QUALITY ASSURANCE PLAN

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Nuclear Engineering Teaching Laboratory

Balcones Research Center

The University of Texas at Austin

QUALITY ASSURANCE PROGRAM

Objectives of quality assurance (QA) may be divided into two major goals. First is the goal of safe operation of equipment and activities to prevent or mitigate an impact on public health and safety. Second is the reliable operation of equipment and activities associated with education and research functions of the University. The risk or potential release of radioactive materials is the primary impact on public health and safety, and may be divided into direct risks and indirect risks. Direct risks are activities such as waste disposal, fuel transport and decommissioning that introduce radioactive materials into the public domain. Indirect risks are accident conditions created by normal or abnormal operating conditions that generate the potential or actual release of radioactive materials from the controlled areas of a facility.

1. Introduction

Characteristics of uranium loaded zirconium hydride fuel used in the TRIGA reactor provide substantial benefits to safe reactor operation. Many accident situations are simulated by normal operation of the fuel in either pulse mode or steady state mode. Other features such as fission product retention, stainless steel cladding design, facility engineered features, and periodic schedule of operation combine with routine operation procedures to decrease the consequences of failure of any reactor components. The limited scope of application of formal quality assurance criteria is due to the fact that most parts and procedures associated with operation of the TRIGA type reactor are not relevant to public health and safety.

Safety-related identifications for quality assurance are determined from safety analyses. Although several systems such as the reactor safety and protection system, engineered safety features and radiation monitoring systems are important to safety, only one reactor component is identified as safety-related. The quality assurance program is not applied to routine reactor operations and surveillance activities but shall be implemented for non routine activities determined to be safety-related in nature or affecting safety-related components. Activities shall include design, construction, testing, modification and maintenance of safety-related items. Other components related to safety limits, limiting conditions for operation and design features, as identified in technical specifications, will apply only those elements of quality assurance necessary to establish reliable performance of the intended structure, system or component function. The following table lists the components subject to quality assurance program or selected sections of the program.

Two additional conditions remain, however, that are important to the application of at least portions of the quality assurance program. One is the safety to operation personnel and experimenters and the other is continuity of the operations programs. Each of these conditions must be examined objectively relative to operation procedures and program expectations. In general, the application of good industry quality assurance practices is sufficient to meet operational program goals.

Table 1
Q-List for 1MW UT TRIGA

Structures, systems or components	Safety*	QC/QA Specs
Fuel Element		
Cladding structure	1	manuf.
Shipping package	1	manuf.
Reactor Core		
Structural components	2	manuf.
Tank structure	2	design
Shield structure	2	constr.
Experiment Equipment (core reflector)		
Beam tube components	2	design
Rotary rack system	2	design
Experiment Equipment (core grid)		
Pneumatic tube components	2	design
Installed core system	2	design
Protective Systems		
Instrumentation system	2	manuf.
Control system	2	manuf.
Safety system	2	manuf.
Auxiliary Systems		
Pool coolant system	2	design
Water purification system	2	design
Room confinement components	2	const.
Area ventilation components	2	const.
Area radiation monitor system	2	manuf.
Air radiation monitor system	2	manuf.

Notes:

1 - All sections of quality assurance program shall be considered applicable.

2 - Specific sections of quality assurance program should be applied as required to assure reliable performance.

The quality assurance program shall be commensurate with the TRIGA type reactor, The University of Texas administrative programs and the goals of quality assurance. This document provides requirements for establishing, managing, conducting and evaluating the QA Program. The QA Program applied to items or activities determined to be safety-related follows the guidelines of Nuclear Regulatory Guide 2.5 (77/05) [1, 29, 10].

1.1 Purpose. Quality assurance of certain activities associated with the University of Texas TRIGA reactor facility is important for the safe and efficient completion of tasks that are identified as safety-related. This document outlines the general elements of quality assurance applied to safety-related structures, systems or components, and activities. Requirements are documented for establishing, managing, conducting, and evaluating the QA Program. Although aspects of the QA Program may be routinely applied to many facility activities, the formal implementation of the program is limited to specific items or activities related to public health and safety. Table 1 lists the quality level and description of key systems and components.

