TOPICAL
XN-NF-1A, Rev. 3

Issue Date: 08/04/80

EXXON NUCLEAR COMPANY, INC.

QUALITY ASSURANCE PROGRAM

TOPICAL REPORT

FOR

NUCLEAR FUEL DESIGN AND FABRICATION

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUN 27 1980

Mr. J. A. Perry, Manager
Quality Assurance
Exxon Nuclear Company
P.O. Box 130
Richland, WA 99352

Dear Mr. Perry:

SUBJECT: NRC ACCEPTANCE OF REVISED EXXON NUCLEAR QUALITY ASSURANCE TOPICAL REPORT

The Perry/Haass letters of August 14, 1979 and January 25, 1980 submitted Revision 3 to Exxon Nuclear's topical report, XN-NF-1A, "Quality Assurance Program Topical Report for Nuclear Fuel Design and Fabrication," for staff review and approval. Revision 3 revises the topical report to reflect organizational changes, current design control and corrective action practices, and editorial changes.

Based on our review and evaluation of Revision 3, we find that all applicable requirements of Appendix B to 10 CFR Part 50 are included in the QA program requirements. Therefore, your revised topical report is acceptable, and you may implement it upon issuance of the revision. We do not intend to repeat our review of this topical report when it is referenced in an application.

To use the Exxon Nuclear topical report in future license applications, applicants need only reference this topical report in Chapter 17 of the Safety Analysis Report. In addition, this QA program may be implemented immediately on all ongoing activities. In this regard, identify in your transmittal letter those existing contracts that will be covered by Revision 3 to XN-NF-1A.

Should regulatory criteria or regulations change such that our conclusions about this topical report are invalidated, we will notify you. You will be given the opportunity to revise and resubmit it should you so desire. Programmatic changes by Exxon Nuclear to this topical report are to be submitted to NRC for review prior to implementation. Organizational changes are to be submitted no later than 30 days after announcement.

Please replace our letter of March 21, 1979 with a copy of this letter, renumber the report XN-NF-1A, Revision 3, and resubmit 35 copies of the revision to the NRC.

Should you have any questions regarding our review or if we can provide assistance, please feel free to contact Mr. James Conway on (301) 492-7741.

Sincerely,

Walter P. Haass

Walter P. Haass, Chief
Quality Assurance Branch
Division of Engineering

EXXON NUCLEAR CO., INC.
QA PROGRAM FOR
NUCLEAR FUEL DESIGN AND FABRICATION

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EXXON NUCLEAR COMPANY, INC.

QUALITY ASSURANCE PROGRAM

FOR

NUCLEAR FUEL DESIGN AND FABRICATION

Approved by: E R Astley — Vice President & Executive in Charge, Fuels Manufacturing — 1/11/80 Date

P. L. Bupp — Vice President & Executive in Charge, Engineering & Technology — 1/21/80 Date (3)

Concurred by: J. A. Perry — Manager, Quality Assurance — 1/10/80 Date

Prepared by: L L Davis — Manager, Quality Assurance - Nuclear Fuels — 1-10-80 Date

Summary of Changes:

1. Minor changes on pages 3.3 and 20.2 to provide compatibility with Design Control QA Procedure changes initiated to provide better control.

2. Minor change to page 4.1 to make text compatible with page 20.2.

3. Minor change to page 5.2 terminology.

4. Incorporation of the organizational changes announced in August, September and December of 1979.

5. Change to para. 16.2 to provide for more efficient investigation and reporting of significant incidents.

6. Minor editorial clarifications in paras 2.2, 2.5, 2.8, 3.2, 8.0 and 8.7.

7. Clarify paragraph 0.0 (Introduction), 2.1, and 5.1.1 to allow consistent application of QA program as required by reload contract commitments and letter of 4/16/79 to Walter P. Haass (NRC) from J.A. Perry (ENC), Subject: Quality Assurance Program Topical Report (XN-NF-1A).

8. Changed terminology in section 15 from "Deviating Material Report" to nonconformance report and deleted "DMR waivers" from Appendix I.

0.0 INTRODUCTION

The purpose of this document is to describe the elements of the Exxon Nuclear Company Quality Assurance Program which are applicable to the nuclear safety-related aspects of the design, procurement, and fabrication of nuclear fuel assemblies and their related parts and components and to show how these meet the quality assurance requirements of Title 10, Code of Federal Regulations, Part 50, Appendix B. 3

When this Topical Report is specified in a contract between Exxon Nuclear Company (ENC) and a utility customer the ENC Quality Assurance program will comply with the Regulatory Position in Regulatory Guides 1.28 (6/7/72), 1.38-Rev. 2 (5/77). 1.58 (8/73), 1.64-Rev. 2 (6/76), 1.74 (2/74), 1.88-Rev. 2 (10/76), and 1.123-Rev. 1 (7/77) as well as ANSI N45.2.12, Draft 3, Rev. 4 (2/22/74) as set forth in this Topical Report supplemented with the exceptions noted in Appendix II. 3

1.0 ORGANIZATION

1.1 Corporate Organization

Exxon Nuclear Company, Inc. is a subsidiary of Exxon Enterprises Inc., which is turn is a wholly owned subsidiary of Exxon Corporation. Exxon Nuclear Company, Inc., is incorporated in the State of Delaware and has its principal offices at 777-106th Avenue N.E., Bellevue, Washington 98009, with research/technology, reactor fuel manufacturing and engineering facilities at Richland, Washington.

1.2 Company Organization

Exxon Nuclear Company, Inc., hereafter referred to as Exxon Nuclear is responsible for the establishment and execution of the quality assurance program for the design, procurement, and fabrication of nuclear fuel assemblies and has established an organization, as shown in Figures 1 and 2 to meet this responsibility. The Vice President and Executive in Charge, Projects of Exxon Nuclear is responsible for the establishment and execution of the quality assurance program. The Quality Assurance Manager is responsible for the planning, preparation, development, and evaluation of the quality assurance program. This position reports to the Vice President and Executive in Charge, Projects and has the authority to identify quality problems, to initiate remedial action, and to verify implementation of corrective action.

The accountabilities and responsibilities of key individuals within Exxon Nuclear involved in the quality assurance program are shown in the matrix of Appendix I. Responsibilities of key individuals are as follows:

1.2.1 President & Chief Executive Officer

The President & Chief Executive Officer of Exxon Nuclear is responsible for establishing the Corporate Exxon Nuclear Quality Assurance Policy including goals and objectives and ensuring that Company operations are carried out in full compliance with that policy. He is responsible for assuring that all personnel in key positions are qualified to execute their assigned functions and responsibilities. Verification of conformance to established quality requirements for safety-related items is accomplished by individuals or groups who do not have direct responsibility for performing the work being verified.

The President & Chief Executive Officer's responsibilities include:

a) Establishing the Company's organization structure and defining the participating management roles; and

b) Providing adequate resources.

