CAN/CSA-N286.4-M86
Commissioning Quality Assurance for Nuclear Power Plants

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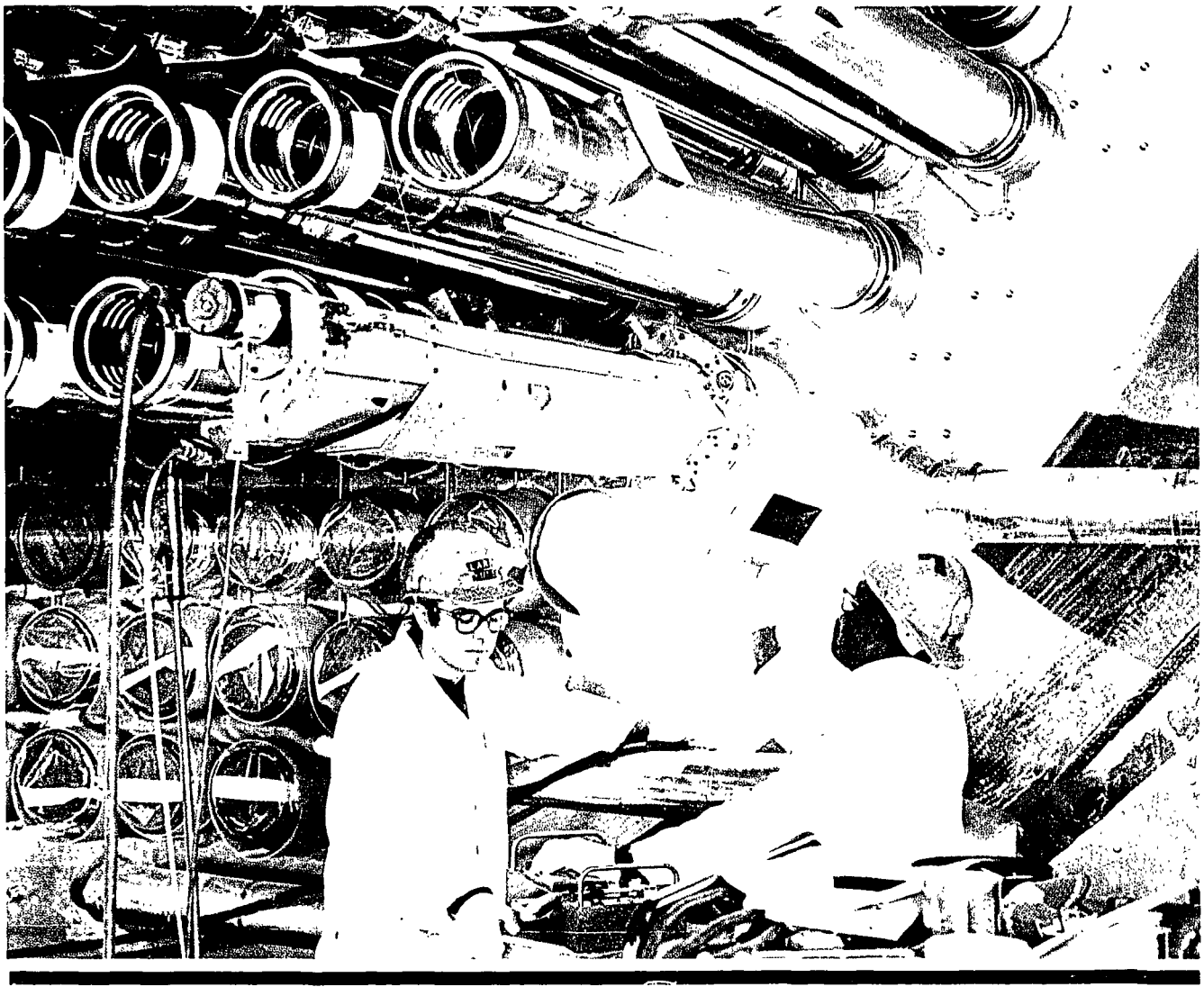

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General Instruction No. 1

CAN/CSA-N286.4-M86
September 1986

CSA Standard CAN/CSA-N286.4-M86, Commissioning Quality Assurance for Nuclear Power Plants, consists of **28** pages, each dated **September 1986.**

This Standard, like all CSA Standards, is subject to periodic review, and amendments in the form of replacement pages may be issued from time to time; such pages will be mailed automatically to those purchasers who complete and return the attached card.* Some Standards require frequent revision between editions, whereas others require none at all. It is planned to issue new editions of the Standard, regardless of the amount of revision, at intervals not greater than 5 years. Except in unusual circumstances, replacement pages will not be issued during the last year of that edition.

**This card will appear with General Instruction No. 1 only.*

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Preface

This new edition of CSA Standard N286.4 (now CAN/CSA-N286.4), Commissioning Quality Assurance for Nuclear Power Plants, supersedes the Preliminary Standard of the same title published in May 1979.

This Standard is the fourth second-tier Standard in the N286 series on quality assurance and is complementary to the first-tier Standard, CAN3-N286.0, which covers general requirements for the overall quality assurance program. The N286.4 Standard develops in detail the specific requirements for the commissioning phase of the program.

The application of the N286 series of quality assurance standards during the design and construction phases of a nuclear power plant ensures that appropriate technical standards and safety objectives have been applied to the design, procurement, manufacture, and installation of all safety-related systems and equipment.

The objective of the commissioning program that follows the design and construction phases is to demonstrate, prior to operation of the station, that all systems and equipment will perform their intended functions. This Standard addresses itself to quality assurance for safety-related systems and equipment during the commissioning phase.