1.2 Responsibility. The University of Texas at Austin as owner and operator of the TRIGA reactor facility shall be responsible for a quality assurance program. The owner-operator shall establish and implement a program consistent with the goals of quality assurance for safety-related activities, structures, systems and components. Identification of safety-related items shall be the responsibility of the owner-operator and will include a description of the item and the applicable elements of the quality assurance program. Special quality provisions, delegated functions of the program, and unresolved quality assurance problems shall also be identified by the owner-operator. The facility supervisor shall have the ultimate responsibility for both the specifications of quality related requirements and the functions of quality related activities. Table 2 lists the responsibilities and key personnel participating in the University TRIGA QA Program.

Table 2
RESPONSIBILITIES AND KEY PERSONNEL

Responsibilities	Key University Personnel
1. Establish program Implement program Identify Safety-related items	Director or Supervisor of TRIGA facility
2. Unresolved issues	President or Executive Vice President and Provost
3. Delegated functions	Faculty and staff
4. Specialized functions	Specified personnel

1.3 Organization. The organization applied to quality assurance activities shall be part of the normal university administrative structure. The facility Supervisor shall develop and implement the quality assurance program and identify safety related items. Unresolved issues of quality assurance shall be reported to the Director of the facility and the appropriate administrative vice president of the university. Execution of specific elements of the program may be delegated to persons in the University organization or other organizations as appropriate. University persons shall include committees, faculty, researchers or staff as required for specific program applications. Non-university organizations or persons may supplement University personnel when specialized qualifications are necessary for specific quality assurance tasks. The University organization applied to reactor safety and quality assurance is the academic administration represented by Figure 13.

Reactor operation is the responsibility of qualified ~~personnel~~ with ~~him~~ operator permit

1.4 Documentation. All activities affecting safety-related items subject to the quality assurance program shall be identified and documented formally. The format of Table 3 shall be used to identify applicable elements of the Quality Assurance Program and identify documents, procedures, reviews, inspections, tests, or other quality assurance features that are to be applied to a safety-related activity. The checklist or approval shall be incorporated in the table format for the acceptance of each specified quality assurance element by the facility supervisor.

2. Quality Assurance Controls

2.1 Design Controls. Design controls shall consist of design specifications, references to applicable codes, standards and regulations, design verifications and document approval. Applicable codes, standards, regulations or other quality requirements will be identified and requirements incorporated into the design documents. Design document approvals shall be part of the design document. Design approval will be by a person, other than the design originator, that is knowledgeeble of the design criteria and is informed of the quality requirements.

Modifications of safety-related documents shall be subject to the same provisions as the original document. Approval of the design modification will be included with the design document and the modification identified.

Verification of design adequacy shall be provided by either design reviews, alternate calculation, test program or other method, determined to be appropriate. Verifications of the design shall check characteristics such as compatibility of materials; suitability of application of inspection, maintenance and repair; proper interfacing of sub-systems, and proper acceptance criteria. Method of verification will be identified and documented by approval of the design document.

