ATTACHMENT 47 – SVERDRUP & PARCEL AND ASSOCIATES, INC. DOCUMENT ENTITLED QUALITY CONTROL COORDINATION AND CHECKING PROCEDURES DATED APRIL 1975

(20 pages)

QUALITY CONTROL COORDINATION

AND CHECKING PROCEDURES

APRIL 1975

SVERDRUP & PARCEL AND ASSOCIATES, INC.
ENGINEERS ARCHITECTS PLANNERS

TO: Distribution List

FROM: R. C. West

SUBJECT: Quality Control

1. Sverdrup & Parcel's increasing growth and diversification requires intensified attention to quality. High quality work is the foundation of our success - and the prime factor in our continuing growth and development. S&P has acquired an international reputation for superiority, the result of the combined efforts of many people paying attention to all aspects of their jobs, down to the most minute details. Various instructions in regard to quality control have been issued from time to time. Our effort in this current distribution has been to combine and update all previous instructions and, with the exception of the QA manual for nuclear projects, such instructions may be considered to be superseded.

2. Quality work is the responsibility of every employee, but project quality is the sum of the work of a number of individual employees needed to perform a project. Project quality demands proper management and supervision, from the issuance of clear instructions and schedules to the coordination of team efforts, and particularly the checking of work to assure that no detail remains undone and unverified.

3. Time and budget are always major considerations and actually impinge directly on the quality of our work. Certain jobs require a special approach under the "fast track" or "construction management" method. These jobs usually require frequent issue of documentation to outside parties at various stages of completion. Bidding plans or Guaranteed Maximum Cost documents must be provided at various stages of completion, depending on job requirements. Issuing this type of documentation unchecked is a serious matter because these documents are widely distributed to subcontractors, material and equipment suppliers, and sometimes to government reviewing agencies. If any of this work is of poor quality because it is unchecked, the negative effect on the S&P reputation is obvious.

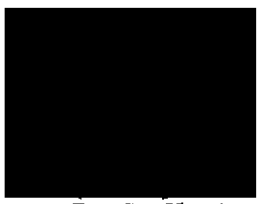
4. It is the supervisor's responsibility that drawings, cost estimates and other material in the working paper stage are so marked and are strictly limited in distribution. New procedures must be instituted immediately, where not existing, to assure that all documentation is checked or at least reviewed for appropriateness. If material must be issued unchecked, each document must be appropriately stamped or marked with a statement such as "for information only," or "unchecked," and the supervisor must see personally that distribution is limited to a "need to know" basis. Final checked documents will follow unchecked documents when the latter must be issued, and letters of transmittal

must clearly state the extent of completeness and whether checked, and the purpose of the transmittal.

5. Bidding or GMC documents should not be issued unless they have been reviewed in a manner consistent with the purpose of the documents.

6. Implementation of these procedures is the individual responsibility of the manager involved.

7. The attached "Coordination and Checking Procedures" provides a standard for minimizing errors, omissions, and conflicts in our calculations, drawings, and specifications. It is intended that these procedures be useful in clarifying responsibilities on all projects.



R. C. West

COORDINATION AND CHECKING PROCEDURES

1. PURPOSE

This document formalizes existing procedures and clarifies responsibilities for coordination and checking which are essential in minimizing errors, omissions, interferences, and inconsistencies in our drawings and specifications on all projects.

1.1 Responsibility for coordination and checking is assigned to the Section Head. This responsibility shall rest with the manager in charge or the person he specifically designates in those offices or groups which are not organized into sections.

1.2 Duties and responsibilities assigned in this document to Division Managers or Chief Engineers shall rest with Office Managers in those offices not organized into Divisions.

2. DEFINITIONS

As used in these procedures, the terms "coordinate," "check," "backcheck," "review," and "support" are defined as follows:

2.1 COORDINATE Verifying that no interference exists, that interface is consistent, and that all elements of the designs and specifications produced are compatible.

2.2 CHECK Verifying that the quality, completeness, and correctness of design assumptions, design computations, drawings, and specifications are consistent with all job requirements and with good engineering practice.

