Subgroup

The start-up subgroup will perform the preoperational, start-up, and acceptance tests on the plant systems after construction and construction testing have been completed. They are responsible for reviewing and approving all GE and S&L test specifications. The GE and S&L start-up support personnel will be assigned to this subgroup. Other departments such as engineering, QA, and production should support the start-up test program. This approach will assure a successful test program by providing the necessary expertise and providing training and "hands on" experience in operating the various systems prior to taking the reactor critical.

The start-up subgroup should have a staff dedicated to providing support to repair/rework capability for systems and components deficiencies that are discovered during testing. This will allow the start-up subgroup to correct any deficiencies in an efficient, expeditious manner. This will also permit establishing priorities and scheduling the work consistent with test program needs.

Supervisory and other key personnel assigned to this group must have had prior nuclear power plant start-up experience. If this experience is not available within the CG&E organization, it can be obtained by using contract personnel.

10.7.4. Radiation Control/Chemistry Subgroup

The radiation control/chemistry subgroup is responsible for all radiation protection activities including chemical control and liquid and solid waste control. It will provide radiological environmental monitoring as well as monitoring and surveillance activities within the plant. This subgroup will administer the radiation protection program and the chemistry program. They will prepare, review, and revise (as required) all station procedures dealing with radiation control and chemistry. All records pertaining to radiation chemistry will be prepared and maintained by this subgroup.

10.7.5. Training/Services Subgroup

The training/services subgroup administers and conducts all operations training activities at the plant. This includes operator training, health physics and radiation control training, maintenance procedure training, industrial safety training, and training in the use of all Zimmer-related administrative procedures. Operator training will utilize the plant simulator. This subgroup will maintain the records of all personnel requiring training and will be responsible for ensuring that personnel requiring some form of certification are refreshed and/or retested before such certification expires.

Additional services provided by this subgroup include security, industrial safety, medical/first-aid, and fire protection.

10.8. ADMINISTRATIVE GROUP

TPT recommends that administrative activities be centralized and standardized under a single manager to relieve the burden on the Executive Vice President, ZPM created by multiple independently-reporting organizations.

Presumably, corporate CG&E resources would continue to be utilized for standard administrative functions such as finance, accounting, legal, contracts, purchasing and personnel. In these areas specific individuals at the CG&E main office should be clearly designated as having Zimmer duties as their first priority. They should be available as required by the Executive Vice President, ZPM and should in any event be coordinated through a single senior individual manager (independent of other groups) on the Zimmer project staff reporting to the Executive Vice President, Zimmer. In the case of Contracts and Purchasing, although standard administrative head office resources may be utilized, serious consideration should be given to locating the designated individual(s) at the Zimmer site depending on the level of activity.

Three functions that require special emphasis (and that should be centralized, standardized, and specific to and located at the Zimmer site) are in the areas of Program Planning and Scheduling, Management Information Systems, and Document Control. Major shortcomings of the Zimmer project in the past have been the lack of effective integrated planning of construction, QA and the transition to operations, the absence of comprehensive management information systems, and an inadequate documentation/records control system.

There is a major and urgent need to establish such a capability. In the area of Planning and Management Information Systems, some progress has been initiated by CG&E particularly in the Operations area. A powerful computer code and related software systems have been purchased but are not fully operational or effectively utilized. It is strongly recommended that this capability be established and applied to all future activities, commencing with planning for the QVP, and be applied for all activities thereafter.

As noted previously, in the area of documentation some progress is being made to identify and centralize records at a central facility. However, progress is slow and the transfer is not being accomplished in a thorough manner. This activity should be elevated in priority and focused under a relatively senior manager.

TPT recognizes that there are many acceptable ways to organize this activity in detail. The best way is largely dependent on the personnel available. The subgroup structure given below is TPT's suggestion based on limited knowledge of the personnel available. Other ways could be equally acceptable. However, all the functions mentioned must be covered.

At the working level, the group would be organized as shown in the attached organizational chart (Fig. 10-5).

10.8.1. Planning and Cost Control Subgroup

The primary function of the planning and cost control subgroup is to provide centralized planning, scheduling, and cost/schedule performance monitoring and reporting systems.