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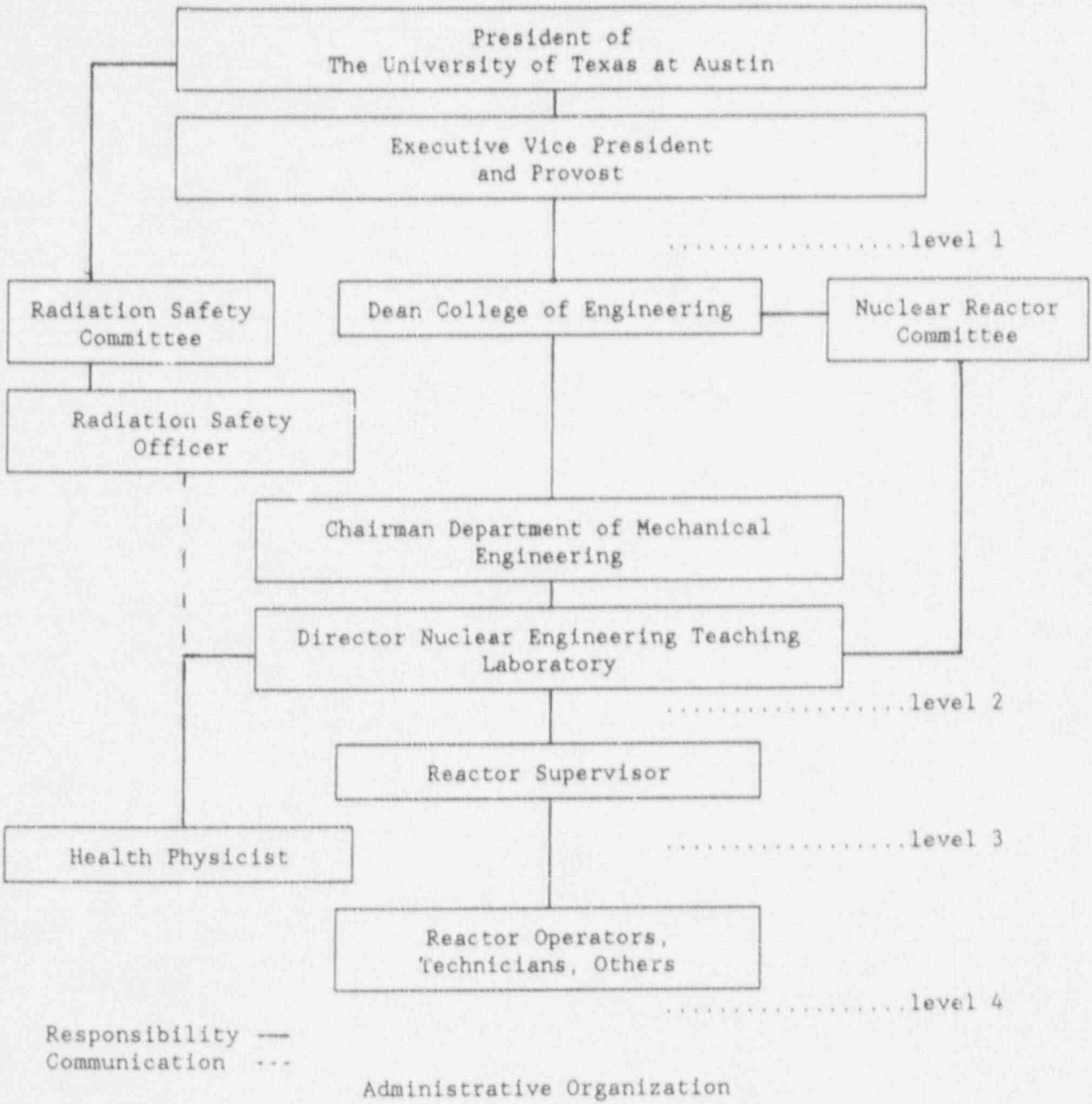
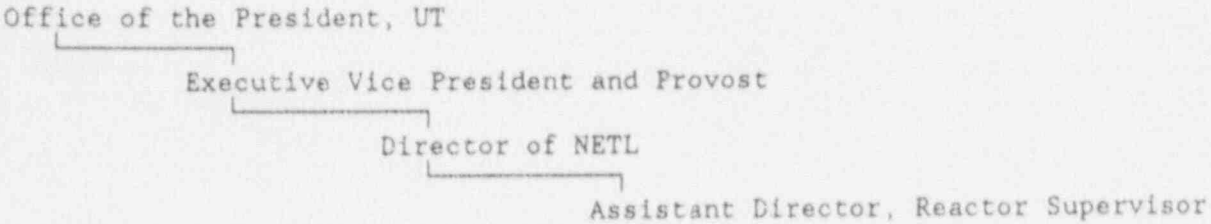


Administrative Organization



QUALITY ASSURANCE Line Organization
Figure 1

Table 3
FORMAT FOR SAFETY RELATED QA CHECKS

Each safety-related activity structure, system, or component will be given a letter symbol, such as A, B, C, and be appended with the following designations (for example, A1.0):

1.0 Title
Identification and description of safety-related item
1.1 Participation - supplemental organization and functions
1.2 Documents - applicable procedures or special measures

2.1 Design Control

2.1.1 Codes, standards and regulations
2.1.2 Method of verification
2.1.3 Modifications proposed

2.2 Procurement Control

2.2.1 Codes, standards and regulations
2.2.2 Quality assurance specifications
2.2.3 Proposed changes enacted
2.2.4 Procurement conformance method