2.3 BACKCHECK Analyzing the comments and needed corrections noted by the checker to assure that the corrections and/or additions desired should be made.

2.4 REVIEW Surveillance to determine general suitability of design and details, compliance with client requirements and good engineering practice; and adherence to schedule as well as compliance with internal procedures. This requires maintaining a knowledge of the current status of the project.

2.5 SUPPORT Supplying assistance to another who is charged with the primary responsibility for an activity, usually upon request.

2.6 PROJECT ENGINEER The term "Project Engineer," means "Project Manager," "Project Architect," "Project Engineer," or "Project Planner," as used in this document.

2.7 DIVISION MANAGER Officer in charge of a division, Division Chief Engineer, or Office Manager.

2.8 DRAFTER Title previously called Draftsman.

3. PROJECT ENGINEER RESPONSIBILITIES

3.1 RELATIONSHIP WITH MANAGEMENT The Project Engineer, as a designated representative of S&P management, shall be responsible for complete direction of a project. He shall keep S&P management advised of project schedules, project status, unusual technical requirements, modified requirements and problem areas.

3.2 ASSIGNMENTS The Project Engineer, in consultation with the Division Manager, shall assign the various portions of the project work to the sections and, where appropriate, designate a lead section. When restricted to one section or when no lead section is designated, the Project Engineer shall assume the responsibilities designated in these procedures for the Group Leader of the lead section.

3.3 RELATIONSHIP WITH SECTIONS The Project Engineer shall keep all sections advised of status, schedules, and technical requirements. He shall schedule timely flow of information between sections for coordination, review and support functions, and shall follow up to assure that this scheduled flow of information is maintained. From the sections, he shall obtain status information and requirements for clarification of information from the client. The Project Engineer shall consult with the Section Head (or heads) on any intra-section or inter-section problem areas adversely affecting section performance and, in consultation with the Project Executive, determine the corrective action required.

3.4 RELATIONSHIP WITH CLIENT The Project Engineer shall maintain liaison with the Client to obtain clarification of requirements, inform him of project status, and advise him of problem areas. For a large project, or in specific cases, arrangements may be made for direct communication between the Group Leader and Client. However, in these, as in all other instances, the Project Engineer shall be kept informed of the transactions including date, place, personnel involved, information exchanged, etc., which may have a bearing on the project, so that he may fulfill his responsibility in relationship with the client.

4. SECTION RESPONSIBILITIES

4.1 SECTION HEAD The person in charge of a section or group. The Section Head has overall responsibility for the performance of his section. For each project, he shall designate a Group Leader and assign to him, as needed, a sufficient number of properly qualified personnel to perform the required work within the allotted time.

He shall cooperate with the Project Engineer and keep him informed of any circumstances developing within his section which might affect section performance on his project. As one facet of his overall responsibility for section performance, he shall take such steps as are necessary to assure conformance by his section to these coordination and checking procedures, and shall allow variations therefrom only in specific instances for which prior approval has been given by the Project Executive or Division Manager.

4.2 GROUP LEADER An Engineer or Designer Technician assigned by the Section Head to be in charge of work done by the section on a particular project. The Group Leader outlines the work for a design; supervises and coordinates all work by his group; reviews the design problems, conditions, assumptions, and completed design; and reviews selected important calculations to confirm the adequacy of the design and checking work. He also sees that all Design Engineers and Design Checkers within the section coordinate their work, and that their work is coordinated with that of other sections. He maintains an index of the calculations made by his group and stores them in labeled loose-leaf binders.

4.3 DESIGN ENGINEERS AND DESIGN CHECKERS

4.3.1 DESIGN ENGINEER An Engineer or Designer Technician who is technically qualified to compile and perform the assigned task, and is assigned to design all or part of a project under the direction of a Group Leader.

4.4 QUALITY ASSURANCE MANAGER (where applicable) The QA Manager provides surveillance to see that S&P QA objectives are followed by all project personnel. He reports adverse conditions affecting quality to all responsible parties including the Executive Vice President, St. Louis.