1.2.2 Vice President & Executive in Charge, Projects

The Vice President & Executive in Charge, Projects is a chief operating officer reporting to the President & Chief Executive Officer and has authority for the day-to-day conduct of the Company within the assigned areas of responsibility including fuel cycle services, Licensing and Quality Assurance. He shall ensure that Company operations in the assigned areas of responsibility are carried out in full compliance with established policies and guidelines. He is also responsible for producing the desired results within the allocated resources and for reporting of results to the President & Chief Executive Officer. 3 3

The principal responsibilities for Quality Assurance activities associated with fuel and related component design and fabrication and related operations include:

a) Formulating quality assurance requirements;

b) Auditing of the Quality Assurance Program and procedures used within Exxon Nuclear. Auditing functions are normally delegated to the Manager, Quality Assurance;

c) Ordering work stopped when the seriousness of a condition adverse tc quality or safety warrants such action in order to maintain the required quality or safety.

1.2.2.1 Manager, Quality Assurance

The Manager, Quality Assurance reports to the Vice President & Executive in Charge, Projects and is responsible for providing Quality Assurance program management for all Exxon Nuclear activities. The Manager, Quality Assurance is responsible for the overall establishment and execution of the Quality Assurance program for fuel and related component design and fabrication operations. He is charged with no direct product engineering or manufacturing responsibilities and is responsible for interpreting quality requirements, and for defining, developing, administering, executing, and auditing the Quality Assurance Program in accordance with quality requirements. He has detail responsibility for the implementation of the quality assurance related activities including stop work authority. In matters pertaining to Quality Assurance, he has direct lines of communication to the President & Chief Executive Officer and the Vice Presidents and Executives in Charge, Fuels Manufacturing, Engineering and Technology, and Marketing and Uranium Operations. 3

1.2.2.1.1 Manager, Quality Assurance - Nuclear Fuels

The Manager, Quality Assurance -Nuclear Fuels reports to the Quality Assurance Manager and is responsible for quality assurance activities related to Nuclear Fuels. His responsibilities include:

a) Preparing, interpreting, and administering Quality Assurance Procedures and Program documents specific to the Nuclear Fuels operations;

b) Assuring that Quality Assurance and Quality Control Procedures for fuel fabrication are consistent and workable with the overall Quality Assurance Program;

c) Ordering work stopped when the seriousness of a condition adverse to quality warrants such action in order to maintain the requisite quality;

d) Providing and executing an audit program, including followup audits, as required, of internal operations and vendor quality assurance programs to assure that quality, engineering, design, manufacturing, purchasing, and other related requirements are being met;

e) Providing indoctrination and training in Quality Assurance requirements and practices to promote the understanding of quality and quality requirements throughout the organization;

f) Interfacing with customers and government agencies on their audits of fuels and related component design and manufacturing activities;

g) Monitoring and conducting corrective action followup for quality assurance activities; and

h) Providing the necessary organization for carrying out the required Quality Assurance functions.

In matters pertaining to nuclear fuels Quality Assurance, he has direct lines of communication to the Vice Presidents & Executives in Charge, Fuels Manufacturing, Engineering and Technology, and Marketing and Uranium Operations. Reporting to the Manager, Quality Assurance as shown on Figure 2, is the Manager, Quality Assurance - Nuclear Fuels with detailed responsibility for assisting in the implementation of activities within the responsibility assigned to the Manager, Quality Assurance. 3

1.2.3 Vice President & Executive in Charge, Engineering and Technology 3

The Vice President and Executive in Charge, Engineering and Technology is a chief operating officer reporting to the President & Chief Executive Officer and has authority for the day-to-day conduct of the Company within assigned areas of responsibility including nuclear fuel design, research and related engineering functions or services. He shall ensure that Company operations in the assigned areas of responsibility are carried out in full compliance with established policies and guidelines. He is also responsible for producing the desired results within the allocated resources and for reporting of results to the President & Chief Executive Officer.

1.2.3.1 Manager, Nuclear Fuels Engineering

The Manager, Nuclear Fuels Engineering reports to the Vice President & Executive in Charge, Engineering and Technology and is responsible for fuel design and testing, development and specification of fuel fabrication processes, reactor core monitoring, fuel safety analysis, and fuel management. Specific responsibilities include: 3

a) Setting design approaches and policy;

b) Organizing product design and testing activities for effective implementation of design criteria and other technical requirements;

c) Implementing the design quality assurance requirements;

d) Ensuring that the factors affecting design (quality, technology, licensability, economics, customer requirements, fuel performance feedback, compatibility and fabricability) are adequately integrated into fuel designs;

e) Conducting design testing as needed to verify designs and components or safety and licensing aspects of designs;

f) Performing neutronic design and fuel management services;

g) Preparing design packages consisting of Parts Lists, Product and Material Specifications, and drawings, Design Test Authorizations and other related documents.

h) Coordinating with manufacturing regarding design adequacy and upgrading of designs;

i) Performing thermal-hydraulic design of fuel and translating the requirements into appropriate Product Specifications;

j) Performing fuel and reactor safety analysis, as required, related to fuel design;

k) Preparing Process Specifications, and related documents;

l) Designing, developing, and qualifying new processes and major process modifications;

m) onitoring adherence to Process Specifications, parameters, and qualification procedures;

n) Designing and evaluating process tests.

Reporting to the Manager, Nuclear Fuels Engineering are several Managers shown in Figure 1 with detailed responsibility for assisting in implementing the responsibilities assigned to the Manager, Nuclear Fuels Engineering.

1.2.4 Vice President & Executive in Charge, Fuels Manufacturing (3)

The Vice President and Executive in Charge, Fuels Manufacturing is a chief operating officer reporting to the President & Chief Executive Officer and has authority for the day-to-day conduct of the Company within the assigned areas of responsibility including manufacturing, quality control and purchasing for the nuclear fuel program. He shall ensure that Company operations in his assigned area of responsibility are carried out in full compliance with established policies and guidelines. He is also responsible for producing the desired results within the allocated resources and for reporting of results to the President & Chief Executive Officer. He is also the Contact Director for the ENC Board of Directors for the ENC subsidiary at Lingen, Germany, ENGmbH. (3)

1.2.4.1 Manager, Manufacturing - Richland

The Manager, Manufacturing - Richland reports to the Vice President & Executive in Charge, Fuels Manufacturing and is responsible for the overall management of the Exxon Nuclear fuels fabrication plant within the constraints imposed by the product, process, quality assurance, licensing, and safety requirements. In addition to UO2 Shop Operations, Machine Shop & Component Fabrication, Mixed Oxide and Specialty Fuels Operations, and Manufacturing Production Control, his responsibilities include the functions of quality control, manufacturing engineering, maintenance, document/records control, radiological safety, and security. (3)

In the context of quality assurance, he has the responsibility of ensuring that all manufacturing operations, especially those affecting product quality, are carried out in compliance with the Exxon Nuclear Quality Assurance Program. The Managers reporting to the Manager, Manufacturing - Richland are shown in Figure 1. (3)