The establishment of a separate quality assurance organization, in addition to the commissioning organization, is neither required nor precluded by this Standard, whose intent can be met by integrating its requirements with other commissioning requirements, provided that the principle of separation of functions is respected.

It should be noted that

(a) the responsibilities of management for quality assurance include the implementation of a quality assurance program review;

(b) whereas system and equipment testing and inspection are frequently considered verification activities, this Standard recognizes that certain testing and inspection activities are considered performance activities and are subject to both verification and audit; and

(c) nonconformance can arise from and be identified by any one (or more) of performance, verification, and audit functions.

This Standard introduces concepts and philosophies that are in some ways novel and it is expected that some of the requirements contained herein will be refined as a result of experience gained from their application.

This Standard was prepared by the Working Group on Commissioning Quality Assurance for Nuclear Power Plants and approved by the Technical Committee on Overall Quality Assurance for Nuclear Power Plants under the jurisdiction of the Standards Steering Committee on Nuclear Standards. It has been approved as a National Standard of Canada by the Standards Council of Canada.

September 1986

Note: *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the user of the Standard to judge its suitability for his or her particular purpose.*

CSA Standards are subject to periodic review and suggestions for their improvement will be referred to the appropriate committee. All enquiries regarding this Standard, including requests for interpretation, should be addressed to Canadian Standards Association, Standards Division, 178 Rexdale Boulevard, Rexdale (Toronto), Ontario M9W 1R3. Requests for interpretation should

(a) define the problem, making reference to a specific Clause, and, where appropriate, include an illustrative sketch;

(b) provide an explanation of circumstances surrounding the actual field condition; and

(c) be phrased, where possible, to permit a specific "yes" or "no" answer.

Interpretations are published in "CSA Information Update". For subscription details and a free sample copy, write to CSA Marketing or telephone (416) 747-2292.

The N286 Series of Standards

The preparation of the N286 series of Quality Assurance Standards was initiated by the Canadian Nuclear Association in response to a recognition by the utilities, jurisdiction, and industries concerned with the design, construction, commissioning, operation, and decommissioning of nuclear power plants in Canada of a need for Standards pertaining to the assurance of quality throughout the life cycle of a nuclear plant.

The N286 Standards are administrative in nature and complement the CSA "N" series of nuclear technical standards. Proper implementation of the requirements of the N286 Standards requires compliance with these other nuclear technical Standards, and will provide assurance that both the safety and technical objectives of the "N" series of Standards are met.

The CSA N286 series comprises two tiers:

The first-tier Standard, CAN3-N286.0, contains the requirements for the overall quality assurance program and applies to the complete life cycle of a nuclear power plant project from conceptual design to decommissioning. It is addressed to the owner, and encompasses all the generic quality assurance principles that apply to major participants as well.

The N286.0 Standard

(a) defines the requirements of an overall quality assurance program applicable to the owner;

(b) identifies and requires the control of the interfaces between the different second-tier documents and between the N286 and other Standards;

(c) establishes the scope and applicability of second-tier standards;

(d) establishes the authority for approval of quality assurance programs developed to meet second-tier standards;

(e) specifies the responsibilities of participating organizations.

The Standards in the second-tier series develop in detail the requirements of the quality assurance program as they apply to the specific needs of each constituent phase of a power plant's life cycle.

Each second-tier Standard embodies the generic quality assurance principles set forth in the first-tier Standard, CAN3-N286.0, as well as including specific program requirements, limits of responsibility, authority, and application of criteria.

The scopes of the second-tier Standards are as follows:

N286.1, Procurement

This Standard covers all procurement activities, including the evaluation and selection of suppliers and bids and the surveillance of suppliers' performance carried on during any phase of a nuclear power plant. It applies to the procurement activities of both the owner and those acting on behalf of the owner or a participant. Procurement is an activity that applies to any of the constituent phases, rather than a distinct phase in the cycle. However, when undertaken by the owner or a main participant, it may precede or overlap the phases covered by the other second-tier Standards. In order to avoid possible gaps in the second-tier Standards, and to reduce repetition, procurement has been taken as the subject of the first second-tier Standard.

N286.2, Design

This Standard applies to all engineering design activities carried out by the owner and his design consultants that lead to the production of engineering design documents. Such documents may include drawings, data sheets, and specifications; they may also include fabrication, testing, erection, construction, installation, or commissioning instructions for use during any phase of the project. The Standard contains mandatory and optional requirements for conceptual, preliminary, and final design, and associated analytical and development work. These requirements cover management, document control, change control, performance, verification, and audit procedures.

N286.3, Construction and Installation

This Standard covers all activities carried out for and by the owner, from the receipt of components or materials on the site to their incorporation in systems or structures as required by drawings or other formal engineering information. It also covers the provision of required support activities and equipment, and applies at all stages on the site as far as the testing of components or systems before they are submitted for commissioning.

N286.4, Commissioning

This Standard applies to all activities carried out, after completion of installation and related testing, to demonstrate and ensure that equipment and systems will perform effectively and within the intent of their design when they are declared in-service. It covers the pertinent documentation and test equipment required for commissioning activities.

N286.5, Operation

This Standard covers all activities concerned with the operation and maintenance of the plant equipment and systems, and applies from the completion of commissioning of that equipment or system to final shutdown of the plant.

N286.6, Decommissioning

This Standard covers all activities from final shutdown to approved stabilized site condition.

In addition, the four Standards in the CSA Z299 series:
Z299.1, Quality Assurance Program—Category 1
Z299.2, Quality Assurance Program—Category 2
Z299.3, Quality Assurance Program—Category 3
Z299.4, Quality Assurance Program—Category 4
have been adopted for use by the owner or participants within their N286 quality assurance programs.