5. PROCEDURES

5.1 DESIGN CALCULATIONS

5.1.1 GENERAL All sections shall make and retain design calculations covering the basis of selection, arrangement, performance and/or sizing of equipment systems and structures on which S&P is to prepare designs, specifications, and estimates of cost. The design calculations shall be prefaced by a statement of the function, operating requirements and design requirements of the system which is to be designed. All design calculations shall be made on standard S&P reproducible computation sheets. It is important that the design calculations be legible, in proper form, be dated and in sufficient line weight that they can be readily printed and reproduced. Neat, orderly, easily-followed design calculations result in a substantial saving of time to all who subsequently have reason to use them and minimize the probability of errors.

"Basis of Design"

The Design Engineer shall prepare, and periodically update, an index of all design calculations made by him. Included with the index of calculations should be a tabulation of sheet numbers that reference calculations by other sections. The sheet numbers should be tabulated according to the section referenced. He shall keep the calculations in labeled loose-leaf binders until they are given to the Group Leader for storage within the section. The Group Leader shall see that all Design Engineers and Design Checkers within a section coordinate their work and that their work is coordinated with that of other sections; and he shall furnish to other sections information known to have an effect on the design of those sections. The Group Leader shall also keep the Section Head advised of the nature and progress of the work and the anticipated work load so that he can plan assignments within the section to meet established schedules.

The Group Leader and Section Head shall, upon request, provide needed support to the project group and to other sections which have been assigned primary responsibility for a design or an element of design.

5.1.2 PREPARATION The Group Leader shall outline the work for a design or an element of design and shall furnish the Design Engineer with the known design requirements. The Design Engineer shall review the design requirements, correspondence, and any drawings related to the design. He shall then develop a detailed design criteria and shall document and review it with the Group Leader along with the design problem, conditions and assumptions before making the calculations.

5.1.3 MAKING DESIGN CALCULATIONS When a Design Engineer begins a sheet of design calculations he shall completely fill in the data at the top of the sheet including date, the job number, description of the job, and the items being designed.

The design calculations shall include notations as to the sources of any reference material used in the calculations and also references to other portions of the design calculations including calculations or data obtained from other sections, so that the Design Checker and others may readily follow them. They shall be neatly arranged in logical sequence with sufficient titles and descriptions of items being designed so that all persons using the calculations in the future may readily identify the parts they are concerned with. The design calculations must include sufficient sketches to adequately convey to the detailer and others using them the intent of the design, and to assure the Design Engineer himself and the Design Checker that the results of the analysis can be assembled into a functional part of the project. However, they shall include only those calculations and sketches which are required to accomplish their objective. It is the responsibility of the Design Engineer to make his calculations and sketches adequate but not superfluous, and the responsibility of the checker to see that this is accomplished.

5.1.4 CHECK, BACKCHECK, AND RECHECK

5.1.4.1 CHECK Upon completion of the design calculations they shall be checked by an engineer technically competent for the assigned task. Because of the progressive nature of design calculations, the checker, during his design check, shall consult with the Design Engineer on any differences which are found. If agreement between the checker and the Design Engineer cannot be reached, the matter shall be resolved as outlined in the paragraph below entitled "Backcheck." In the interest of efficiency and accuracy, as few checkers as practicable shall be used in checking the design on any one project.

It is the intent that the checker determine that the design is suitable and adequate to accomplish the required function, and that the supporting calculations are on a sound basis and mathematically correct. It is <u>not</u> the intent that the Design Checker revise a suitable design in order to do it his way or to strive for perfection.

The design calculations shall be checked on prints of the calculations, and the prints shall be signed by the checker at the completion of each sheet checked. The original calculations shall not be signed by the checker until they have been backchecked, corrected, and rechecked.

The check of design calculations may be made by an independent calculation by the checker who shall compare the results of the two calculations and resolve any discrepancies with the original design engineer. The original design calculations shall then be initialed by the checker and marked to indicate that the check was made by independent calculation. The independent calculation shall be filed with the original calculation.