1.2.4.1.1 Manager, Quality Control

The Manager, Quality Control reports to the Manager, Manufacturing and has the responsibility for implementing the Quality Assurance Program in the manufacturing process. The Manager, Quality Control is independent of the Manager, UO_2 Shop Operations, Component Fabrication and Machine Shop, MO and Specialty Fuels, and Manufacturing Engineering, thereby assuring independence in carrying out the functions of checking, inspecting, process surveillance, or otherwise verifying that the work has been performed satisfactorily and that the product conforms to specifications and process parameters. Specific responsibilities of the Manager, Quality Control include:

a) Developing and operating the Analytical Laboratory and Physical Testing Laboratory such that they are capable of meeting internal and customer requirements for analytical services and physical testing or, alternatively, securing and auditing outside service vendors;

b) Preparing the Quality Control Program relating to vendor inspection activities and off-site source surveillance;

c) Preparing receiving inspection, in-process and final inspection Quality Control Standards;

d) Preparing Technician Certification Standards and monitoring performance of related qualifications;

e) Administering the system of material, component, and production releases;

f) Performing receiving inspection, specified in-process, and final inspections, including non-destructive testing of components and products per issued Quality Control Standards.

g) Performing process control surveillance and follow-up;

h) Withholding from further processing any components, sub-assemblies, or fuel bundles whose quality is in question and/or to order work stopped when conditions adverse to quality exist;

i) Administering and maintaining the quality control records related to products; and

j) Administering and maintaining the inspection gauge calibration and control system.

Reporting to the Manager, Quality Control, as shown on Figure 2, are the Supervisor, Inspection; Supervisor, QC Engineering; Manager, Analytical Laboratories; and the Supervisor, Process Control with detailed responsibility for assisting in implementing the responsibilities assigned to the Manager, Quality Control.

1.2.4.1.2 Various Shop Operations Managers

The Managers, UO_2 Shop Operations, MO and Specialty Fuels, and Component Fabrication and Machine Shop (hereafter referred to as Shop Operations) report to the Manager, Manufacturing - Richland and are responsible for fuel manufacturing and related facilities including responsibilities for UO_2 and mixed oxide operations, machine shop operations, component fabrication, for executing the Quality Assurance Program related to their activities, and for completion of fabrication operations within established fabrication schedules. The Managers reporting to the Manager, Manufacturing - Richland are shown in Figure 1.

1.2.4.1.3 Manager, Auxiliary Operations

The Manager, Auxiliary Operations reports to the Manager, Manufacturing - Richland and is responsible for document control and related activities regarding implementation of the Quality Assurance Program.

1.2.4.1.4 Manager, Manufacturing Engineering

The Manager, Manufacturing Engineering reports to the Manager, Manufacturing and is responsible for the reliability of all process and facility equipment under the control of Manufacturing. This responsibility includes management of the Instrument Repetitive Maintenance Program and the development of non-destructive testing methods and equipment.

1.2.4.2 Manager, Purchasing and Logistics

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The Manager, Purchasing and Logistics reports to the Vice President & Executive in Charge, Fuels Manufacturing and is responsible for:

a) Preparing and executing Purchase Specifications which assure that materials and components are procured on schedule and comply with the applicable Product and Material Specifications and quality assurance requirements;

b) Assisting in the evaluation of vendors' capabilities;

c) Providing an interface between vendors and Exxon Nuclear;

d) Maintaining the approved vendor list;

e) Interfacing with other groups on purchased material, vendor schedules, quality and corrective action;

f) Maintaining storage facilities and services for purchased material and components; and

g) Shipping completed fuel assemblies and other material.

Reporting to the Manager, Materials and Purchasing are several Managers shown in Figure 1 with detail responsibility for assisting in implementing the responsibilities assigned to the Manager, Materials and Purchasing.

2.0 QUALITY ASSURANCE PROGRAM

The Exxon Nuclear Quality Assurance Program for Nuclear Fuel Design and Fabrication includes activities in the design, procurement, and fabrication of nuclear fuel assemblies. This quality assurance program applies specifically to the activities affecting the safety-related aspects of nuclear fuel assemblies. These activities include designing, purchasing, fabricating, and testing. The quality assurance program has been established to ensure the delivered nuclear fuel assemblies do not adversely affect the health and safety of the public. This is accomplished through conformance with the requirements of 10 CFR 50, Appendix B.

2.1 Related ANSI Standards & Regulatory Guides

The Exxon Nuclear Quality Assurance Program for Nuclear Fuel Design & Fabrication encompasses and satisfies the requirements of Appendix B to 10CFR 50, "Quality Assurance Criteria for Nuclear Power Plants," NRC Safety Guide 28, "Quality Assurance Program Requirements," and ANSI N45.2 (1971), "Quality Assurance Program for Nuclear Power Plants." Additionally, when specified in a contract between ENC and a utility customer, other related ANSI standards and Regulatory Guides are committed to by ENC on a contract by contract basis. The methodology for implementing these requirements is reflected in this QA Manual in general and more specifically in the QA Procedures and any supplements thereto. 3

2.2 Applicability to Fuel Assemblies, Parts & Components

The finished nuclear fuel assemblies furnished by Exxon Nuclear to utilities for their nuclear power plants are classified by utilities as being nuclear safety-related. Therefore, the applicable requirements of 10 CFR 50, Appendix B apply to the finished fuel assemblies.

In order to place the correct amount of emphasis on the more important characteristics of the various parts and components making up the final nuclear fuel assemblies, Exxon Nuclear has developed a system of classifying characteristics identified in the product and material specifications as critical, major or minor. The essential criteria for the classification is as follows: 3

Critical — A characteristic of a specification, inspection, test or defect, which if not properly controlled, could result in a reactor fuel failure. Such a defect, for example, is one that judgment and experience indicate is likely to prevent performance of the function of an end item such as fuel rod, fuel assembly, or fuel reload core. 3

Major — A characteristic of a specification, inspection, test or defect, other than critical, which if not properly controlled, could result in excessive costs, defect rates, rework, or delays in scheduled shipping dates. Such a defect, for example, is likely to reduce materially the usability of the product or an end item such as a fuel rod or fuel assembly.

Minor — A characteristic of a specification, inspection, test or defect, other than critical or major, which if not controlled, does not materially reduce the usability of the product or an end item such as a fuel rod for its intended purpose, or is a departure from established standards having no significant bearing on the effective use or operation of the unit, or affects the appearance in a minor degree where appearance is a significant characteristic.

Based on the above classification criteria, Exxon Nuclear's design and engineering personnel determine the proper classification of characteristics during the design process. These are identified in the Product and Material specifications. As a result of the assigned classification, the inspection and testing is then conducted in sufficient numbers to assure that the finished products meet the defined characteristics in relation to their assigned classification.