They apply to items whose design, production, fabrication, and assembly take place on the premises of the supplier or his agent. They also cover handling, storage, and shipping, as required, as well as site construction where this is the contractual responsibility of the supplier.

The Z299 Standards cover the manufacture of all components, equipment, and fabricated items required for installation or incorporation in the nuclear power plant at any phase. In addition to manufacturing, these Standards also cover a number of other activities such as procurement, design, and fabrication and may be used to supplement the second-tier N286 Standards when appropriate.

The owner may directly undertake activities covered by the second-tier Standards. In this event, the owner must meet the requirements of the relevant second-tier Standard, in addition to those stated in the first-tier Standard, CAN3-N286.0.

The owner's overall program may be, in large measure, an integration of the individual constituent phase programs. The responsibility for the effectiveness of the overall program, however, will require the exercise of effective control over the whole project and assured coordination of the work between the constituent phases.

It is important to highlight the fundamental concept of quality assurance functions as they relate to the quality of items or services. Quality itself is achieved in the performance activities, and the main emphasis must therefore be placed on adequate performance. This requires that these activities be appropriately planned, controlled, and implemented, together with the necessary verification, audit, and review activities that ascertain the existence of the required quality. It is the integrated combination of these activities that provides assurance of quality.

This philosophy of quality assurance has served as the basis for the preparation of the N286 Standards, and is illustrated in Figure 1, Commissioning Quality Assurance Process Model, which is provided to assist the reader in gaining an understanding of the quality assurance process and the interrelationship between the various activities described in the N286 series of Standards.

In all instances, the Standards in this series are intended to apply within the framework of pertinent regulatory and jurisdictional requirements established by the various federal and provincial governments and governmental agencies. Thus, requirements for inspection, tests, and documentation, etc, arising therefrom are not affected by the provisions of the N286 Standards.

CAN/CSA-N286.4-M86
Commissioning Quality Assurance for Nuclear Power Plants

1. Scope

1.1
This Standard contains the requirements for the quality assurance program applicable to the commissioning phase of a nuclear power plant.

1.2
This Standard embodies the relevant quality assurance requirements of CSA Standard CAN3-N286.0, and is the governing Standard for commissioning quality assurance activities in the event of any conflicting requirements.

1.3
This Standard is addressed to the owner and is applicable to commissioning activities carried out by both the owner and participants designated by the owner.

1.4
This Standard applies to the commissioning of safety-related equipment, systems, and structures as identified by the owner. It may be applied to other equipment, systems, and structures at the discretion of the owner.

1.5
This Standard recognizes that the extent of the application of the quality assurance requirements to the particular equipment, system, structure, or activity can vary according to the potential impact on the safety of the plant.

Notes:
(1) *Interpretation of this Standard by the Technical Committee will be in accordance with the intent expressed in Standard CAN3-N286.0.*
(2) *The application of the term safety-related will be defined in an application guideline that is to be included in a future edition of CAN3-N286.0.*

2. Definitions

2.1
The following definitions apply in this Standard:

Audit means those activities which are carried out to confirm that applicable elements of the quality assurance program have been established in accordance with the requirements of the program and are being effectively implemented in accordance with specified requirements.

Calibration means the comparison of two instruments or measuring devices, one of which is a standard of known accuracy traceable to nationally recognized standards. It is done to detect, correlate, report, or eliminate by adjustment any variation in accuracy of the instrument or measuring device of unknown accuracy.

Commissioning and commissioning program (interchangeable terms) means all those activities designed to demonstrate that equipment and systems perform within the intent of their design specifications at the time they are declared in-service.

Commissioning *is deemed to commence at a point in time, following completion of system and equipment installation and installation-related testing, when the equipment or system in question is ready to undergo functional performance testing.*

Commissioning *is deemed to be complete at that point in time when the equipment or system in question is declared in-service, following the completion of all actions necessary to show that it performs as intended by the design.*

Commissioning documentation means those plans, instructions, procedures, drawings, reviews, records, reports, and the like which collectively describe the commissioning program.

Commissioning quality assurance manual means the document that describes the commissioning quality assurance program.

Note: *The total program may be described in many diverse documents. It is not intended nor is it necessary that all source documents be compiled in one master document. It is necessary however that a summary document (ie, the commissioning quality assurance manual) be compiled to identify the sources; to index such source documents to the requirements of this Standard; and to provide a consolidated base for description of the program.*

Commissioning quality assurance policy means the statement issued by the plant owner that details the quality objectives to be met during commissioning and outlines the commissioning quality assurance program to be implemented to meet these objectives.

Commissioning quality assurance program means the planned, systematic, integrated series of performance, verification, audit, and review activities, including related management activities, that are implemented to ensure that safety-related equipment and systems perform within the intent of their design specifications at the time they are declared in-service.

Corrective action means measures taken and documented to determine the cause of deficiencies or nonconformances and prevent their recurrence.

Inspection means any or all of the careful examination, measurement, and testing of the characteristics of items and services to ensure that they meet specified requirements.

Item means contractual raw materials, parts, components, subassemblies, assemblies, equipment, subsystems, systems, structures, or finished product.

Jurisdiction means the Atomic Energy Control Board or its designated representative.

Nonconformance means a deficiency in characteristic, documentation, or procedure that renders the quality of an item or service unacceptable or indeterminate, or not according to specified requirements.

Operational phase means the period of time in the plant life cycle during which the principal activities are associated with the operating and maintenance of the plant. This phase is considered to commence when systems and equipment are declared in-service following the commissioning phase, and to end when these systems are permanently removed from service, thus marking the onset of the decommissioning phase.