2.3 Document Control

2.4 Material Control

2.4.1 Special procedures required
2.4.2 Equipment required
2.4.3 Personnel qualifications

2.5 Process Control

2.5.1 Special procedures
2.5.2 Special equipment
2.5.3 Personnel qualifications

3.1 Inspection Program Description
3.2 Test Program Description
3.3 Measurement Equipment
3.4 Nonconformance Item and Disposition
3.5 Corrective Actions Instituted

4.0 Records List

2.2 Procurement Controls. Procurement controls shall consist of procurement specifications, references to applicable codes, standards and regulations, procurement acceptance and document approval. Applicable codes, standards, regulations or other quality requirements will be identified and references incorporated into the procurement documents. Procurement document approvals shall be part of the procurement document. Procurement approval will be by a person, other than procurement originator, that is knowledgeable of the procurement specifications and is informed of the quality requirements.

Changes to safety-related procurement documents shall be subject to the same provisions as the original document. Approval of procurement changes will be included with the procurement document and the change identified.

Acceptance of procured items or services shall consist of evidence provided by the contractor, evaluation of the procurement source, inspection at the source or inspection upon receipt. Acceptance of the procurement should require measures such as quality assurance by contractor, inspection and test functions, or controls on materials processes and nonconformances. The methods of acceptance will be identified and documented by approval of the procurement document.

2.3 Document Control. Document control consists of monitoring the development, revision, release and use of documents, drawings or specifications affecting safety-related activities. Document control shall include assurance that safety related documents are identified as such, and are completed and maintained properly. The laboratory Supervisor shall provide control of safety related documents that are specified according to the format of Table 3.2.

2.4 Material Control. Procedures shall be written to establish material control when special measures are necessary to assure material quality of safety-related items. Controls shall be applied to activities such as identification, handling, storage, shipping, cleaning and preservation. Procedures shall specify equipment and personnel required to accomplish the specified material control. Applicable codes, standards, specifications and personnel qualifications shall be documented.

2.5 Process Control. Procedures shall be written to establish process control when special measures are necessary to assure process quality of safety-related items. Controls shall be applied to activities such as crimping, soldering, welding, painting, cleaning and heat treating. Procedures shall specify qualifications of equipment and personnel required to perform the appropriate process control. Applicable codes, standards, specifications and personnel qualifications shall be documented.

3. Inspection and Corrective Actions

3.1 Inspection Program. An inspection program shall be established for safety related items or activities. The inspection program shall apply to construction, procurements, experiment equipment fabrication, and modifications that effect safety-related structures, systems, or components. Persons delegated to perform inspections shall not be the same person involved in the safety-related activity but may be from the same organization.

The inspection program will consist of written procedures that will include, as appropriate, procedures specifying characteristics to be inspected, acceptance criteria and inspection hold points.

Procedures should provide for identification of inspected and tested items. Provisions shall be made to clearly identify non conforming items from conforming items. In situations that inspections are not advantageous a description shall be provided for monitoring actions.

Procedures shall be written for in service inspections of safety-related structures, systems or components.

3.2 Test Program. A test program shall be established for safety-related items or activities. The test program shall apply to prototype qualifications, installation proofs and functional tests. Testing shall be performed in accordance with acceptance criteria derived from design or procurement documents.

The test program will consist of written procedures that will include, as appropriate, procedures that specify acceptance criteria, monitoring requirements, equipment required, personnel qualifications, environmental conditions, data acquisition, and documentation of results.

3.3 Measuring and Test Equipment. Measurement tools, gages, instruments, and other measuring or test devices that measure critical parameters of safety-related items shall be identified. Provisions for identified measuring and test devices shall include availability, adjustment, calibration and accuracy as required for each application. Test equipment will be identified.

3.4 Non-Conforming Material and Parts. Non-conforming materials and parts associated with safety-related structures, systems or components shall be identified. The disposition such as acceptance, repair, rework or rejection of parts from safety-related functions will be determined by the person responsible for document control. Repair or reworked parts will be removed or labeled until accepted. Rejected parts will be removed and labeled. The disposition of non conforming materials will be documented.