5.1.4.2 BACKCHECK Upon completion of his check the checker shall return the design material to the Design Engineer for backcheck and correction. If the Design Engineer does not agree with the checker's notations and the differences cannot readily be resolved between the two, the matter shall be referred to the Group Leader (and Section Head if necessary) for decision. The Design Engineer shall then make all necessary corrections to the design.

5.1.4.3 RECHECK Upon completion of the backcheck and corrections, the Design Checker shall recheck pertinent portions of the design to determine that all proper corrections have been made. Only when he is satisfied that all corrections have been made and the design is suitable and adequate shall the Design Checker sign the original design calculations.

5.1.5 REVIEW OF DESIGN CALCULATIONS The Group Leader reviews the design criteria and the design problem, conditions, and assumptions before the Design Engineer makes the calculation. The Group Leader shall also review the completed design after the checking by the

Design Checker described above. Designs made or checked by the Group Leader shall be reviewed by the Section Head or by another qualified engineer.

After his review the Group Leader shall enter the calculation on the calculation index that he maintains for all calculations made by his group.

Calculations for systems, structures, or components designated for integrated-design-review are subject to additional review at that time over and above the review described in the paragraph above.

If any assumptions made to initiate the design cannot be verified at the time the design computations are checked, and must be confirmed by later design or by as-built submittals or conditions, the Group Leader and the Design Engineer are responsible for itemizing these assumptions and for notifying the cognizant project engineer of the need for later verification. The Group Leader shall follow-up on this verification at the appropriate time.

5.1.6 REVISIONS OR CHANGES IN DESIGN CALCULATIONS The Group Leader is responsible for keeping all calculations updated to reflect the latest design concepts as they are developed. He shall keep other disciplines informed of any changes in the design that affect their work.

No change or revision shall be made to any checked design sheet without authorization of the Group Leader. Before a change is made to any checked design sheet the Design Engineer making the change shall give the Group Leader a copy of the original design sheet for his files.

Changes to checked calculations shall be made by crossing out superseded portions of the design calculations and referencing the revision. The engineer making the change shall mark the sheet as revised, and shall add the revision date and his initials. Revisions shall be clearly marked as such whether they are made on approved design sheets or on new sheets being added. A notation of the revision number shall be made adjacent to the revised portion of any revised design sheet.

The procedures followed for checking and review of revisions shall be identical to those described above for original design calculations.

5.1.7 COMPUTER CALCULATIONS

5.1.7.1 PROGRAM VERIFICATION All computer programs shall be checked for accuracy prior to their use. Programs shall be checked initially for accuracy of model, technique, equations and constants by an experienced engineer technically qualified to do the work. Computer results of test problems shall then be checked by manual methods or by a previously verified program to check computer performance with the program being verified.

5.1.7.2 SUITABILITY OF PROGRAM Details of programs shall be checked for total suitability to the particular task at hand.

5.1.7.3 PERFORMANCE, CHECKING, AND REVIEW For the normal S&P computer programs the computer prints out both the problem input and output, including the S&P job number, the project name, the problem number and description, the name of the computer program, the date, and the name of the Design Engineer responsible for the calculation. If any of this information is missing from the printout for a problem, the Design Engineer shall add it to the first sheet of each copy of the printout.

As part of S&P's normal design procedure using computer programs, the Design Engineer may check the listing of input cards for the problem before running the program. If he does not check the listing before running the program, he shall check the input printout. He shall also review the output, and shall make, but need not retain, whatever manual calculation and other checks he deems appropriate to verify that the computer results are reliable.

Either the listing of input cards or the input printout for all problems must be checked by another technically qualified engineer who did not prepare the original calculations. He shall also review the output and make, but need not retain, whatever independent manual computation and other checks he feels are necessary to satisfy himself that the computer results are reliable. He shall then sign the first sheet of each copy of the computer printout as checked.