Owner means the party who has or will have title to the nuclear power plant.

Participant means any organization required by the owner to apply one or more of the N286 series of Standards.

Performance means commissioning activities that are implemented to ensure that equipment and systems perform within the intent of their design specifications at the time they are declared in-service.

Procedure means a document that states the purpose and scope of an activity and specifies how to perform it.

Program review means a periodic assessment of the effectiveness of the commissioning quality assurance program in achieving the objectives established to implement the commissioning quality assurance policy.

Record validation means stamping, initialling or signing, and dating or otherwise authenticating documents by authorized individuals.

Repair means processing a nonconforming item so that it can function reliably and safely, although the item still does not conform to the originally specified requirements.

Rework means reprocessing an item to conform to the originally specified requirement.

Software means computer programs and related data.

Surveillance means the act of monitoring or observing to determine whether an activity or item conforms to specified requirements.

Verification means confirmation by activities such as reviewing, inspecting, testing, or checking that activities, items, processes, or documents conform to specified requirements.

3. Management Functions

3.1 Responsibility

3.1.1

The owner shall be responsible for establishing and implementing a commissioning quality assurance program that is effective and is in accordance with this Standard.

3.1.2

The owner may delegate to participants part or all of the activities of planning, establishing, and implementing the commissioning quality assurance program, but shall retain responsibility for its effectiveness.

3.1.3

The owner shall be responsible for identifying the participants required to meet the requirements of this Standard.

3.1.4

The owner shall require such participants to establish and implement a commissioning quality assurance program for the items or services they are supplying, in accordance with this Standard.

3.1.5

The owner shall be responsible for auditing and assessing the effectiveness of the quality assurance program developed by participants to meet the requirements of this Standard.

3.1.6

The owner shall be responsible for ensuring that before any activity covered by this Standard is undertaken, the applicable portion of the commisioning quality assurance program is documented, approved, and implemented.

3.2 Policy

3.2.1

A written policy, the commissioning quality assurance policy, shall be prepared and issued by the owner, stating the quality assurance objectives to be met during commissioning, and outlining the quality assurance program to be implemented to enable these objectives to be met. This policy shall be binding upon the owner and each participant.

3.2.2

This policy shall establish the authority of the commissioning quality assurance program and provide the authority for the discharge of the program responsibilities.

3.2.3

This policy shall be binding on all levels and functions of management.

3.3 Organization

3.3.1 An organizational plan shall be documented, showing
(a) organizational structure;
(b) functional responsibilities;
(c) levels of authority; and
(d) internal interfaces.
Where multiple organizational arrangements exist, the plan shall clearly establish the responsibilities of each organization.

3.3.2

The organization shall recognize the requirement for separation between performance, verification, and audit activities. This separation requires that no one person may execute more than one of these three functions for any particular commissioning activity.

3.3.3

The individual(s) responsible for the implementation and effectiveness of the quality assurance program shall be identified.
Note: *In many cases responsibility has been delegated to a senior person located at the plant.*

3.3.4

The individual(s) delegated to be responsible for monitoring and assessing the effectiveness of the quality assurance program shall report to a management level such that the required organizational freedom is provided.

3.4 Authority

3.4.1

The person(s) designated as responsible for the verification, audit, and program review functions of the commissioning quality assurance program shall have sufficient authority and organizational freedom to
(a) identify problems related to the effective implementation of the quality assurance program;
(b) initiate or recommend solutions to such problems; and
(c) confirm the implementation and effectiveness of the solutions.

3.4.2

Such person(s) shall have direct access to that level of management necessary to ensure that appropriate commissioning quality assurance actions are implemented.

3.5 Personnel Qualifications and Training

3.5.1

Personnel involved in the implementation of the commissioning quality assurance program shall have the appropriate training, as well as the qualifications and the competence, necessary to perform effectively their assigned tasks.

3.5.2

The owner shall be responsible for establishing the necessary level of qualification for all personnel involved in the application of the commissioning quality assurance program (ie, the performance, verification, audit, and program review functions) and for ensuring that only such qualified personnel perform these activities.

3.5.3

Training programs shall be established as necessary to ensure that the required proficiency of personnel is achieved and maintained.

3.5.4

Records shall be maintained of the relevant qualifications of personnel executing the commissioning quality assurance program.

3.6 Quality Assurance Manual

3.6.1

A commissioning quality assurance manual, describing the commissioning quality assurance program and cross-referenced to the overall quality assurance program for the project, shall be prepared and issued prior to the initiation of any relevant commissioning activity. The commissioning quality assurance manual shall contain sufficient detail to demonstrate that a program has been developed that meets the requirements of this Standard and reflects the degree of potential impact on safety of the particular items, equipment, systems, or activities.

3.6.2

The commissioning quality assurance manual shall
(a) include a statement of the commissioning quality assurance policy;
(b) identify the organizational structure(s) within which the commissioning quality assurance program is to be planned, administered, implemented, and monitored, and clearly delineate the responsibility and authority of the various personnel and organizations involved;
(c) identify the equipment and systems to which it applies, and the commissioning documentation by which performance activities will be implemented;
(d) describe the process(es) to be used for document control, and the collection, storage, and retrieval of quality assurance records;
(e) identify requirements for the training and qualification of personnel executing commissioning quality assurance activities;
(f) specify how verification, audit, and program review functions will be conducted and how assurance will be provided that actions will be taken to correct deficiencies revealed; and
(g) identify the interrelationship and hierarchy of documents used in the program.

3.6.3

Participants involved in the execution of commissioning activities shall either adopt the owner's commissioning quality assurance manual or shall prepare their own detailed

quality assurance manual covering the equipment or systems for which they are responsible. All such manuals shall be cross-referenced to the owner's manual, and shall be approved by the owner.