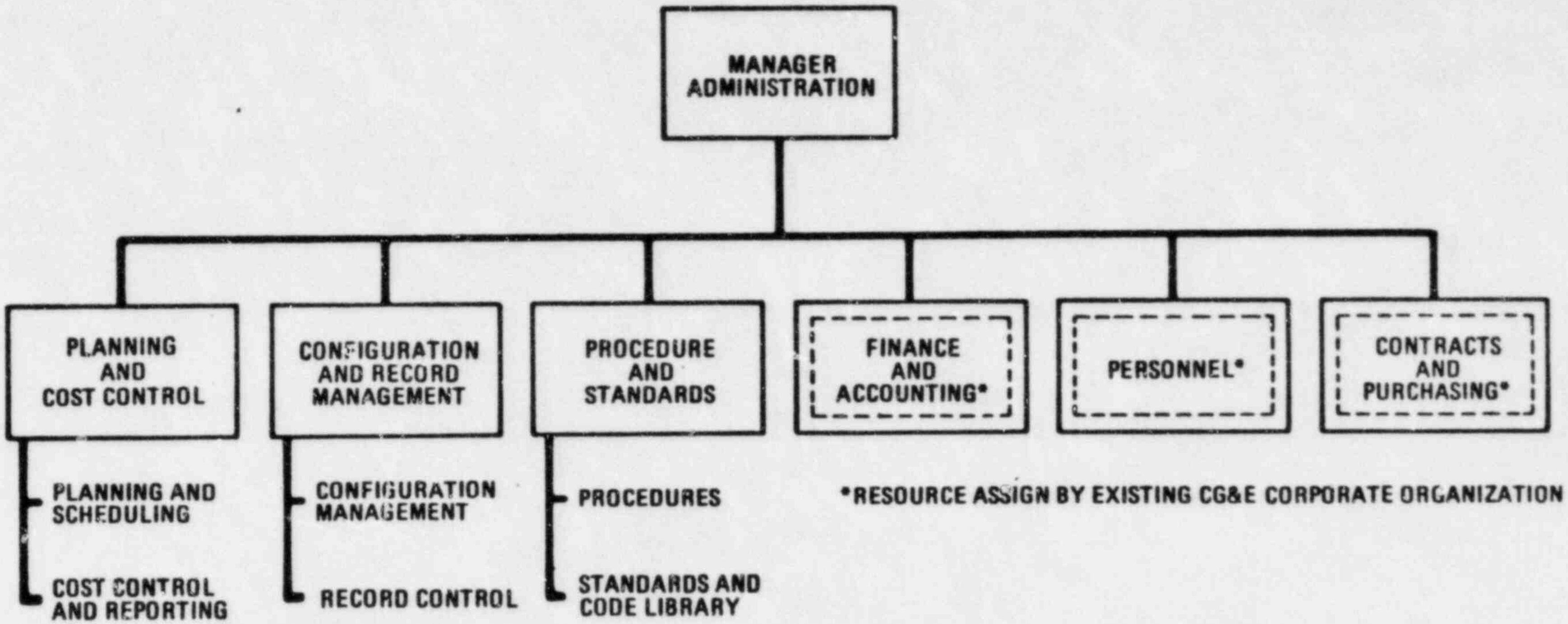

Fig. 10-5. Proposed administration group organization

The centralized Planning and Scheduling Section with the subgroup is responsible for coordinating and integrating all Zimmer project planning and scheduling activities to ensure that all CG&E and contractors' work activities are properly managed and controlled throughout project completion. The staff consists of planning and scheduling engineers who have sufficient experience in planning and scheduling during the construction and start-up phase of the nuclear project. TPT considers a staff of five planning/scheduling engineers with at least four support personnel appropriate. Specific responsibilities of the planning and scheduling engineers are:

1. Develop and maintain the summary and detailed critical path network schedules. These schedules must be interfaced and integrated with input from CG&E departments and contractors.

2. Establish and maintain interface procedures between CG&E organizations and with contractors to facilitate the transfer of planning data.

3. Resolve conflicting planning/scheduling information requirements between CG&E organizations and with contractors.

4. Coordinate and develop plans, schedules, and priorities that define all tasks and deliverable products such as the equipment list, valve list, project key milestones list, punch list, etc.

5. Assist CG&E managers to develop planning and information that will alert the Project Manager to the early identification of problems and to identify available alternatives.

6. Prepare manpower availability versus manpower requirements and update data schedule, priority, and milestone progress.

The function of the Cost Control and Reporting Section within the Planning and Cost Control Subgroup is to establish centralized, integrated cost control and reporting procedures for the financial control of Zimmer work activities through the use of a cost and schedule performance measurement system. This group works closely with the Planning and Scheduling Section to provide management with information and recommendations for financial management at the Zimmer project. The Cost Control and Reporting Section assures that the preparation of estimates for all work requested is accurate for the purpose of controlling project costs, establishing budget, and verifying the reasonableness of planned performance measurements. The section will assist in the proper implementation of the project cost collection and accounting system and, in conjunction with the Planning and Scheduling section, will assess the potential impact of work scope changes on the project cost/schedule and reporting. TPT considers a staff of four professional personnel with five support personnel to be appropriate. Specific responsibilities of the Cost Control and Reporting Section are to:

1. Coordinate the preparation of cost estimates on all work requested and establish the budget baseline for the cost control and performance reporting system.