Only those characteristics classified as "critical" and which, if they should fail, could result in the release of radioactive material at the site boundary in excess of allowable limits are safety related and are subject to the requirements of 10 CFR 50, Appendix B. The characteristics classified as "major" or "minor" are not subject to these requirements. 1

2.3 Implementation of Quality Assurance Program

Implementation of the requirements of this Quality Assurance Program and related procedures, are considered to be normal practice in the design, fabrication, procurement, engineering, inspection, certifying, and shipping of the nuclear fuel and related products. If special projects are undertaken within Nuclear Fuels that are not subject to the requirements of 10 CFR 50, Appendix B and therefore do not require all the Quality Assurance system requirements and practices established by this document, a specific exemption may be made with the following contingencies:

1) A Special Project Authorization document is written to include necessary steps and requirements, including design, engineering, manufacturing, quality assurance, quality control, and purchasing; and

2) The Special Project Authorization shall be prepared and approved in accordance with Appendix I.

2.4 Policies, Procedures, and Instructions

The objective of the Quality Assurance Program is to provide nuclear fuel that will perform satisfactorily in service with a high assurance against failure or malfunction and without undue risk to the health and safety of the public. Compliance with the policies and procedures of the Exxon Nuclear QA manual is mandatory for personnel performing activities affecting the quality of the nuclear fuel. This is communicated to personnel through indoctrination sessions and distribution of the QA manual. When required, disputes involving quality are referred to the next higher level of management for resolution. The distribution of the QA Manual including revisions is controlled as described in Section 6.0 Document Control.

The Exxon Nuclear QA manual contains three parts as follows: Part I--Introduction, Part II--QA Program, and Part III--QA Procedures. 3

The Introduction, Part I, contains a brief description of the purpose, scope, implementation and control of the manual. The QA Program, Part II, contains a description of the program setting forth mandatory requirements, policies, and responsibilities. The QA Procedures, Part III, sets forth instructions governing the methods, practices, procedures, and controlled conditions to be employed by Exxon Nuclear in the implementation of the program. 3

Part II, QA Program, and Part III, QA Procedures, are signed off by members of Exxon Nuclear management as indicated on Appendix I. Control of the QA Manual and distribution of copies, including revisions, is the responsibility of the Manager, Quality Assurance -Nuclear Fuels. Internal QA audits are conducted to ascertain the effectiveness and proper implementation of the QA program.

2.5 Indoctrination and Training

Indoctrination and training of Exxon Nuclear personnel whose activities affect the quality of products and/or safety-related systems shall be provided. Both direct Quality Assurance training and specific job-related training or certification are conducted as necessary including retraining and/or recertification to assure that desired proficiency is maintained. Quality Assurance is responsible for conducting Quality Assurance Program and Procedure training. Managers are responsible for assuring that the personnel within their organizations attend the Quality Assurance training sessions and that they have the necessary training to perform their assigned jobs consistent with Quality Assurance Program requirements. 3

2.6 Qualification Requirements for Principal Quality Assurance and Quality Control Management Positions

2.6.1 The qualification requirements for the Manager, Quality Assurance are:

a) A bachelor's degree in a technical field;

b) At least ten years' experience in responsible management of technical or manufacturing activities in the nuclear field, five years of which have been in fields allied to nuclear quality assurance;

c) Knowledge of applicable quality - related codes, standards, and regulatory requirements; and

d) Thorough knowledge of the Exxon Nuclear Quality Assurance Program.

2.6.2 The qualification requirements for the Manager, Quality Assurance - Nuclear Fuels; and Manager, Quality Control are:

a) A bachelor's degree in a technical field;

b) At least six years' experience in responsible management of technical or manufacturing activities in the nuclear field, four years of which have been spent in quality related nuclear activities;

c) Knowledge of applicable quality - related codes, standards, and regulatory requirements; and

d) Thorough knowledge of the Exxon Nuclear Quality Assurance Program.

2.7 Management Reviews

Review of the scope, status, implementation, and effectiveness of the Quality Assurance Program to assure that the program is adequate and complies with 10 CFR 50, Appendix B criteria is conducted by management for the portion for which they have designated responsibilities. These reviews are conducted on an annual basis where major changes have been made, and at a minimum of once every two calendar years. These reviews will be performed on a unique design or project, if possible. The reviews may consist of third-party audits, which are conducted at the direction of the Vice President and Executive in Charge, Projects or his designee.

2.8 Revisions

This Quality Assurance Program document is to be reviewed each calendar year and revised if the need exists. The Manager, Quality Assurance - Nuclear Fuels is responsible for soliciting comments each calendar year from Fuels Manufacturing and Nuclear Fuels Engineering Department Managers on proposed changes. As substantive (including organizational) changes to the Quality Assurance program are identified, they will be reflected in a revision to this program document. New or revised Quality Assurance Program requirements are to be implemented within 90 days following issue unless additional time is approved by the Manager, Quality Assurance - Nuclear Fuels. (3)

The NRC will be notified of programatic changes (except for those that are editorial in nature) to this Topical Report prior to implementation of such changes. Notification is not a prerequisite to approval, but must occur prior to document issuance. The NRC will also be notified of changes in the organization displayed in Figures 1 and 2 within 30 days following announcement of such change.

3.0 Design Control

Quality assurance for design includes assuring that design activities are carried out in a planned, controlled, and correct manner. It also includes design document control, independent verification of calculations, design testing, and auditing with appropriate corrective action to assure that the design program is functioning as planned.

Design of fuel assemblies and related components and the preparation of design documents are performed in accordance with approved procedures and techniques. Customer requirements contained in Design Criteria are translated into Material Specifications, Product Specifications, and drawings. Wherever practical and applicable, industry standards and specifications (e.g., ASTM) are utilized in design specifications for suitable materials, parts, equipment, and processes. Approved Product or Material Specifications are required to procure or fabricate materials or components for the nuclear fuel manufacturing process.

3.1 Design Planning and Implementation

Overall design planning includes providing a schedule for work completion and identifies the responsibilities for the various phases of design. Where applicable, schedules include tasks, milestones, and control points relating to the design.

Factors included in typical design planning, implementation and, evaluation are:

a) Compatability with reactor and remaining fuel;

b) Reactor physics, stress, thermal-hydraulic, and accident analyses;

c) Optimum balance in fuel enrichment, life, and power costs;

d) Choice and compatability of materials and suitability for use of standardized materials, parts, and equipment or those which have been used previously for similar applications;

e) Choice of physical parameters;

f) Mechanical stability under service;

g) Licensability; and

h) Choice of design methodology.

3.2 Design Documentation

3.2.1 Design Criteria

Design Criteria are prepared which are consistent with the principal technical requirements and needs of the customer as reflected by the contract with Exxon Nuclear and with applicable regulatory requirements. Design Criteria are approved in accordance with Appendix I. 3

3.2.2 Parts List

The design of production fuel, lead assemblies, "Proof of Fabrication", or special "In-reactor Performance Evaluations" are defined by a Parts List which displays by number and revision all Product Specifications, Material Specifications, and drawings required to define the product. The Parts List is the sole authoritative definition of the product. Partial Parts Lists which do not include all fuel bundle components may be issued prior to approval of the complete Parts Lists in order to expedite procurement or fabrication of materials and components for which the design has been completed.