3.6.4

Quality assurance manuals shall be controlled documents, updated as necessary as a result of the program review process, and appropriate records of changes shall be maintained.

3.7 Program Review

3.7.1

The commissioning quality assurance program shall provide for formal documented reviews of the status and adequacy of the program. Such reviews shall take place at least twice during the commissioning phase and not less frequently than once every 12 months.

3.7.2

Such reviews shall also take place on an ad hoc basis whenever the effectiveness of the program is in doubt.

3.7.3

The review process shall assess the effectiveness of the program in achieving its objectives.

3.7.4

When any portion of the work carried out under the requirements of the commissioning quality assurance program is delegated to a participant, reviews shall be conducted by the owner of the effectiveness of the participant's program.

3.7.5

Corrective action(s) arising from all reviews, and verification of their implementation, shall be documented.

3.7.6

Changes to either the owner's or participants' commissioning quality assurance manual(s) arising from such reviews shall be subject to the same degree of control as exercised in the establishment of the original program.

3.8 Interface Control

3.8.1

Interfaces shall be identified and controlled between

(a) owner and participants;
(b) participants; and
(c) the commissioning and other second-tier quality assurance programs.

3.8.2

Interface control shall include the assignment of responsibilities and the establishment of procedures for the identification, review, approval, release, distribution, and revision of documents that cross organizational boundaries.

3.9 Feedback

3.9.1

Information pertaining to quality, relevant and related to the owner's previous commissioning experience, shall be obtained where practical.

3.9.2
Measures shall be established for documenting quality-related commissioning experience. This information shall be made available as appropriate to both the commissioning and other phases of the plant life cycle.

3.9.3
These measures shall ensure that information contained in such documentation or information received from other phases of the plant life cycle is assessed and incorporated into the commissioning of the plant and/or its quality assurance programs, as appropriate.

3.10 Correlation to Other Standards
Measures shall be established to ensure that the commissioning quality assurance program recognizes and satisfies the applicable requirements (including the quality assurance requirements) of other relevant technical codes and standards.

4. Performance Functions

4.1 Work Control

4.1.1
Commissioning activities shall be planned and documented in such a way as to meet the objectives of the commissioning quality assurance program. Planning shall include the identification and integration of the methods, requirements, and organizational responsibilities for all such commissioning activities.

4.1.2
Work done to commission equipment and systems shall be performed in conformance with written procedures prepared prior to the execution of the work. Deviations from procedures shall be approved.

4.1.3
The format of such procedures may vary from plant to plant, depending upon the policies of the owner organization. As a minimum, the following areas shall be addressed:
(a) **Title.** Each procedure shall contain a title description of the activity, system, or equipment to which it applies, a revision number, a date, and an approval status.
(b) **Statement of Applicability.** The purpose for which the procedure is intended shall be clearly stated.
(c) **References.** References shall be included where appropriate.
(d) **Prerequisites.** Each procedure, prior to its use, shall identify those independent actions or procedures which must be completed and those plant conditions which must exist.
(e) **Precautions.** Precautions shall be identified to alert the individual performing the task to those measures which are to be used to protect equipment and personnel or to avoid an abnormal or emergency situation, or both.
(f) **Limitations and Actions.** Limitations on the parameters being controlled and, if required, appropriate corrective measures to return the parameter to within normal limits shall be specified.
(g) **Main Body.** The main body of the procedure shall contain step-by-step instructions in as much detail as necessary for the performance of the particular commissioning activity.
(h) **Acceptance Criteria.** Procedures shall contain, where applicable, acceptance criteria against which the success or failure of the activity is to be judged.
(i) **Check-Off Lists.** Complex procedures shall contain check-off lists, either included in the procedure or referenced.

4.1.4
For each commissioning activity, a person with authority to execute the work shall be identified. Procedures shall be established whereby the group having responsibility for the commissioning activities, including operational control of devices and energization of systems, is clearly designated.

4.1.5
Measures shall provide for identification of points marking the boundary of commissioning responsibility.

4.2 Equipment Control

4.2.1
Plant equipment and systems under commissioning control shall be clearly identified. A system of permits, tags, or other equivalent control procedures shall be established to support this requirement. Particular attention shall be given to the identification of terminal points and to procedures where equipment forming terminal points is to be operated.

4.2.2
Equipment and systems shall be identified to ensure that commissioning actions and records are applied to the correct items.

4.2.3
At the time of transfer to commissioning, equipment and systems shall be inspected to the extent necessary such that equipment or system boundaries, together with any known deficiencies, are clearly identified on the transfer documents.

4.2.4
Equipment and systems whose state has been established as providing safe working conditions shall be identified.

4.2.5
Procedures shall be employed to ensure that at all times throughout the commissioning phase, only correct and intended items or software are used in equipment, systems, and controls. An identification mechanism shall be implemented to relate such items or software to the applicable drawings, specifications, or other pertinent documents.

4.2.6
Procedures shall define the required inspection, test, surveillance, and maintenance activities to be performed on items or software during commissioning.

4.3 Commissioning Documentation

4.3.1
Commissioning documentation shall be prepared by competent staff to describe commissioning activities.

4.3.2
Commissioning documentation shall clearly identify test intent, test objectives, required performance values, prerequisites, resource material, sequencing of activities, and required acceptance criteria.

4.3.3
Commissioning documentation shall provide a clear description of the results obtained and their acceptability.

4.3.4
Relevant commissioning documentation shall be independently reviewed for conformity to the design intent. These reviews shall be carried out by persons (including, where appropriate, those having design responsibility) having access to pertinent information and having adequate understanding of the requirements and intent of the systems and equipment being commissioned.