A print copy of the checked and signed computer printout of the program input plus a checked and signed summary sheet of the pertinent output of the program for each problem shall be filed in the labeled calculation loose-leaf binder with the other calculations for any design. At least one copy of the full computer printout of the input and output must also be retained but need not be filed in the calculation loose-leaf binder.

Review procedures for computer calculations shall be in accordance with paragraph 5.1.5 above.

5.1.8 ISSUANCE AND CONTROL The primary use of the design calculations, aside from the development and verification of the design, is within the section originating the calculations, to prepare the drawings describing the design and to furnish input for other designs.

It is preferable to use only checked design sheets to prepare drawings; but to meet a tight schedule it may sometimes be necessary to start the drawings with unchecked design. It is the Group Leader's responsibility to furnish the Designer/Drafter with updated design calculations, and the responsibility of the engineer who did the design to see that the latest design calculations are being used by the Designer/Drafter. Only checked design calculations shall be used when checking drawings.

The presence or absence of a checker's initials on prints of design calculations furnished for use within a section or by another section indicates the status of that set of prints. Design calculations shall be transmitted only to the Project Engineer or to a Group Leader in another section by the Group Leader in the section originating the design calculataions, who is responsible for furnishing only updated calculations.

It is the personal responsibility of each person using design calculations for any purpose to periodically check with his Group Leader or, if there is any doubt on his part, with the Group Leader of the group originating the design calculations, to verify that he is using only updated design sheets.

5.1.9 FILING, STORAGE, AND TRANSMITTAL TO CLIENT The Group Leader shall compile and keep an updated index indicating the status of all design calculations prepared by his group. After the design calculations are checked and signed, the Group Leader shall see that they remain updated, and shall store them in labeled loose-leaf binders in his file until they are transmitted to the Client at the completion of the design phase of the project.

5.1.10 DESIGN VERIFICATION BY TEST Design verification methods may include qualification testing. In those cases where the adequacy of a design is verified by test, the testing shall demonstrate performance under the most adverse design conditions, and all operating modes shall be considered. Qualification testing shall be done in accordance with approved written procedures which shall include or reference the requirements and acceptance limits dictated by the design. The test results shall be documented, and visible evidence of S&P or Client review and approval of results shall be provided.

5.2 DRAWINGS

5.2.1 GENERAL Design drawings illustrate the designer's conception of the work to be constructed. They should be complete enough to be readily understood and followed by constructors in the field, or by engineers in manufacturing and fabricating shops. However, it is not intended that we prepare design drawings to such a degree of completeness that the work can be constructed or fabricated from these drawings without further supplemental sketches or drawings which will be supplied by the contractors. Excess detail should be rigorously avoided as it is not only a waste of effort but is confusing to the constructor and may unnecessarily limit the constructor or fabricator in accomplishing his part of the work. Drafting work shall conform to the principles outlined in the S&P Drafting Manual, St. Louis Office, published April 10, 1974.

The design drawings will, in general, be in pencil on mylar unless the Client requires that they be in ink or pencil on tracing cloth or paper. All drawings, whether in ink or pencil, are to be treated with care, to avoid wrinkling and soiling. Pencil work should be done with the same neatness, cleanliness and legibility as ink work. It is important that proper consideration be given to the weight of lines which are used to delineate the drawing. Important features should be in heavier weight line than dimension lines, etc. Sufficient cross references shall be placed on the drawings. In this way the drawings can be made to stand out and be easily read.

The Project Engineer will, after consultation with the Group Leaders, determine the orientation of plan views, and all design sections shall be governed by this determination. Insofar as practicable, uniformity of scales, especially on plan views, shall be maintained. Care shall be taken that drawings do not usurp the function of specifications and vice-versa.

In general, the Client will specify the size and type of sheet, and in some cases will specify the size of lettering that goes on a sheet. In cases where the Client does not do this, the determination of the size of sheet and the title block will be made by the responsible Project Engineer. On any project the lettering used by any particular section should be consistent throughout for the work of that section, both as to size and types of lettering used. Drafting standards will be the regular standards of the design sections unless the Client imposes special requirements which will be outlined in writing by the Group Leader.