Product Specifications, Material Specifications, and the Parts List are approved in accordance with Appendix I. 3

3.3 Design Interfaces

Interfaces among participating organizations within Exxon Nuclear are defined in Appendix I for preparation and approval of design documents. Additional interfaces are defined in design control quality assurance procedures.

3.4 Design Change Control

Major design changes require approval in accordance with the original document. If those required to accept or approve are unable to achieve a unanimous agreement, the items of disagreement are referred to the next higher level of management until resolved.

Minor design changes require approval as indicated in Appendix I. However, any one of these signers may, at his option, call for approval of the change as a major change.

3.5 Design Verification

The adequacy of product designs may be verified in several ways, including in-reactor experience of similiar design, performance of design reviews, alternate calculations, or design testing. The depth of design reviews and verifications depend upon the complexity and end use of the item. The individuals responsible for performing design verification activities should include persons other than those who performed the original design. Use of the designer engineer's subsection manager for design verification is restricted to special situations where the subsection manager is the only individual within the design organization competent to perform the verification. Design verification activities are performed in accordance with design quality assurance procedures.

3.5.1 Design Reviews

Reviews of fuel designs and related documentation are performed to determine adequacy of the design, to assure that design parameters can be controlled during manufacture, and that design features can be inspected and tested and that inspection and test criteria are identified. Approval of the design is signified by signature on the applicable design documents.

Additionally for new designs or significant changes to previous designs, a final design review is conducted by the authorities identified in Appendix I prior to the initiation of fuel fabrication. (3)

3.5.2 Alternate Calculations

Verification of some types of calculations or analyses may be achieved by comparison with alternate methods of calculation or analyses. When performed, these alternate calculations are performed by persons other than those who performed the original calculation and serve to verify the correctness of the original calculation. Alternate calculations may employ a more simplified approach or be less rigorous and the results may not exactly check with the original calculation, however they must provide results consistent with the original calculation or analyses. The alternate calculation will also address the appropriateness of assumptions, input data, and the code or other calculation used.

3.5.3 Design Testing

Test programs utilized to verify design adequacy are conducted under design conditions sufficient to demonstrate that the item will withstand in-service use. Design tests are approved and controlled in accordance with design control quality assurance procedures. Existing data from tests of previous designs may be valid for current designs provided the designs are adequately similar. In such cases new testing may not be required.

3.6 Document and Records Control

Reproducible copies of design documents (Design Criteria, Product Specifications, Material Specifications and drawings) and revisions thereto are maintained in the Document Control Central Files as discussed in Section 6.0. Documents are controlled in accordance with Quality Assurance document control procedures.

3.7 Customer-Supplied Designs

Exception is made to the normal requirements for design control to accomodate instances in which the fuel design is supplied by the customer. Design requirements applicable to the following areas, as determined by the scope of work and contract, may be deemed not applicable:

1) Preparation and review of Design Criteria, Product Specifications, Material Specifications and drawings;

2) Design reviews;

3) Calculational checks; and

4) Design testing.

In such instances, approval of the Parts List constitutes approval of the design package by affected organizational components.

4.0 PROCUREMENT DOCUMENT CONTROL

Procedural controls are established to assure that applicable regulatory requirements, design bases, fabrication requirements, and other requirements are included or referenced in procurement documents for material, equipment, and services.

4.1 Purchase Specifications

Design requirements set forth in approved Product Specifications, Material Specifications, and drawings are transferred into Purchase Specifications by Purchasing and Logistics. Additionally, the Purchase Specifications must be technically compatible with approved Quality Control Standards, Process Specifications, and Quality Assurance requirements. Purchase Specifications are prepared and approved as indicated in Appendix I. Acceptance by the Manager, Quality Control is intended to assure that quality requirements are adequate, correctly stated, and are controllable. (3) (3)

4.2 Content of Purchase Specifications

Purchase Specifications for the purchase of material, equipment, and services include or reference the following provisions as applicable:

a) A statement of work to be performed;

b) Technical requirements regarding specific drawings, specifications, codes, regulations, procedures, or instructions including test and inspection requirements and special process instructions;

c) Quality assurance program requirements, including applicable requirements of 10 CFR 50, Appendix B;

d) Submittal of Vendor's Quality Assurance Program (manual) and access to the vendor's QA/QC procedures;

e) Standard clauses for access to their plant and records, performance of source inspection, and auditing their QA system and those of their subvendors;

f) Identification of documentation required to be submitted, including quality assurance records, for information, review, or approval of the purchaser;

g) Retention and disposition requirements of quality assurance records not delivered to the purchaser;

h) Submittal of Process Outline and QC Inspection Plan to the Purchaser, including process hold points;

i) Requirements for control and approval of vendor nonconformances;

j) Source inspection requirements; and

k) Requirements for extension of applicable quality assurance requirements to subtier procurements.

Suppliers of "off-the-shelf" items are exempt from many of the provisions listed above. The need for specific provisions is evaluated on an individual basis at the time the Purchase Specification is prepared and reviewed.

4.3 Control of Contract Changes with Vendors

The procurement documents state the controls which will exist between Exxon Nuclear Company and vendors in requesting and accepting changes in the purchase contracts, changes in product or service specified including revisions of design and specifications, changes in processes used, and, where applicable, changes in sources of supply and/or subcontractors.

Changes to Purchase Specifications, drawings and quality assurance program requirements for product components and materials are reviewed and approved by the same authorities reviewing and approving the original documents in accordance with Appendix I.

Exxon Nuclear acceptance of vendor-supplied material known to be nonconforming to procurement documents requires an approved Variance Report. Nonconforming material shipped to Exxon Nuclear is identified as nonconforming by the supplier. 

5.0 INSTRUCTIONS, PROCEDURES & DRAWINGS

The Quality Assurance Program and associated quality - related design, procurement, manufacturing, inspection, handling, and shipping activities are prescribed by documented instructions, procedures, and drawings, as appropriate, to assure adequate definition of and instruction for satisfactory completion of activities. The instructions, procedures, and drawings include qualitative and quantitative acceptance criteria to verify that important activities have been satisfactorily accomplished.

5.1 Quality Assurance and Quality Control Documents

5.1.1 Exxon Nuclear Quality Assurance Program described herein establishes the fuel manufacturing quality system which inter-relates with design, process, manufacturing, procurement, and customer requirements to assure that the quality related work elements are identified and controlled.

The various types of documents addressing fuel design, procurement, and manufacturing activities and associated responsibilities for preparation, concurrance, and approval are shown in Appendix I. Provisions for the preparation, approval and control of instructions, procedures, and drawings are discussed in Section 6. Quality Assurance Program documents, which specifically address the requirements of 10 CFR 50 Appendix B and Regulatory Guides, (as deemed applicable per Appendix II) are indicated in Appendix III. 3

5.1.2 Quality Assurance Procedures listed in Appendix III provide instructions for carrying out Quality Assurance Program requirements.

5.1.3 Quality Control Procedures provide written inspection instructions and techniques, non-destructive testing procedures, equipment operating procedures, and other Quality Control methodology employed to implement the Quality Control Standards and the Quality Control portion of the Quality Assurance Program requirements.