4.4 Receiving, Handling, and Storage

4.4.1 General
Measures shall be implemented to control the receipt, handling, storage, and issue of material, equipment, and test instruments in accordance with documented instructions, procedures, or drawings.

4.4.2 Receiving

4.4.2.1
Visual examination shall be performed to establish that
(a) the item received is free from physical damage;
(b) the specified packaging and shipping requirements have been maintained during shipping; and
(c) identification and markings are in accordance with applicable codes, specifications, purchase orders, and drawings.

4.4.2.2
The associated documentation shall be examined to establish that
(a) the item received was fabricated, tested, and inspected prior to shipment in accordance with and meets the applicable code, specification, purchase order, and/or drawings;
(b) the documentation requirements of the purchase order for the item have been met; and
(c) the documentation has been reviewed by an organization other than the manufacturer to ensure that the purchase order requirements of the item have been met.

4.4.2.3
If the item requiring inspection was not inspected at source, the item shall be inspected at the point of receiving, to verify conformance with purchase order requirements.

4.4.2.4
Items that conform to specified requirements shall be identified as such and either held in storage for later release or released and moved directly to their final location for installation or use.

4.4.2.5
Items that do not conform to specified requirements shall be identified as nonconforming, and segregated to prevent inadvertent installation or use.

4.4.2.6
A nonconforming item may be released for installation or use on a conditional release basis. A statement documenting the authority and technical justification for the

conditional release of the item for installation or use shall be prepared and made part of the documentation.

4.4.3 Handling and Storage

4.4.3.1

Measures shall be implemented to control handling and storage in order to preserve items from the time of their receipt and prevent their abuse, misuse, damage, deterioration, or loss.

4.4.3.2

Handling instructions and procedures shall be provided for any material, equipment, and instrumentation that may be damaged if handled incorrectly. Other items not covered by a specific procedure shall be handled in accordance with sound material-handling practices.

4.4.3.3

When special handling tools and equipment are required, they shall be inspected and tested at specified times to verify that they are adequately maintained.

4.4.3.4

Items shall be stored under appropriate conditions according to their susceptibility to environmental deterioration.

4.4.3.5

Inspections shall be performed periodically to ensure that storage areas and the integrity of the items are being maintained as required.

4.5 Measuring and Testing Equipment

4.5.1

Procedures shall be implemented to ensure that all measuring and testing equipment is of the proper range, type, condition, and accuracy to establish conformance to specified requirements.

4.5.2

All such equipment shall be adjusted, maintained, and calibrated against equipment having a known relationship to nationally recognized standards, as necessary, to ensure that it is accurate within required limits when it is used for commissioning activities. Where no such standard exists, the basis for calibration shall be documented.

Records of adjustment, maintenance, and calibration shall be maintained, and equipment shall be suitably identified or marked, so as to enable the user to establish its calibration status.

4.5.3

If the accuracy of an instrument or item of equipment becomes suspect, it shall be checked. Where an instrument or item of equipment is found to be out of calibration, an evaluation shall be made of the acceptability of the items previously measured or tested by this instrument or item of equipment since the date of its last acceptable calibration.

5. Verification Function

5.1

Verification methods shall be implemented for determining that items are of the prescribed quality and that activities are accomplished as specified.

5.2

The scope of the verification function shall include the following:
(a) confirmation that the procedures are appropriate for the equipment or system being commissioned, operated, or maintained;
(b) confirmation that the performer is qualified and understands the required procedures;
(c) confirmation that performance activities are implemented in accordance with requirements;
(d) confirmation that all relevant parameters meet specified acceptance criteria; and
(e) confirmation that nonconformances were suitably identified and resolved.

5.3

Line management shall be responsible for ensuring and demonstrating that commissioning activities are objectively and adequately verified.

5.4

Production and schedule considerations shall not override the proper completion of planned verification activities.

5.5

Required verification activities shall be planned and sequenced with commissioning activities. Separate verification and commissioning procedures are not necessarily required. Deviations from planned verification activities shall be approved.

5.6

The characteristic or activity being verified, the acceptance criteria, the materials, equipment, and documentation to be used, and the recording requirements shall be identified.

5.7

Persons with the responsibility to execute verification activities shall be identified in verification procedures or other related documents. These persons shall
(a) not verify activities that they have performed or decisions that they have made themselves; and
(b) report observed nonconformances to the appropriate level of management.
Where verification activities are carried out by the performer's immediate supervisor, such a person shall meet the above criteria.

5.8

The immediate supervisor shall be responsible to ensure that verification takes place. Verification additional to or in place of immediate supervisory verification is carried out when
(a) the defined verification task requires a specialized skill, expertise, or qualification not available from the immediate supervisor; or
(b) there is significant potential in the execution of the work to adversely affect the achievement of worker safety or public safety standards.
The immediate supervisor shall be responsible for ensuring that such verification takes place.

5.9

Procedures shall be implemented to ensure that the following verification activities are planned and implemented as appropriate:
(a) **Procedure Verification.** Commissioning documentation shall be reviewed prior to use to ensure that it is appropriate and complies with the design requirements and the design

intent. Where appropriate, this shall include review and acceptance by persons with design responsibility.

(b) **Confirmatory Inspection.** Visual or physical confirmation that prerequisites have been met, or that activities have been performed satisfactorily, shall be carried out according to identified requirements.

(c) **Witnessing.** When the performance of a commissioning activity is to be directly observed, it shall be designated by hold or witness points and carried out according to identified requirements.