2. Monitor program cost/milestone and manpower actual work performance against the work plan and budget and, together with Planning, prepare summary project management reports.

3. Work with planning and scheduling engineers to permit the identification and collection of cost, milestone, and work progress data that will be meaningful for project cost and schedule control.

4. Prepare cost forecast requirements and economic evaluation.

5. Prepare cost trend and cost/schedule variance analyses and make recommendation for corrective action to management.

6. Perform cost trade-off and productivity studies.

7. Report cost and financial concerns to the Project Manager for major action items.

10.8.2. Configuration and Records Management Subgroup

The centralized configuration and records management subgroup for the Zimmer project is comprised of two sections. This group works closely with Planning and Cost Control and the Procedures and Standards Sections. The primary function of the configuration and records management subgroup is to provide central record filing and retrievability document record traceability, report changes, record changes and status of reports, and provide permanent retraceable records to meet 10CFR50, codes, and standards requirements.

10.8.2.1. Configuration Management Section. The integrated/centralized Configuration Management Section, which is part of the configuration and records management subgroup, is responsible for coordinating, controlling changes, and tracking all the documentation status associated with the Zimmer project. The staff consists of trained and experienced Configuration Management personnel with prior experience in the engineering/design changes, release, issue, tracking, maintaining, and controlling of project technical documentation. A staff of five professional personnel with additional appropriate support staff appears to be appropriate. Specific responsibilities of Configuration Management personnel include:

1. Develop and control a structure for the identification, retention, retrieval, and control of design documents.

2. Control the release of engineering documents by verifying compliance with issuance criteria, completeness of document identification classification, and the correctness of indentured relationships.

3. Perform engineering/design change control processes which incorporate the following activities:

   (a) Review and approve all requested changes to final design baseline.

   (b) Verify the accompanying cost and schedule impact data.

   (c) Assure compatibility of equipment, materials, and processes that are affected by a proposed change with all interface systems and equipment.

   (d) Prepare and publish summaries of pertinent data concerning all changes to items of the final design baseline.

   (e) Update and issue reports to responsible departments and contractors which identify the current design configuration of the Zimmer plant.

10.8.2.2. Records Control Section. The integrated Records Control Section encompasses those activities required for the logging, filing, storage, retrieval, and other maintenance of project documents. This activity should be carried out by experienced records control personnel, a staff of five professional records management and 15 to 20 support personnel, as required, who provide the following functions for the protection of company and program records and information:

1. Document filing and retention which may include indexing, microfilming, distribution, filing, and safe storage of design and technical support documents.

2. Development of records retention schedules, indexing, and storage of inactive records, vital records protection, and the routine destruction of unneeded company records.

3. Management of record storage facilities which may include microfilming facilities, vault, document center, and warehouse facilities.

The Records Warehouse facility should be established for storing temporary and permanent records to meet the requirements of applicable standards, codes, and regulations. The warehouse shall be constructed so as to protect the contents from possible destruction by causes such as fire, flooding, tornadoes, insects, and rodents, and from possible deterioration by a combination of extreme variations in temperature and humidity conditions.

10.8.3. Procedures and Standards Subgroup

The Procedures and Standards Subgroup comprises two sections and is responsible for ensuring that all internal procedures meet the intent of company objectives. In addition, this subgroup has the responsibility of ensuring that applicable standards, codes, and practices are defined, documented, and employed. This group is assigned the responsibility to ascertain that organizations incorporate and follow the Federal and State government policies and directives as they apply to the Zimmer project.

10.8.3.1. Procedures Section. The Procedures Section is responsible for ensuring that procedures are established and enforced as they relate to applicable codes, standards, and practices. The Procedures Section will ensure that company processes are defined, documented, and employed. Periodically, this section will review organizational procedures for currency, applicability, and clarity. Specific responsibilities include:

1. Ensuring that the policies and procedures of the Zimmer project and its organizations are consistent with management policies and company objectives.