5.1.4 Quality Control Standards identify the Quality Control requirements and methods for assuring conformance to the Process and Product Specifications for each step of the manufacturing process, including receiving inspections, releases to manufacturing, in-process inspection steps and hold points, final inspections, and shipment to the customer.

5.1.5 Analytical Procedures are testing and operating procedures written for use in the analytical laboratories.

5.1.6 Metallurgical Procedures are operating procedures for the physical and metallurgical testing of samples.

5.2 Product Definition

5.2.1 Design Criteria combine contract, regulatory, and Exxon Nuclear imposed requirements which unite technical, material choice, economic, Quality Assurance, and compatibility factors, and serve as the basis for product design.

5.2.2 Design Reports provide the final expression of the design combining relevant factors such as contract requirements, reactor compatibility, Design Criteria, product life and warranties, applicable codes and standards, choice of materials, reactor safety and licensability, inspectability, and product quality. 3

5.2.3 Material Specifications, Product Specifications and Drawings identify the "end function" requirements for product components and final product. They serve as the basis for Purchase Specifications, Process Specifications, and Quality Control Standards and must meet the requirements of the Design Criteria. The Product and Material Specifications establish limiting physical and chemical properties of materials and related products. The Parts List identifies the specific Product and Material Specifications and drawings applicable to a particular reload and thus constitutes the authoritative definition of the product. Product Specifications include the required characteristics and the standards or tolerances applicable to each part and a classification of characteristics as to importance. This "importance" statement (critical, major, or minor) establishes the basis for inspection and testing requirements.

5.3 Process Definition

5.3.1 Process Specifications establish the step-by-step requirements for manufacturing the product and also provide an indirect means of specifying product quality. Conformance to Process Specifications is also indirect evidence of conformance to Product Specifications.

5.4 Procurement

5.4.1 Purchase Specifications serve as the actual purchase documents and encompass technical requirements identified in approved Product and Material Specifications, Process Specifications, Quality Control Standards, and Appropriation Requests. Purchase Specifications also specify necessary quality assurance certification and inspection and test requirements to assure receipt of acceptable quality material or services.

5.4.2 Vendor Quality Assurance Requirements establish the Quality Assurance requirements of a vendor and his subvendors to assure there is objective evidence that they have in effect a quality assurance program capable of conforming to the Purchase Specifications. Routine assessment of vendor's control of quality is established at intervals consistent with the importance, complexity, and quality of the product or service.

5.4.3 Purchase Orders establish the legal contract between the vendor and Exxon Nuclear. Included in Purchase Orders are the Purchase Specifications, quality requirements, quantity, terms and conditions, and other procurement requirements.

5.5 Manufacturing

5.5.1 Operator Certification Standards for Special Processes specify the qualification procedures, training, and certification examination requirements for those personnel to be qualified for work in the special processes of welding, ultrasonic testing, dye penetrant, gamma scanning of fuel rods, helium leak testing, and radiography.

5.6 Fuel Performance

5.6.1 Performance Evaluations examine product performance from in-reactor tests, post-irradiation data and ex-reactor tests and data.

5.6.2 Failure Analyses provide for the detailed evaluation of any fuel failure with specific emphasis on comparing pre-and post-irradiation physical measurements, reactor operating transients, fuel management, and any other specific observations that will assist in isolating the specific failure mechanism.

6.0 Document Control

Document Control is required to assure that documents (which include drawings by definition) affecting quality and revisions thereto include appropriate quality requirements and are identified, reviewed for adequacy, approved for release by authorized personnel, and properly distributed, stored, recalled and disposed of. Document Control requirements are defined in Quality Assurance Procedures.

6.1 Procedure for Document Identification & Control

The Document Identification and Control Procedure provides for identification, review, approval, and control of fuel fabrication product line documents issued by Exxon Nuclear. This includes preparation and revision, review and comment, approval, distribution, and storage of documents, which affect quality, or are controlled for other reasons.

6.2 Controlled Documents

Controlled documents are defined as documents which either contain information which must be periodically updated or replaced to maintain accuracy, or which contain information which is intended for limited distribution because of its nature. The instructions, procedures, specifications, standards, drawings (tracings and reproductions), reports, manuals (such as QA Manuals), and other materials, which define the nuclear fuel product line, or affect fuel quality are controlled documents.

6.3 Responsibilities

The originator of a document is responsible for the preparation of the document in accordance with document identification and format requirements, obtaining required reviews and approvals, determining the original distribution list, and revising, as necessary. Document Control is responsible for issuance and distribution of documents and revisions including retention of file copies in accordance with the Document Identification and Control Procedure.

6.4 Control of Document Generation and Issuance

Document Control assigns numbers for documents upon request, maintains distribution lists of controlled documents, issues copies of approved documents and revisions and maintains file copies. Approved changes to documents are included in documents prior to implementation of the change and commencement of work. Document Control is responsible for physically entering the revisions in the Shop Operation and Quality Control copies used for fabrication; however, individual groups may

physically enter the revisions in these copies subject to controls described in quality assurance procedures.

Documents and revisions to off-site holders are mailed with instructions for insertion into the document. Recipients of controlled documents and revisions acknowledge receipt in writing.

6.5 Special Control Provisions

In order to avoid the unnecessary shutdown of key shop operations, Quality Assurance Procedures provide for the distribution of "advanced copies" and "emergency document revisions." Copies of fully approved documents may be distributed in advance of the normal distribution ("advance copies") provided they are identified and controlled per the applicable Quality Assurance Procedure. Minor emergency revisions to documents may be approved by a limited number of signatures, provided the change is for a limited time and the documents are approved and controlled per the applicable Quality Assurance Procedure governing emergency document revisions.

6.6 Document Indices

Indices for specific project documents, which includes several specifications, drawings, or procedures, serve as the controlling identification of documents applicable to a project. They are up-dated to indicate the applicable documents and revisions included and are approved each time a specification, drawing, procedure, or drawing contained therein is added, deleted, or revised. These specific project documents include:

a) Parts List;

b) Process Specifications;

c) Quality Control Standards.

6.7 Approval of Changes

Major revisions to previously approved and issued documents require the same approvals as the original document as shown in Appendix I.

Minor changes to documents are changes which involve minor corrections or clarifications with no serious impact on cost, schedule, quality, or safety. Changes are considered major if any of the signators of the change to the document so indicate. Minor changes are prepared, concurred, and approved in accordance with Appendix I. 

6.8 Temporary Deviations

Temporary Deviations from procedures or instructions may be approved, provided the following conditions are met:

a) The Temporary Deviations are not used for deleting license requirements and do not decrease assurance of product quality;

b) The Temporary Deviation or addition is approved by the Manager, Quality Assurance - Nuclear Fuels and the responsible manager; e.g., deviation from design control requirements requires approval by the Manager of Quality Assurance - Nuclear Fuels and Manager of Nuclear Fuels Engineering; 3

c) The Temporary Deviation is documented prior to use and a description of the change is distributed to all affected individuals and to signators of the original document. Any one of the individuals who signed the original document may ask for a full review of the change; and

d) The Temporary Deviation includes the effective dates, not to exceed 30 days.