(d) **Surveillance.** Periodic observation or monitoring of activities or items to confirm adherence to requirements shall be carried out according to identified requirements.

(e) **Inspection.** The quality characteristics of identified items shall be examined or measured during or following maintenance, repair, or modification, to ensure that specified quality requirements have been met.

(f) **Functional Testing.** Following maintenance, repair, or modification, the capability of items to meet specified functional requirements shall be determined by subjection to physical, chemical, environmental, or operating conditions.

(g) **Results Verification.** Commissioning records, reports, or results shall be reviewed to confirm that the prescribed work has been performed and that the results are satisfactory. Appropriate commissioning results shall also be reviewed by persons with design responsibility before systems are declared available for service. Authorized signatures shall be used on reports and records to indicate final acceptance of items being commissioned.

6. Audit Function

6.1

A system of planned and documented audits shall be carried out in accordance with written procedures and checklists to confirm that activities affecting quality comply with all aspects of the commissioning quality assurance program and that the program has been implemented effectively. Where parts of the program have been delegated to participants, the owner shall conduct audits of the participants' quality assurance programs.

6.2

Audits shall include an evaluation of

(a) the extent to which performance and verification activities are being carried out in accordance with the requirements of the commissioning quality assurance program; and

(b) the extent to which nonconformances are being identified and corrected.

6.3

Audits, which may be carried out separately, should include as appropriate:

(a) program-oriented audits, which assess conformity with quality assurance practices, procedures, and instructions, and the effectiveness of their implementation; and

(b) records-oriented audits, which assess the quality assurance records for conformity to the requirements of the commissioning quality assurance program.

6.4

Audits shall be conducted with sufficient frequency to confirm conformance to the commissioning quality assurance program. The scope and timing of audits shall recognize the status and duration of the commissioning program.

6.5

Audits shall be carried out by persons

(a) not directly responsible for the performance and not performing the verification of the activities being audited; and

(b) having direct access to that level of management necessary to ensure that appropriate commissioning quality assurance actions are implemented.

6.6

Auditors shall bring to the attention of the appropriate level of management the deficiencies revealed by their audits, and shall subsequently confirm that
(a) measures have been taken to remedy such deficiencies; and
(b) corrective actions have been taken where appropriate.

7. Corrective Functions

7.1 Nonconformance

7.1.1

Measures shall be established to identify, report, review, dispose, control, and document items, activities, and services that do not conform to requirements, in order to prevent their unauthorized use.

7.1.2

These measures shall also provide for
(a) identifying responsibilities in the review and disposition process;
(b) developing and implementing acceptable dispositions;
(c) interfacing with the corrective action process; and
(d) ensuring that a history of all nonconformances is maintained and that all such nonconformances are resolved before the associated commissioning activity is considered complete.

7.2 Corrective Action

7.2.1

Measures shall be established and documented to ensure that conditions adverse to quality are identified and corrected.

7.2.2

In the case of significant conditions adverse to quality, the causes shall be determined and analyzed for trends, and corrective action shall be taken to prevent their repetition. The inputs to the corrective action process shall be identified.

7.2.3

Persons responsible for initiating and implementing corrective actions and performing follow-up reviews shall be identified.

7.2.4

The identification of a significant condition adverse to quality, its cause, and the corrective action taken shall be documented and reported to appropriate levels of management.

7.3 Change Control

7.3.1

Proposed modifications to systems and equipment, computer software, procedures, drawings, and instructions shall, prior to their implementation, be reviewed and approved either by the group that reviewed and approved the original or by a group with appropriate competence specifically designated by the owner. This review group shall have access to pertinent background information and have adequate understanding of the requirements and intent of the design.

7.3.2
Such modifications shall be documented and included either in the original document or as an appendage thereto, and shall be shown promptly on all relevant documents being used by commissioning personnel.

8. Documents and Records

8.1 Document Control

8.1.1
The identification, review, approval, issue, distribution, and revision of all documents and software essential for meeting the quality assurance commissioning program objectives shall be controlled.

Measures shall be established to ensure that

(a) documents and software, including changes and revisions, are

(i) reviewed for adequacy and approved for release by authorized personnel; and

(ii) distributed for use at the location where the prescribed activity is performed or where the document is required for reference;

(b) the latest authorized documents and software are used;

(c) obsolete documents and software are identified as such and promptly removed from use;

(d) current distribution lists are maintained; and

(e) information that permits the identification of any changes and revisions to all such documents or software is maintained.

8.1.2
The individuals or organizations responsible for preparing, reviewing, approving, and issuing documents and all changes and revisions shall be identified.

8.1.3
Modifications to documents relating to items or services shall, prior to implementation, undergo the same reviews and approvals as the original documents. Such reviews and approvals shall be carried out by persons having access to pertinent background information and having adequate understanding of the requirements and intent of the original document.

8.2 Quality Assurance Records

8.2.1
The owner shall identify, control, and retain the records that are essential to provide documented evidence that items and services meet specified requirements and that the commissioning quality assurance program has been effectively implemented in accordance with this Standard. This shall include records required by applicable codes, standards, specifications, and regulations. The owner shall establish and specify the records that are to be compiled during the commissioning phase of the plant life cycle.

8.2.2
The system shall provide for validation of each record to ensure completeness and shall provide documented transfer at interfaces with other quality assurance programs.

8.2.3
Each validated record shall be legible, readily retrievable, and traceable to the items and activities to which it refers.

8.2.4

Two categories of essential records shall be established: permanent and nonpermanent.