2. Coordination of procedural review with procedures requiring interorganization acceptance and approval.

3. Coordination and processing of procedure changes with the organizations.

4. Control master distribution of procedures and company manual.

10.8.3.2. Standards, Codes, and Library Section. This section is responsible for ensuring that the company employs applicable NRC, ANSI, ASME, ASTM, and other recognized codes, standards, and practices. The section will ascertain that the codes, standards, and practices that the company proposes to employ are thoroughly identified and referenced in design criteria, analyses, descriptions, plans, specifications, drawings, and other engineering documents. The section will maintain a library of relevant and pertinent codes, standards, and practices. Specific responsibilities include:

1. Selecting and ordering of current, up-to-date codes and standards and documents for the library.

2. Maintenance of the library and reference documents for the Zimmer project.

3. Maintaining liaison with organizations who develop guidelines, codes, standards, and practices; i.e., American Nuclear Society (ANS), American Society of Mechanical Engineers (ASME), American National Standards Institute (ANSI), Standards Committee N45, Reactor Plants and Their Maintenance.

4. Ensuring QA compliance on library content.

10.9. FINANCE AND ACCOUNTING

The standard CG&E Administrative Home Office Finance and Cost Accounting function, which includes the review and approval of expenditures and budgets and the maintenance of cost records, should be handled by CG&E finance and cost accounting personnel. These personnel should be dedicated to the project and assigned to the site based on the level and type of finance activity required.

10.10. PERSONNEL GROUP

Personnel activities which include hiring, terminating, and labor administration should be handled from the CG&E Home Office with personnel dedicated to the Zimmer project and assigned to the site on the basis of activity and need.

10.11. CONTRACTS AND PURCHASING

The standard CG&E contracts and purchasing activities and function should be handled by personnel from the administrative Home Office resources. TPT believes representatives of the contracts and purchasing functions should be dedicated to the Zimmer project and temporarily located at the site.

The contracts representatives will provide contractual review, advice, and negotiation services to assure properly documented contractual obligations with suppliers which are based on mutually agreeable terms. Contracts personnel are also responsible for negotiating and administering all subcontracts. Their responsibilities include: (1) maintaining a fair and businesslike relationship with all suppliers; (2) obtaining competitive proposals; and (3) negotiating and issuing subcontracts, administering, including cost and technical reviews, maintaining official subcontract files, and closing out subcontracts.

The Purchasing representatives will be responsible for negotiating, coordinating approvals, and expediting the procurement of materials, equipment, supplies, services, and subcontract items necessary for completing project work packages. The following are some of the functions related to the group's scope of responsibility:

1. Obtain information on the price and/or delivery of materials, supplies, construction/installation, and subcontract and services; and issue POs/awards based on a competitive procurement system, whenever practicable.

2. When extensive proposals are received, coordinate bid/proposal evaluations, involving cognizant reviewers, for proper selection of a planned procurement.

3. Review lease or rental of property/equipment according to planned use and determine whether a lease or purchase is the more economical approach.

4. Perform expediting procedures in order to ensure the timely delivery of procured goods and services.

5. Assist in the proper implementation of the project cost codes to the items procured.

6. In conjunction with the cost planning and control subgroup, verify the reasonableness of planned procurement by means of comparable engineering estimates.

7. Work closely with the planning and scheduling subgroup to assess the potential impact of planned procurement lead times on project schedules and priorities.

11. LIST OF DETAILED RECOMMENDATIONS

Based on observations and conclusions reached during the study, TPT developed a number of detailed recommendations, which are additional to those major recommendations (in Sections 9 and 10) identified to correct deficiencies in the project organization. These detailed recommendations were not extensively evaluated, and to some extent individual recommendations may overlap. However, they are listed in this section by subject area, for further consideration by CG&E as it considers appropriate.

11.1. PROJECT MANAGEMENT SYSTEMS

CG&E management should develop, implement, and support the operation of a system which integrates and monitors cost and schedule performance for the entire Zimmer project. The PREMIS/PICOM system (recently procured by CG&E) is an example of such a system. The planning and scheduling (PREMIS) system should integrate all plant activities affecting cost and schedule, and it should be controlled under an integrated centralized Administration Group.

Project Management reporting systems which give visibility (cost, schedule, work accomplishment, problem analyses, and corrective action followup) should be established and proper training for the implementation of these systems given to all cognizant CG&E and contractor personnel.

A cost and schedule performance measurement system should be established and made a integral part of the Project Management System.

CG&E department managers and contractors should participate in overall project planning and scheduling, utilizing a Critical Path Method (CPM) network, and must understand clearly the obligations and responsibilities of each party.

The overall planning system for the project should have the capability to produce the following reports:

1. Exception Reports: These reports identify problem areas to cognizant managers and alert them to take followup action.

2. Detailed Analysis Reports: These reports allow management and technical staff to identify and focus on activities that should be nearing completion.