All design drawings must be checked by a competent checker and then backchecked, preferably by the Designer/Drafter who prepared the original drawing.

5.2.2 DRAWING LIST A list of all design drawings for the project shall be prepared by a designated Project Engineer with the assistance of the Group Leaders.

All design drawings shall have assigned to them a title, a letter for design section identification, and a sequential sheet number delegated by the Group Leader unless another numbering system is specified by the Client.

The drawing list shall follow a numerical sequence, listing all drawings by the exact titles and numbers shown in the drawing title blocks. It shall include the status of each drawing and the scheduled start and finish dates. It shall be updated monthly by the Group Leaders and reissued after each updating.

5.2.3 DRAWING PREPARATION AND COORDINATION Upon completion of the design check (discussed in section 5.1 this document), the material shall be given to the Designer/Drafter assigned to prepare the drawings. The Designer/Drafter will receive guidance from the Group Leader or engineer who did the design. The Designer/Drafter shall receive the required information via design sketches, marked prints, and written instructions. If oral clarification is needed in addition to the above, any important instructions should be recorded and filed.

See paragraph 5.2.4.3 for additional drafting requirements after the drawing has been checked.

The Group Leader is responsible for the performance of those under his direction and shall see that drawings are properly detailed, checked, and coordinated within the section and the project.

5.2.4 DRAWING CHECK Upon completion of the drawings they shall be checked by a checker who is technically competent for the assigned task. They shall be checked for adherence to design, accuracy and adequacy of delineation and notation, and for interference with work designed both within the section and by other sections. In the interest of efficiency and accuracy, as few checkers as practicable shall be used to check the drawings on any one project.

All equipment, component and system sizing, arrangement, and configuration shall be checked for correctness and appropriateness for the particular project. All notes, tables, and dimensions shall be checked for correctness.

5.2.4.1 CHECKING PREREQUISITES Before a design-drawing check is begun the following should be available to the checker:

a) A current print of the completed drawing to be checked.

b) Group Leader instructions (either oral or written) itemizing all reference information used by the Designer/Drafter to make the drawing. This information includes, but is not limited to, flow diagrams, schematic elementaries, equipment arrangement plans, written criteria, engineer's instructions, specifications, design calculation sheets, vendor's drawings, material listings, etc.

c) Access to reference prints of associated design drawings made by his own and other sections.

d) Access to the project correspondence file for reference to conference notes, proposals and any other documentation.

e) Access to project and company procedures and practices.

5.2.4.2 CHECKING INSTRUCTIONS The checker shall work independently of the original Designer/Drafter. He must interpret the drawing and details without further explanation. The checker's personal opinion as to the presentation of the design or suitability of the selected equipment as established by the Group Leader or Project Engineer shall have no influence on the prime function of impartially checking the drawing against the established criteria. Dissenting opinions of the checker shall be discussed with the Group Leader, and if disagreement remains it shall be discussed with the Section Head and the appropriate Project Engineer.

Poor or generally incorrect details requiring major rework shall be encircled and returned for redrawing without excessive expenditure of checking time; but redrawing shall not be done without the Group Leader's authorization.

The checker shall use yellow crayon to mark off correct items and red crayon for corrections and additions. Reference data or instructions to the corrector shall be noted in black pencil.

Among items to be checked are the following:

a) Quality of the general appearance of the drawing.

b) Organization of the material to assure complete and clear depiction, and that the subject matter can be readily understood and will not lead to a misconception or require a field interpretation.

c) Sharpness and consistency of line work necessary for good reproductions.

d) Lettering: for legibility, relativity to the subject matter, proper size, and uniform appearance.

e) Conformance of drafting techniques to S&P practices, such as sectional arrows, detail identifications, cross-referencing, symbols, etc.

f) Presence and suitability of general notes and reference drawings.

g) Completeness of the title block information, and presence of the Designer/Drafter's and checker's initials.

5.2.4.3 CHECKLIST The checker shall enter a checkmark against each item on the drawing checklist, Attachment"A," and shall add the project title, job number, drawing number, date, and his signature. He shall attach the completed checklist to the check print which shall be returned to the Designer/Drafter for correction.