3.5 Corrective Action. Documentation of specified quality control or assurance documents shall provide evidence of quality of safety-related items. Significant deviations from acceptable quality, repeated quality problems or unresolved quality issues shall be noted and reported in writing to administrative management personnel. It should be recognized that a determination of a quality problem may be subjective and should include evaluation of the documented quality requirements relative to the impact on the safety-related nature of the item.

3.6 Experimental Equipment. Design, construction, modification, inspection, testing and maintenance of experimental equipment shall be subject to this quality assurance program to the extent that these activities are safety-related.

3.7 Replacements, Modifications, or Changes. Insofar as possible, the replacement, modification, or change to structures, systems or components with a safety-related function shall be documented as meeting the requirements of the original structure, system or component. Evaluation should establish a performance and reliability equivalent or exceeding the original.

4. Records and Audits

4.1 Quality Assurance Records. Records that document quality of safety-related items or activities are identified according to Table 3. The records identified consist of inspection and test results, quality assurance reviews, quality assurance procedures and engineering analysis in support of design modifications or changes. The records shall be retained with as-built drawings, manuals and other records of important facility and system information. The retention period is to be the life of the facility or system for most, if not all, safety-related items.

The retention period is indicative of the expectation that items which affect safety related to as TRIGA reactor are integrally related to the reactor, instrumentation and facility design and should persist for the system or facility life.

4.2 Audits. An audit shall be conducted to examine the records and function of the quality assurance program. Audits will occur within two years of the QA Program activities by designated persons that were not directly responsible for the audited functions. Written procedures, Table 4, for the audit will be considered part of the Quality Assurance Program. A report of the audit results, actions to resolve deficiencies and evaluation of the program will be made to a facility operations committee and university administrative management, and maintained with other Quality Assurance Program documents.

Table 4

QUALITY ASSURANCE PROGRAM
AUDIT PROCEDURES

1. Designate a person or persons responsible to perform the program audit.
2. Determine the date of the previous audit.
3. Review the Quality Assurance Program document.
4. Examine the list of safety-related items.
5. Note additions to the safety-related items.
6. Identify records applicable to additional items.
7. Determine the location of all indicated records.
8. Review records for abnormalities and completeness.
9. Prepare statement that evaluates functions of Quality Assurance Program.
10. Report findings of audit and program functions to operations committee and management.

Table 4

QUALITY ASSURANCE PROGRAM
AUDIT PROCEDURES

1.	Designate a person or persons responsible to perform the program audit.
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7.	Determine the location of all indicated records.
8.	Review records for abnormalities and completeness.
9.	Prepare statement that evaluates functions of Quality Assurance Program.
10.	Report findings of audit and program functions to operations committee and management.

References:

1. "Quality Assurance Requirements for Research Reactors", Nuclear Regulatory Guide 2.5 (77/05).

2. "Quality Assurance Program Requirements for Research Reactors", ANSI/ANS - 15.8 - 1976 (N402).

Example Quality Control Record

1.0 Title:

Item identification: _____

(designate A, B, C, ...) ____ (quality level 1, or 2) ____

Item description:

1.1 Participation:
(personnel and task assignments)

1.2 Documents:
(procedures applicable)

(special provisions)

Applicable Sections (#.#):

Section #.#:

Conditions:

Comments:

Dates:

Activity Initiated _____ Initial_____

Activity Accepted _____ Initial_____

Audit of Activities:

Review by _____ Date: _____

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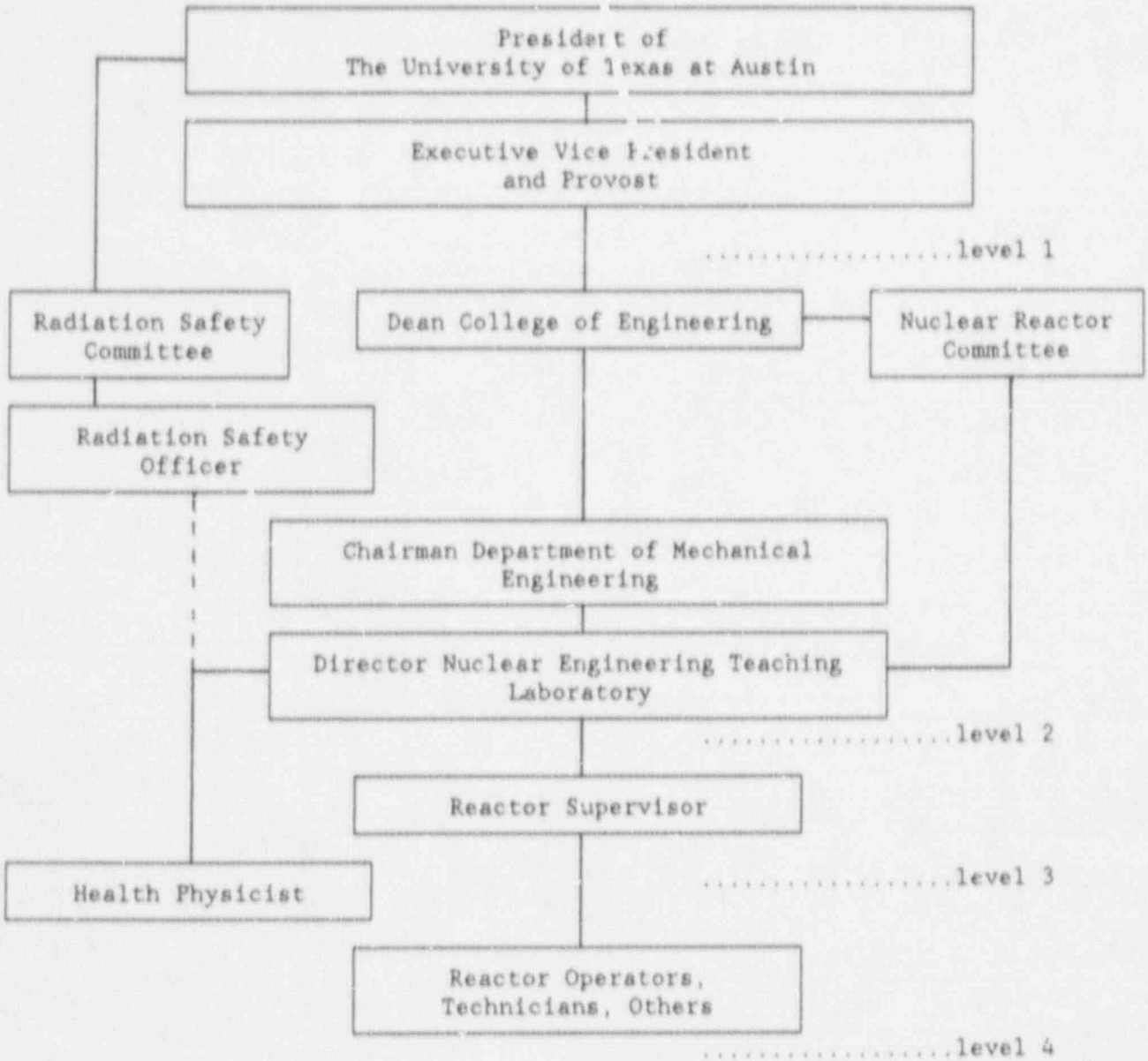
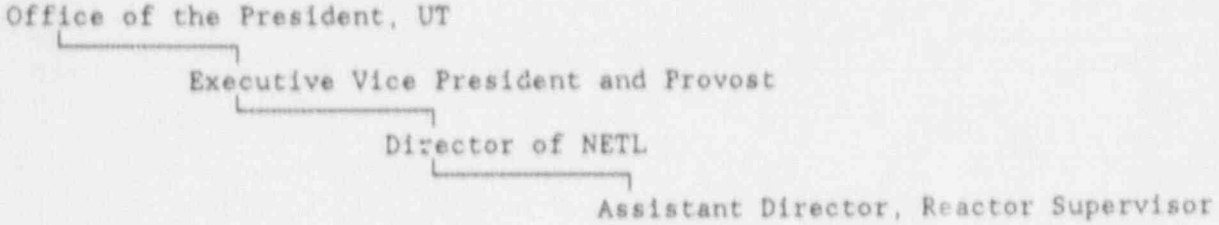


Administrative Organization



QUALITY ASSURANCE Line Organization
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1.2 Documents - applicable procedures or special measures

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2.1.2 Method of verification
2.1.3 Modifications proposed

2.2 Procurement Control

2.2.1 Codes, standards and regulations
2.2.2 Quality assurance specifications
2.2.3 Proposed changes enacted
2.2.4 Procurement conformance method

2.3 Document Control

2.4 Material Control

2.4.1 Special procedures required
2.4.2 Equipment required
2.4.3 Personnel qualifications

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The test program will consist of written procedures that will include, as appropriate, procedures that specify acceptance criteria, monitoring requirements, equipment required, personnel qualifications, environmental conditions, data acquisition, and documentation of results.