Each department and contractor should establish the scope, schedule, and budget for its work. The resulting budgets and plans should be sufficiently detailed to specify the quantity and qualifications of personnel required.

All key project management personnel at the Zimmer project should have training in planning and scheduling, and performance management control techniques.

Management must ensure that the entire Zimmer project team have, and use, compatible information relative to performance on the project.

CG&E should establish minimum Project Performance Measurement and Control System Criteria requirements when delegating any responsibilities to contractors to perform work.

Develop a construction work package system that applies to all organizations and that would ensure uniformity. Develop comprehensive procedures to identify, prepare, review, and approve requirements and perform rigorous audits to assure compliance of these requirement.

11.2. POLICIES AND PROCEDURES

A centralized, integrated system of project management policies and procedures for the Zimmer project should be established to control all policies, procedures, costs, schedules, design documents, and records.

The organization structure should be updated and the organization charts, position descriptions, and procedures should be revised. The procedures must explicitly define responsibilities, authorities, and accountabilities within the organization. These charts, descriptions, and procedures should be monitored, enforced, and kept current.

Formal lines of communication need to be defined and implemented. More comprehensive, timely information needs to be communicated in order to get out of the "crisis" mode of operation.

Procedures need to be established in order to accurately define the interfaces between departments and contractors.

CG&E should review all policy statements related to Zimmer (e.g., OPP, PSAR, and FSAR), eliminate any ambiguities or inconsistencies, and ensure that the resulting policies (particularly those relating to quality and safety) are properly understood by, and available to, all personnel.

The current development of procedures by individual departments should be continued; however, the effort must be closely coordinated between departments and integrated into centralized control documents managed by experienced professional personnel. All departments affected by a procedure must review and concur with the change prior to the effective date of the procedure. Procedures should be formally signed by affected department managers to indicate their approval and concurrence, as appropriate. Management overview must be provided to expedite turnaround in the review and approval cycle.

As part of the current effort to review all procedures, conduct a review of past deficiencies and disagreements to ensure that the new procedures provide a workable system to prevent recurrence of old problems.

Review and modify, as necessary, all applicable procedures, directives, etc., to minimize future risk of record loss.

The Owners Project Procedures, written since the IAL in April 1981, should be used as a basis for a final set of Project Procedures because they appear to contain the correct level of detail and reference to nuclear standards.

11.3. DOCUMENT CONTROL

CG&E should establish a centralized document control department, including transferring the responsibility of all Zimmer documents control from contractors to CG&E, as soon as possible or prior to plant startup and operation.

The Document Control system being developed by GCD should centralize, integrate, and control all project technical and admistrative important documents (including revisions), and maintain adequate permanent records.

The record control indexing systems should separate technical documents from administrative documents. The technical documents include design documents, and construction and operation records. The administrative documents are nondesign documents used by project management for organization, communication, commitment, and management of the project.

Initiate (or revive) the microfilming of all established records whose accuracy and validity have been verified.

Issue a directive to the managers of all site activities, or assign a special project team, to clean out each file cabinet, desk, etc., to ensure that no valid records are overlooked. In particular, collect, review, microfilm, and file all records stored in the warehouse.

Configuration Management (CM) should be initiated by the project under the control of CG&E, and the project should be fully in control of CM before plant turnover. (The CM functions are now being handled and controlled by the contractors.)

Computerize data inputs and data sorting in order to broaden the data base with the many thousands of documents at Zimmer having useful information.

Materials Control and record systems are now being handled and controlled almost exclusively by contractors. CG&E should take control of this important function which is an essential control tool in assuring the quality of the plant. It can be used as a major control point for plant modifications, maintenance, and on-going operation.

Engineering information should be included in work packages which uniquely define a specific task. Preplanning should ensure that adequate craft support is applied to the task, that proper software is created and stored for each task, and that proper inspections are made, coordinating all parties involved.

11.4. STAFFING

Salary levels of QA personnel should be compatible with their counterparts in other CG&E departments, and competitive with QA personnel outside of CG&E.

Job descriptions, experience level requirements, and qualifications for all CG&E positions should be developed. Positions for quality engineering personnel should require a technical degree or the equivalent in experience.

CG&E should commence the immediate hiring of the full complement of permanent staff which CG&E will need for long-term operation.

11.5. QA PROGRAM

An executive summary report of QA program status and effectiveness should be prepared on a periodic basis for the CG&E President and Vice Presidents. This report should highlight progress, open items, problem areas, trends, and other items important to the decision-making process to ensure adequate quality in construction of the Zimmer plant.