5.2.4.4 BACKCHECK The Designer/Drafter shall analyze all marks and comments made by the checker to agree that the corrections and/or additions should be made. If the Designer/Drafter disagrees with any of the checker's notations and the difference cannot readily be resolved between the two, the matter shall be referred to the Group Leader or the engineer who did the design. The Designer/Drafter shall indicate with a green checkmark which corrections are to be made, and shall then make all necessary corrections. After each correction has been made the appropriate area of the check print shall be circled with a green crayon.

5.2.4.5 RECHECK After the corrections are made the drawing shall be returned to the checker for a recheck to determine that all corrections have been made. The checker shall then add his initials to the original drawing in the space provided in the title block and shall return all check prints, with attached drawing checklists, and all checking prerequisite data to the Group Leader for retention in his files.

5.2.5 DRAWING REVIEW AND ISSUANCE The engineer responsible for the design shall periodically review the drawings during their preparation for:

a) Conformance to latest criteria and changes received from the Group Leader.

b) Resolution of interferences between disciplines not previously resolved.

When the drawings are completed, both the engineer responsible for the design and the Group Leader shall review them. It is the responsibility of the engineer who did the design to see that the drawings as finally completed are compatible with the design. The review of the completed drawings shall include the following items.

a) Completeness of title and revision block information.

b) Plans, sections and details for easy readability.

c) Definition of contract limits (when applicable).

d) Check for presence of cross-referencing in the body of the drawing.

e) Spot check presence of equipment titles and numbers.

f) Careful review of unusual areas of design for suitability.

g) Final disposition of all disagreements between engineers and drawing checkers.

The Group Leader, with the assistance of the Project Engineer, shall coordinate the review for compatibility of his drawings with those drawn by other sections.

When the cross discipline review has been completed, the Group Leader shall have the drawings signed for submittal to the Client by a company officer or his authorized representative, and a registered Professional Engineer or Architect stamp shall be applied if required.

The Project Engineer shall then issue the drawings in accordance with the Client's directives.

5.2.6 HANDLING OF ENGINEERING DRAWINGS Prior to completion and issuance to the Client, original drawings shall be maintained in metal drawing file cabinets located in the Design Sections. Original drawings, when not actually being worked on should be stored in the metal file cabinets. When the drawings are ready for issuance to the Client, they shall be handled according to the Project Engineers instructions.

Working prints of drawings distributed throughout the S&P organization shall clearly indicate the status of the print and purpose of the distribution. Control stick-files are recommended for each section. These stick-files shall include copies of the latest issue only; all other revisions shall be destroyed or stored in a file of superseded prints. The Project Engineers shall establish controls by written instructions to assure the use of only up-to-date drawings within S&P.

5.3 SPECIFICATIONS The technical provisions of the specification shall be prepared by the Architectural group for conventional architectural and structural items. For work in which the Architectural Section is not involved or involved to a minor extent the lead section shall perform the functions herein described for the Architectural Specifications group. In those offices not organized into sections, or not having an Architectural Specifications group, the specification function shall be assigned to qualified individuals and the effort organized under the direction of the Office Manager.

5.3.1 The following defines procedures for the technical provisions of civil, electrical, instrumentation, mechanical and special structural specifications to be supplied to the Architectural Specification group for incorporation into the specifications for the design project:

5.3.2 PREPARATION The Group Leader or Design Engineer shall prepare the technical provisions of specifications.

5.3.3 COORDINATION The Group Leader shall be responsible for the performance of those under his direction and shall ascertain that designs, drawings and specifications are properly coordinated within the section and within the project. The Architectural Specifications group shall assemble and coordinate the various parts of final specifications into a unified document.

5.3.4 CHECK On completion, the technical provisions of specifications shall be checked by a qualified checker who is technically competent for the assigned task. This check shall include a cross-check between specifications and drawings.