3.3 Measuring and Test Equipment. Measurement tools, gages, instruments, and other measuring or test devices that measure critical parameters of safety-related items shall be identified. Provisions for identified measuring and test devices shall include availability, adjustment, calibration and accuracy as required for each application. Test equipment will be identified.

3.4 Non-Conforming Material and Parts. Non-conforming materials and parts associated with safety-related structures, systems or components shall be identified. The disposition such as acceptance, repair, rework or rejection of parts from safety-related functions will be determined by the person responsible for document control. Repair or reworked parts will be removed or labeled until accepted. Rejected parts will be removed and labeled. The disposition of non conforming materials will be documented.

3.5 Corrective Action. Documentation of specified quality control or assurance documents shall provide evidence of quality of safety-related items. Significant deviations from acceptable quality, repeated quality problems or unresolved quality issues shall be noted and reported in writing to administrative management personnel. It should be recognized that a determination of a quality problem may be subjective and should include evaluation of the documented quality requirements relative to the impact on the safety-related nature of the item.

3.6 Experimental Equipment. Design, construction, modification, inspection, testing and maintenance of experimental equipment shall be subject to this quality assurance program to the extent that these activities are safety-related.

3.7 Replacements, Modifications, or Changes. Insofar as possible, the replacement, modification, or change to structures, systems or components with a safety-related function shall be documented as meeting the requirements of the original structure, system or component. Evaluation should establish a performance and reliability equivalent or exceeding the original.

4. Records and Audits

4.1 Quality Assurance Records. Records that document quality of safety-related items or activities are identified according to Table 3. The records identified consist of inspection and test results, quality assurance reviews, quality assurance procedures and engineering analysis in support of design modifications or changes. The records shall be retained with as-built drawings, manuals and other records of important facility and system information. The retention period is to be the life of the facility or system for most, if not all, safety-related items.

The retention period is indicative of the expectation that items which affect safety related to a TRIGA reactor are integrally related to the reactor, instrumentation and facility design and should persist for the system or facility life.

4.2 Audits. An audit shall be conducted to examine the records and function of the quality assurance program. Audits will occur within two years of the QA Program activities by designated persons that were not directly responsible for the audited functions. Written procedures, Table 4, for the audit will be considered part of the Quality Assurance Program. A report of the audit results, actions to resolve deficiencies and evaluation of the program will be made to a facility operations committee and university administrative management, and maintained with other Quality Assurance Program documents.

Table 4

QUALITY ASSURANCE PROGRAM
AUDIT PROCEDURES

1.	Designate a person or persons responsible to perform the program audit.
2.	Determine the date of the previous audit.
3.	Review the Quality Assurance Program document.
4.	Examine the list of safety-related items.
5.	Note additions to the safety-related items.
6.	Identify records applicable to additional items.
7.	Determine the location of all indicated records.
8.	Review records for abnormalities and completeness.
9.	Prepare statement that evaluates functions of Quality Assurance Program.
10.	Report findings of audit and program functions to operations committee and management.

References:

1. "Quality Assurance Requirements for Research Reactors", Nuclear Regulatory Guide 2.5 (77/05).

2. "Quality Assurance Program Requirements for Research Reactors", ANSI/ANS - 15.8 - 1976 (N402).

Example Quality Control Record

1.0 Title:

Item identification:_____

(designate A, B, C, ...) ____ (quality level 1, or 2) ____

Item description:

1.1 Participation:
(personnel and task assignments)

1.2 Documents:
(procedures applicable)

(special provisions)

Applicable Sections (#.#):

Section #.#:

Conditions:

Comments:

Dates:

Activity Initiated _____ Initial_____

Activity Accepted _____ Initial_____

Audit of Activities:

Review by _____ Date: _____