The existing vehicles used to report quality problems and status (NRC Inspection Reports, Field and Vendor Audit Reports, Corrective Action Reports, and contractor letters) should be brought to management's attention. Executive summary statements should be added by the QA Manager's monthly report to highlight key points and to direct management's attention to those areas requiring management action or support.

The semiannual management audits of the QA Department should be presented both verbally and in writing to the President. Acceptable corrective actions and follow-up methods should be discussed and agreed upon.

A policy and system to assure effective and timely corrective action, including determination of the root causes of quality problems, should be outlined, published, and supported by CG&E management.

QA program deficiencies, including those identified by the NRC, must be tracked and corrective action commitments obtained that address the root cause of the problems in a timely manner.

Management must become more involved in supporting the action taken to determine and correct the root causes of quality-related problems.

Management must become more exposed to the regulations and requirements of a nuclear QA program to enable better participation in problem resolution. Special training sessions are recommended.

CG&E upper management should become familiar with the policy, involvement, and approach to quality assurance used at other utilities (e.g., Arizona Public Service and/or Florida Power & Light) where the value of QA is recognized and aggressively promoted. A similar approach, tailored by professionals, should be implemented at CG&E for Zimmer.

Establish, and periodically update, a priority list of QA problems that need to be addressed.

Prepare a clearly stated summary of QA evaluations for management review, with a recommended action, to address the root causes of problems. Management does not require lists and tables of statistical data in order to take effective action.

Distribute QA evaluation results to appropriate levels of management in all affected organizations.

Develop the necessary procedures describing QA evaluation practices in order to provide a uniform and consistent approach.

Ensure the development of QA inspection procedures, in step with construction work procedures, to ensure that inspection complements quality and schedule, and inspection hold points are identified in the construction procedures.

Revise the procurement document review cycle to require QA review and approval of all outgoing purchase orders before release. This will allow QA to verify that approved vendors are specified on essential procurements and that the controls imposed on the vendor are appropriate.

11.6. TRAINING

Charge the Director of Training with the task of developing a master training plan for the Zimmer project that will include plant construction as well as subsequent plant operation activities.

Establish a hierarchy of training methods on procedures, techniques, and applications relating to construction matters, and identifiable to specific job functions where possible (e.g., training for supervisors that is directed towards recognition of procedural checks to assure conformance by subordinates). Topics should cover the Codes, Standards, and Regulations committed to in the FSAR.

Develop indoctrination courses which will provide a high degree of confidence that each employee is: (1) familiar with the unique quality assurance measures related to the satisfactory construction and operation of a nuclear power plant, and (2) very aware of his/her responsibility for doing a quality job right the first time.

Provide, to the maximum extent possible, dedicated audiovisual equipment and classroom space for training.

11.7. DESIGN CONTROL

The requirement that field changes are to be made only after approval of the design change by the design organization should be enforced.

Identify all field changes that have been made without a DDC and/or without proper QC inspection. Route either a DDC or the as-built drawing through S&L for review. Once approved by S&L, perform inspection by QC to verify that the approved design change was followed during installation.

Before construction resumes, prepare standardized design control audit checklists to ensure that S&L corporate and field activities are thoroughly audited to 10CFR50, Appendix B.

Before construction resumes, prepare standardized design control audit checklists to ensure HJK and subcontractors are audited to the requirements of 10CFR50, Appendix B.

Have an independent third party periodically review the adequacy and effectiveness of the overall design control system.

Before construction resumes, ensure that comprehensive procedures are in place and have been tested for the effective administration of the design control process. Review all past deficiency reports for guidelines testing the effectiveness of the procedures.

Management should modify the DDC form, and other design document change request forms, to include a signature block indicating whether or not a review of the proposed change affects licensing commitments. Those forms that are checked "yes" should receive priority in processing, thus reducing the delay time in effecting appropriate changes to the FSAR.

11.8. AUDITS

Utilize carefully selected, experienced contractors or permanent auditors to augment to CG&E staff who are verified to be certified to ANSI 45.2.23.

Hire a highly qualified and experienced person, who will be a CG&E employee, to serve as the Director of the Audit Group.

Prepare a master plan of audits, to be completed over a specified period of time, which clearly states in the plan complete coverage of 10CFR50 Appendix B requirements.

Establish regular interfaces between HJK, CG&E, and S&L to ensure that vendor surveys, vendor audits, vendor surveillance, and source inspection requirements are mutually agreed upon and executed.

Establish in the Quality Assurance Procedures a defined distribution list for the distribution of the audit report. This list should include managers of the audited organization, and the auditing organization, up to and including the vice presidential level.