7.0 CONTROL OF PURCHASED MATERIAL, EQUIPMENT, & SERVICES

Exxon Nuclear maintains a program for the control of purchased material, equipment, and services consistent with the importance, complexity, and quantity of the product or services. Exxon Nuclear delegates to fuel component vendors the task of establishing and executing quality assurance subprograms, but retains responsibility for overall program effectiveness. Quality assurance programs established by vendors are approved by Exxon Nuclear. To assure that purchased material, equipment, and services conform to Purchase Specifications, evaluations of vendors' capabilities are made by Purchasing and Logistics, Quality Assurance, and Quality Control. (3)

7.1 Vendor Evaluation

The selection of vendors is based on evaluation of their capability to provide items or services in accordance with procurement requirements. Determination of vendor capability involves an integrated evaluation by Purchasing and Logistics, Quality Assurance, and Quality Control or some combination of these, based upon the classification and complexity of the item or service being procured. Results of vendor evaluations are documented and filed. Evaluation of vendor sources include any one or combination of the following methods: (3)

a) Evaluating the vendor's history of providing a quality product based on analysis of vendor survey records, audit reports, or other appropriate methods;

b) Evaluating vendor's current quality records including the vendor's QA program, manual, and procedures, as appropriate; and

c) Performing pre-award surveys at the vendor's plant to determine current capability to satisfy procurement document requirements.

Prior to qualification of vendors who supply major components used in either production fuel or poison assemblies, a source evaluation is conducted to assure that the vendor maintains a Quality Assurance program and organization and that he can effectively demonstrate the controls within his own plant and those of his subvendors to provide the quality that is required. In addition, their technical capabilities and adequacy of facilities are surveyed. Vendors may also be required to demonstrate qualification by production of acceptable products.

7.2 Vendor Audits

Vendor Quality Assurance system audits are conducted by the Manager, Quality Assurance - Nuclear Fuels or his designee. These audits are performed in accordance with the Quality Assurance Audit Procedure and are conducted based on vendor activity and required quality. For major components (i.e., cladding, tie plates, spacer components, poison pel-

lets, zircaloy), these audits are normally conducted once each calendar year when the vendor is active. Audit results written by the auditing organization are transmitted to the vendor in writing by Quality Assurance-NF requesting formal corrective action response to deficiencies. 3

7.3 Vendor Source Surveillance

Vendor product source surveillance is conducted by Quality Control, in accordance with written procedures, to assure the purchase order requirements are being met. These activities may be delegated to Quality Assurance by the Manager, Quality Control. The frequency depends on vendor activity, vendor quality experience, importance of the components, ability to verify conformance to quality requirements upon receipt of product, and the receiving inspections to be performed. Product source surveillance is normally conducted at least once each year when the vendor is supplying major components. If possible, the surveillance is conducted either while the material is being fabricated or inspected and tested. Product source surveillance may be performed in conjunction with audits of the vendor's quality assurance program.

7.4 Approved Vendor List

An approved vendor list is prepared and maintained by the Manager, Purchasing and Logistics and approved as indicated in Appendix I. A vendor may be added to the list if he meets the qualification requirements as specified in the Vendor Qualification and Audit Program, including adequate Quality Assurance and Quality Control requirements as determined by the Managers of Quality Assurance - Nuclear Fuels and Quality Control, respectively. A vendor may be dropped from the Approved Vendor List at any time by request from any one of the Managers of Purchasing and Logistics, Quality Assurance - Nuclear Fuels, or Quality Control. Bid proposals may be withheld from vendors not demonstrating adequate capability. As a minimum, the Approved Vendor List is reviewed and re-issued with approvals once a year. 3 3

7.5 Purchase Order Releases

Purchase Specifications are part of the Purchase Order issued by the Manager, Purchasing and Logistics and are approved in accordance with Appendix I. Order placement is based on assurance gained from past experience that the vendor has implemented an acceptable Quality Assurance Program or is capable of implementing one (if not a previous vendor) and has or is capable of routinely maintaining the quality requirements of the product. In addition, a Purchase Order release is required and approved in accordance with Appendix I prior to initial order placement. This release is based on assurance that the purchase order is being released to an approved vendor and that it contains or references the appropriate technical, regulatory, and quality requirements. Repeat orders to the same qualified vendor for hardware which 3

will be produced using the same process and which do not contain substantive changes in quality, technical or regulatory requirements affecting product critical characteristics may not require a purchase order release.

7.6 Purchased Material Receipt Inspection and Release

Purchased material is received by Purchasing and Logistics, identified, tagged, and stored in accordance with Material Instructions and other quality assurance procedure requirements. Vendor Certifications are required for fuel product line related procured components and materials. Purchased material is inspected by Quality Control in accordance with Quality Control Standards and is returned to Purchasing and Logistics for storage and physical release to the shop. Nonconforming material is segregated and controlled in accordance with written procedures. Quality Control reviews Vendor certifications, records and receiving inspection results and releases material in accordance with Quality Control procedures. Continuing assessment of the effectiveness of vendors control of quality is conducted by reviewing incoming product quality during the release process. (3) (3)

7.7 Control of Vendor Nonconforming Items

Items known to be nonconforming to Exxon Nuclear purchase requirements are not shipped to Exxon Nuclear without prior approval. Allowable rework or repair operations are either specifically identified in procurement documents or are approved by Exxon Nuclear prior to commencement of the operations.

7.8 Records

Certification and receiving inspection records are maintained in accordance with Section 17.

8.0 IDENTIFICATION AND CONTROL OF MATERIALS, PARTS, AND COMPONENTS

Measures are established to assure that materials, components, subassemblies, and assemblies are adequately identified to allow traceability to purchase documentation, manufacturing documents, and nonconforming material reports. These measures are also established to prevent the use of incorrect or defective items. 3

8.1 Identification

Quality Assurance, Quality Control, and Standard Operating Procedures are established to assure control of product or process materials and to maintain traceability of vendor produced characteristics from receipt of material to final shipment. The procedures require that identification is maintained either on the item or on the records traceable to the item. Stamping, tags, labels, and lot follower cards are the normal means of identification. In instances where the identification is located on the item, the location and method of inspection are such that the function, fit and quality of the item is not adversely affected. 3

8.2 Controls

Physical identification requirements for materials, components, fuel rods, and fuel bundles, when applicable, originate in the design stage with specific identification and lot definition requirements set forth in the specifications and drawings. 3

At receiving, lot cards are attached to product components and material which indicate date of receipt, vendor, the reference Purchase Order number, and lot number. Quality Control verifies the correct identification and certification of the items. If the item passes receiving inspections, Quality Control assigns a release number to the item and indicates acceptance of the item on the lot card. The lot card remains with the item until used. The release number is then transferred to a follower card system, which assures traceability of identification throughout the manufacturing process. Specific follower cards are used in fuel and poison element, spacer, and the fuel bundle assembly processes. When items from several lots are assembled, the release numbers are recorded on the follower card, which provides traceability to the individual released lots of material. The follower card is checked at the final certification operation for completeness; it identifies the cards which constitute a manufacturing history of the fuel element, including the date it passed key manufacturing steps and the identification of the operator or inspector doing the work. 3

Preceeding steps are required to be signed off as completed on the follower card before the next step can begin, except as specifically waived by approved conditional releases or out of sequence operations as defined in the Quality Control Standards.