5.3.5 REVIEW On completion of check, the technical provisions of specifications shall be reviewed by the section lead man.

5.3.6 SUPPORT The section lead man shall keep the Architectural Specifications group advised of the expected workload and nature of the specifications being prepared so that the Architectural Section can plan its work to meet established schedules.

5.3.7 The Project Engineer working with the Architectural Specifications group shall prepare the General Conditions of the specifications using the client's standard forms when required, or selecting appropriate forms if the client has no special requirements.

Supplementary and Special Conditions shall be prepared by the Architectural Specifications group or lead section working with the Project Engineer.

Upon completion, General Supplementary and Special Conditions shall be checked by a qualified checker and reviewed by the Project Engineer.

5.3.8 When prewritten text is taken from standard or previously used specifications, every sentence and paragraph should be carefully read and checked for corrections and appropriateness for the new project.

5.4 CONSTRUCTION COST AND SCHEDULE ESTIMATES The Designer (or an Estimator) shall prepare and the Design Checker shall check construction cost estimates and construction schedule estimates (where required) based upon the drawings and specifications. Others in the section shall give support for this work as necessary. The cost and schedule estimates shall be coordinated and reviewed by the Group Leader.

6. INTER-SECTION FUNCTIONS

6.1 LEAD SECTION When a lead section is designated, that section shall accept responsibility as follows for the assigned scope in the functions of check, review, and coordination. These functions are the responsibility of the Group Leader for the lead section.

6.1.1 DESIGN The lead section shall coordinate the design of other sections with its own design. The lead section shall not check the designs of other sections. The lead section shall keep other sections informed of the anticipated workload and the nature of the work.

6.1.2 DRAWINGS The lead section shall coordinate the drawings of other sections with its own drawings. In addition, the lead section shall review the drawings of other sections primarily for general suitability of design, details and interferences; however, the lead section shall not check the drawings of other sections.

6.1.3 SPECIFICATIONS In conjunction with the Architectural Specifications group, the lead section shall provide the master outline for the specifications with definite assignments of the appropriate parts to other sections. The lead section shall coordinate the technical provisions of specifications of other sections with its own. In addition, the lead section shall review the technical provisions of specifications of other sections primarily for general suitability and adherence to schedules; however, the lead section shall not check technical provisions of specifications of other sections.

6.1.4 CONSTRUCTION COST AND SCHEDULE ESTIMATES The lead section shall prepare, review, and coordinate the project construction cost and schedule estimates from the data and information furnished by other sections. The lead section, in consultation with the Project Engineer, shall provide the master outlines of these estimates with definite assignment of the appropriate parts to other sections.

6.1.5 GENERAL ARRANGEMENT, COMPOSITES, ETC. The lead section shall prepare and maintain the master drawing list, general arrangement drawings, composite drawings or other overall drawings necessary for a project from information furnished by other sections. (Where appropriate, some of these functions may be assigned to other sections by the Project Engineer.)

6.2 OTHER SECTIONS All sections except the lead section, and in the event of no designated lead section, then all sections shall perform the function of support and coordination with the work of other sections as follows:

6.2.1 DESIGN Each section shall provide support to other sections during the design activity of a project. Each section shall coordinate its designs with those of other sections. No check of the designs of other sections is required.

6.2.2 DRAWINGS Each section shall provide information and data to other sections as necessary for the preparation of their drawings. Each section shall coordinate its drawings with those of other sections. No check of the drawings of other sections is required.

6.2.3 SPECIFICATIONS Each section shall provide information and data to other sections as necessary for the preparation of their parts of the specifications. Each section shall coordinate its technical provisions of the specifications with those of other sections and with the Architectural Specifications group as necessary to avoid omissions, conflicts, and duplications. No check of the technical provisions of the specifications of other sections or the Architectural Specifications group is required.

6.2.4 CONSTRUCTION COST AND SCHEDULE ESTIMATES Each section shall coordinate with other sections as necessary to prevent omissions, conflicts, and duplications. While the designated lead section will assemble the estimates into their final form, no check of other sections' estimates is required of the lead section.