Base the audit frequency upon: (1) the amount of essential, related work, (2) the size and complexity of the audited unit (relates to the time it takes to cover the 18 criteria), and (3) trend information developed from Quality Engineering data. Conduct the audit when the work is in progress.

Establish a system which will routinely identify special concerns for future audits based upon trend data provided by the Quality Engineering Division, or audit findings from outside auditors such as NRC, Management Assessment Auditors, etc.

Establish written criteria to ensure timely responses to AFRs. Clearly specify the action to be taken by upper management if these criteria are violated.

Establish an effective corrective action program to ensure that audits do not repeatedly discover the same findings.

Provide the QA audit group with sufficient authority and support to develop aggressive auditors.

11.9. NONCONFORMANCE REPORTS

Establish requirements for initiating, approving, and processing specific nonconformance reporting documents that are logical, relevant, and clearly specified.

Establish simple and logical procedures for the nonconformance tracking system, utilizing a computer with exception reporting software. The data input to the computer should be entered in such detail as to also provide failure-trend information.

Ensure that criteria for responses to nonconformance documents are clearly specified and include such elements as resolution of differences of opinion, response time frames (including actions to address violations), and response tracking.

Ensure that comprehensive audits of the nonconformance reporting system are performed.

Modify the CAR, NR, and AFR forms to require the identification of the specific cause of the noted problem. State the action taken to review the entire population of documents and hardware affected by the discrepancy to ensure that all similar discrepancies are purged from the system, and state the action taken to prevent that cause from occurring again.

Develop training aids or classes to instruct personnel in the techniques of original data entry on NRs, CARs, MCARs, CERs, etc.

Ensure that the corrective action system is audited frequently. Develop standard checklists to ensure that all elements of the corrective action system are addressed.

Place "top priority" designations on the identification and closeout of current commitments and open action items relating to nonconformance reports of all kinds.

Improve the response time for the completion of problem-reporting documents such as CARs, NRs, and AFRs through training, reemphasis of priorities, etc. The quicker these data can get into the system, the more effective the evaluations will be to end unsatisfactory trends.

11.10. QUALITY CONFIRMATION PROGRAM (QCP)

A self-contained, internal CG&E document defining the QCP Exhibit 17 (a connotation which is no longer accurate) should be created. Such a document would contain its own identifying number, with internal CG&E review and approvals. The document should contain task definition and envelope information and, by revision, also provide a history of tasks and commitments of the QCP.

Provide procedures for Task VIII of the QCP and define what needs to be done to complete and close out the tasks that remain open.

Notwithstanding the fact that the QCP has just recently completed a study of Exhibit 17 commitments to assure complete coverage by QCP implementing procedures, this same study should be undertaken by an independent third party, culminating with a written definition within the procedural system.

Formally define the QCP program interface responsibilities, particularly where other companies such as HJK and S&L are involved.

Continue the present efforts by the Quality Confirmation Program and the QA Document Verification Group to provide substantial improvement in the accuracy, validity, availability, and retrievability of required records.

Consideration should be given to extending Stop Work Order authority to the QCP Director.

It was brought out during interviews that Task IV, which is presently "on hold" for a Code interpretation (which is considered to have the potential of eliminating or at least reducing the field verification activities) should not be on a total hold since, apparently, certain document-related activities can proceed. This should be investigated by QCP management and, if substantiated, work in those areas should resume.

Provide a contractual definition of QCP tasks assigned to other companies. Define what is to be delivered to satisfy the commitment, or a part thereof.

A comprehensive audit should be conducted periodically by a qualified outside third party to assess the QCP program, with particular response and attention being given to identifying the root cause of the problems.

QCP audits should be performed to verify that:

1. Scope and envelope action items identified in I&E Inspection Report 81-13, Exhibit 17, are specifically defined and addressed by implementing procedures.

2. Action commitments are understood by QCP management.

3. Adequate influence is maintained over interfacing organizations for accomplishing QCP tasks.

4. Procedures identify requirements for task closeout including the required approvals.

5. The QCP program is implemented in compliance with commitments and procedures.

6. Research the procurements of essential items and materials supplied by nonqualified vendors. Through physical examination, test, or records review, verify that the items or materials meet the original quality criteria.

11.11. QUALITY VERIFICATION PROGRAM (QVP)

The QVP, as envisioned, would require significant organizational and reporting changes as well as changes in the approach to carrying out the identification and resolution of items identified as deficient. The approach would differ from the present QCP. However, the work done under QCP need not be redone under QVP.

QVP will require the support of several organizations presently involved in the Zimmer project and, for some activities, independent third parties. Accordingly, TPT sees that the steps leading to the satisfactory completion of the QVP are as follows:

1. Identification. Identification of the scope and planning for step 2.

2. Determination of Quality Status. Verification of design validity. Verification of "as is" construction configuration. Determinations of record document status.