8.2.5

Records designated permanent shall be maintained by, or for, the owner for the operational life of the plant or at least for the life of the particular item concerned. Permanent records are those which meet one or more of the following criteria:

(a) those which would be of value in demonstrating capability for safe operation;
(b) those which would be required to maintain, rework, repair, replace, or modify an item;
(c) those which would be of value in determining the cause of an accident, malfunction, or unscheduled occurrence;
(d) those required to provide baseline data for periodic inspection; and
(e) those which would be of value in decommissioning an item.

8.2.6

Records shall be designated nonpermanent when they are not needed to satisfy the requirements for permanent records, but where they are necessary to show evidence that an activity was performed according to requirements.

8.3 Retention

8.3.1

Measures shall be established to maintain, store, and routinely inspect the conditions of all essential records so as to ensure their preservation and protection from loss, deterioration, or destruction.

8.3.2

Nonpermanent records shall be retained for at least the minimum period specified by the owner. The minimum retention period shall meet the requirements of the applicable codes, standards, and regulatory requirements.

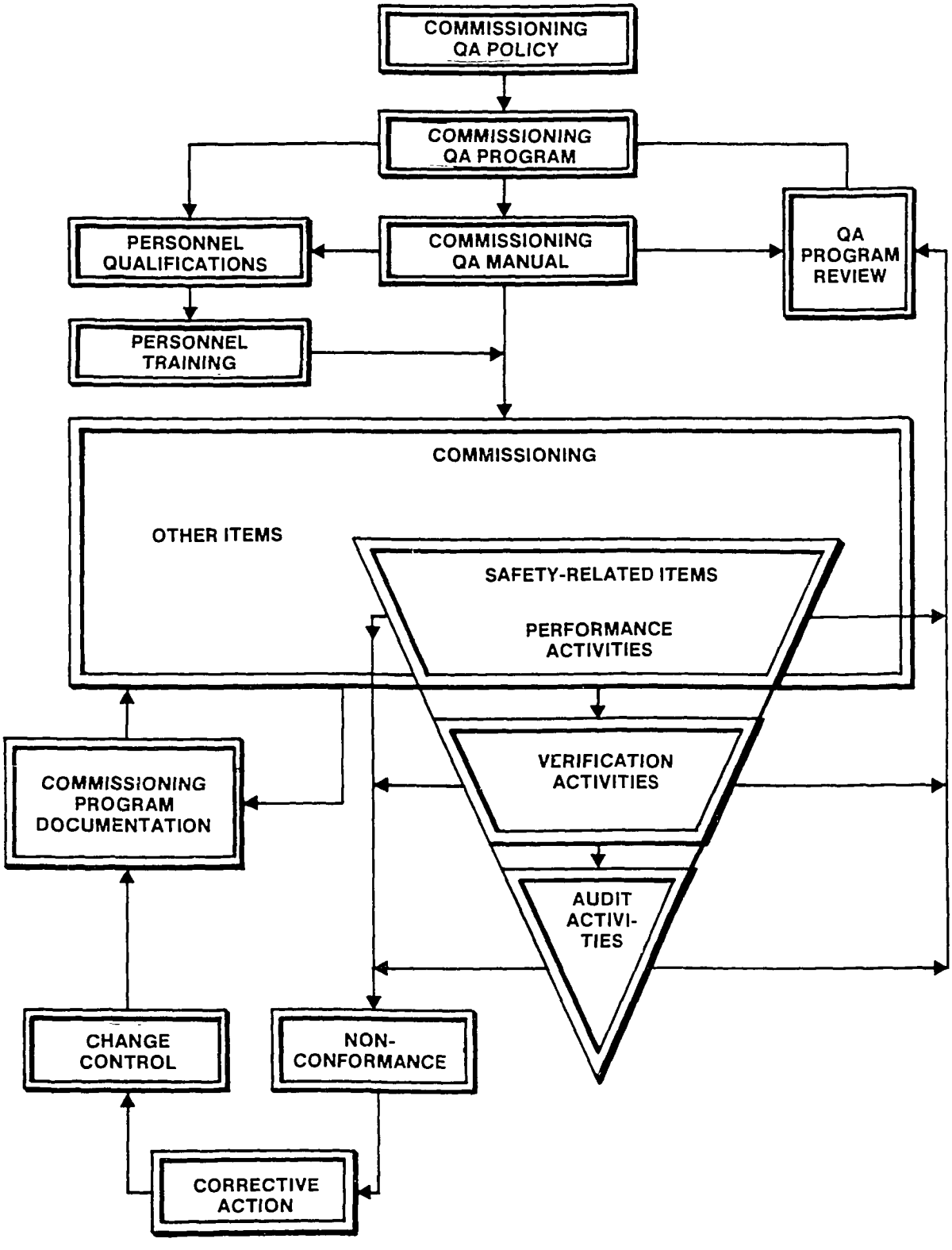

Figure 1
Commissioning Quality Assurance Process Model

Proposal for Change

To help our volunteer members to assess proposals to change requirements we recommend that each proposal for change be submitted in writing and identify the
(a) Standard number;
(b) Clause number;
(c) proposed wording of the Clause (requirement, test, or pass/fail criterion) using mandatory language and underlining those words changed from the existing Clause (if applicable); and
(d) rationale for the change, including all supporting data necessary to be considered.

The proposal should be submitted to the Standards Administrator at least one month prior to the next meeting of the Committee. It is CSA Committee practice that only those proposals sent out to members prior to a meeting can be the subject of discussion and action. This is to allow the members time to consider the proposal and to do any research they may feel necessary.

Date: ____ - ____ - ____
YY MM DD

To: The Standards Administrator of CSA Standard _____

From: _____

Affiliation: _____

Address: _____

_____

Phone: _____ **Fax:** _____

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Proposed change:

(Use reverse and additional pages as required.)

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