3. System Correction/Completion. Performance and confirmation of any necessary modification, rework, and/or correction resulting from step 2 above.

Step 1: Identification

In this step, the areas and/or plant systems that are to be included in the plan are identified. If all safety-related systems are not to be included, then adequate justification, supported by documented evidence, would be provided to justify the exclusion of a particular area or system. The effort to identify what is to be included and to what extent the system/areas are to be examined will require the systematic review of all safety-related systems. Decisions such as 100% review/reinspection of a system, or the use of sampling plans to MIL Standard 105D or a similar standard, would be made based on present knowledge and records of system conditions. This step of the program would also identify, as specifically as possible, the records which require review in detail. It would also identify the hardware to be reinspected, and provide a rationale and/or method of establishing the quality of hardware which is no longer reasonably accessible, such as concrete reinforcement, or weld preparation. All scoping and enveloping of tasks would be done in this step and documented. Project management would review the plans for implementing activities prior to instituting the review and rework activities identified in steps 2 and 3.

Step 2: Determination of Quality Status

Verify the validity of the design by systematic review of the design of plant systems and by audits using external organizations competent in the technical aspects of the design as well as experts in the quality assurance programmatic aspects of the design control process. Appropriate sampling techniques with feedback should be utilized.

With the exception of the verification of design validity, step 2 is essentially an inspection step where examinations of documentation and inspections of hardware are conducted to determine the "as-constructed" condition.

This step includes the inspection of Quality Assurance records for accountability, completeness, accuracy, and traceability to the hardware. Records are also reviewed to ensure that they contain inspection attributes important to the safety of the item/system and are identified for field verification.

Develop and implement a hardware reinspection plan including inspection instructions for the reinspection of accessible items and a plan for review of documentation or other alternate method of verification of inaccessible items.

The objective of step 2 is to verify that the design, hardware, and records are in agreement and that the hardware is in conformance with the design requirements. Disagreements are documented and resolved.

The results of step 2 are reviewed by management to assure that objectives are met.

Step 3: System Correction/Completion

This step utilizes the information obtained from the reviews and reinspections conducted in step 2 to rework hardware and resolve documentation deficiencies in order to update both at a given system status point. At this point any new construction required to complete the plant system may be identified and completed by the QVP team discussed below, that has had system responsibility, or the system may be turned over to the normal construction structure to complete.

The following is an expansion of the TPT suggestion that a team approach be considered for the implementation of the QVP in an effective manner. These teams would be assigned to a system, an area, or other logical and existing subdivision of the plant. These teams would consist of personnel from all the disciplines and functions necessary to that team's assignment, for instance, mechanical engineers, welding engineers, welders, NDE/weld inspectors, and document reviewers for an assignment involving structural steel. The number of such people would vary depending on the team and the activities being performed. The effectiveness of this team approach would be proven by the team's ability to make first-line decisions such as rework, replace, or correct, on-the-spot. If a quality engineer was added, material review board-level decisions such as "accept-as-is" and "repair" could also be effected relatively on-the-spot.

A key element to the satisfactory and effective completion of a QVP is the assurance that the results are correct at each step until completion. Because of the costs involved in implementing such a broad-scoped activity, it is imperative that any deficiency be discovered and corrected in a timely manner. TPT believes the best guarantee of cost effectiveness and acceptable performance on the QVP to be, initially, a comprehensive audit of the scoping activities, and subsequent ongoing audits of its implementation. TPT strongly recommends that these audits be carried out by a independent third party organization recognized as competent and qualified, who would report the audit results directly to the Zimmer Project Manager.

A standard system should be implemented for feeding completion information on work packages to project planning and scheduling.

The QVP rework should be tracked so that the status can always be determined at any time for reporting to both senior management and the NRC.

11.12. TRANSITION TO STARTUP

CG&E procedures should define the difference between "preoperational tests" and "acceptance tests," and Chapter 14 of the FSAR should be amended to list which systems and subsystems will undergo what type of testing.

NSD should be responsible for ensuring that operating information from other nuclear power plants is collected and distributed to Test Engineers, to fulfill requirements to Regulatory Guide 1.68.

An expert review group that is independent of NPD should be established, apart from the SRB, to review preoperational and startup test procedures and results prior to approval by the Manager, NPD.

Formation of an independent review group should be considered to provide technical review of test procedures and results in accordance with the intent of Regulatory Guide 1.68. This group should focus primarily on review of S&L-generated test documents since the review provided by CG&E may not have been adequate.