The Manager, Quality Control is responsible for controlling the use of the hold and follower cards and inspection data forms. The Managers, Manufacturing - Richland and Purchasing and Logistics are responsible for controlling the flow of material as specified in the Quality Assurance Procedures, Process Specifications, Quality Control Standards, Shop Operating Procedures, and Material Instructions and for controlling the proper use of the hold and follower cards as well as other data forms which are part of the record package. 3

8.3 Conditional Releases

Conditional releases of material beyond designated process Quality Control hold points may be initiated by completion of a Conditional Release which is requested by Shop Operations, prepared by Quality Control, and approved in accordance with Appendix I. The purpose of a Conditional Release is to facilitate continued processing when the required analyses or overchecks have not been completed and still assure physical identity and control of material in order to be able to reject, segregate, or otherwise disposition the affected material should the analyses or overchecks be unacceptable. Any conditionally released material is required to be identified until full release of the material is granted or other disposition is directed. Conditional releases are not to be used to waive Process or Product Specification requirements.

8.4 Confirmation of Material Identification and Control From Inspection Records

A comprehensive system of inspection records is maintained to assure that material identification, inspection status, and fabrication status are explicitly identified, including:

a) Vendor inspection and test data and certification;

b) Results of test and inspections obtained onsite (both receiving inspection and final inspections);

c) Releases of material;

d) Status and disposition of "hold", nonconforming", or "reject" items; and

e) Follower cards.

8.5 Loss of Identification

Any material, component, subassembly, or assembly which loses its identification is considered nonconforming until such time as the identity can be established or the item is dispositioned by the Control of Nonconforming Items procedure. 3

8.6 Control of Prohibited Material

Controls are established to assure that materials detrimental to fuel performance are not used. The measures include control of essential material purchases and evaluation of the process via appropriate analyses, as required to assure that adequate control is maintained over the use of such materials.

8.7 Enrichment Control

Measures are established to assure that nuclear materials of varying enrichment and form are positively identified and physically segregated as required to assure no inadvertant intermixing of enrichment or forms. These measures include, as appropriate, identification of storage and processing containers, enrichment marks on pellets and rods, gamma scanning of powder and pellets, analytical examinations, in-process inspections, cleanouts of processing equipment between enrichments, administrative controls on the handling of materials, and audits of processing and product. 3

8.8 Nonconforming Material

Control of nonconforming material is addressed in Section 15.

8.9 Situations Requiring Special Controls

In addition to other required documentation, special follower cards are prepared by the Manager, Quality Control for those rework or repair situations requiring special control in areas where Manufacturing has responsibility for control. These situations include, but are not limited to rework or repair operations of a nature involving more than two process and/or inspection steps performed in a sequence different from the normal process flow diagram for the material being processed. Special followers may consist of portions of standard follower cards.

9.0 Control of Special Processes

Controls over manufacturing and inspection processes are implemented to an extent consistent with process complexity and importance to product quality and safety. These controls assure that equipment and procedures are adequately evaluated and personnel are adequately qualified to perform their assigned tasks.

9.1 Special Processes and Tests

Special processes and tests applicable to fuels manufacturing operations are welding, liquid penetrant, radiography, helium leak, ultrasonic testing, and gamma scanning. These special processes and tests are subject to the following general criteria, as required by supplementary procedures:

a) Qualified operators are used;

b) Qualification of operators are documented;

c) Special process qualification procedures are reviewed and approved;

d) Practices are consistent with approved procedures and appropriate codes and standards related to fuel product line fabrication;

e) Test results are reviewed, validated, and documented;

f) Records of test results and qualifications are maintained; and

g) Controls are provided to assure that personnel qualification records are regularly reviewed and appropriate requirements for requalification are implemented.

9.2 Welding Qualification

Weld qualification procedures are included as part of the Process Specifications, which define qualification requirements for the process parameters, equipment, and operator, including number of welds required, inspection and testing requirements, and acceptance criteria. Operators are certified in accordance with the Process Specifications, Weld Procedures, and the Operator Certification Standards for Special Processes. Approval of the qualification results are in accordance with Appendix I.

9.3 Special Inspection

Liquid penetrant, radiography, helium leak, ultrasonic testing, and gamma scanning are controlled by written operating procedures

and operator qualifications. Operators successfully completing the qualifications are certified in accordance with the Operator Certification Standards for Special Processes.

9.4 Certification Records

Evidence that special processes are performed by qualified personnel exists in the form of follower cards and inspection report signoffs which are traceable to certification records. Qualification and Certification records are part of the Quality Control records and are maintained in accordance with Section 17.

10.0 Inspection

Inspections performed for the purpose of certifying acceptance of items to critical product and process requirements are performed using approved procedures and by personnel who are independent of the activities being inspected. Inspectors report to Quality Control supervisors who are not responsible for fabrication of the work being inspected. 2

10.1 Standards and Procedures

Quality Control Standards are prepared for receiving, in-process, and final inspections which identify the inspection requirements and associated means of assuring conformance to the Product Specifications, Material Specifications, Process Specifications, and drawings. The Standards are supplemented by Quality Control Procedures, Analytical Procedures, Metallurgical Procedures, Product, Material and Process Specifications, drawings, follower cards, inspection forms, and other documents, as required, during the inspections. In-process inspection and Process specifications and their supporting documentation include indirect control by monitoring processing methods, equipment and personnel where direct inspection is not practicable. The Standards or supporting documentation include the following information, where applicable:

a) Identification of the item to be inspected and the individuals or groups responsible for performing the inspection;

b) Equipment and/or method to be used, as appropriate for the inspection or analysis;

c) Prerequisites to be satisfied prior to the inspection, including operator qualifications and equipment calibration checks; and

d) Acceptance and rejection criteria.

10.2 Records Requirements

Identification of the person performing the inspection and the inspection results are recorded on the applicable follower card or inspection record sheet. Follower cards and inspection record sheets become part of the Quality Control records as described in Section 17.

10.3 Hold Points

Hold points are established at specified points in the process whereby material may not proceed until formally inspected and released by Quality Control. Release points are designated in the Quality Control Standards. Releases become part of the Quality Control records as described in Section 17.

10.4 Inspector Qualifications

Inspectors and special test operators are qualified in accordance with the Operator Certification Standards and Section 9. The qualifications and certifications of inspectors are kept current.

10.5 Reworked, Repaired, or Replacement Items

Items which are reworked, repaired, or replaced are inspected in accordance with applicable design and/or inspection requirements applied to the original items or as specified in applicable rework or repair procedures or nonconformance reports. (3)

11.0 Test Control

Test programs are established for new fuel designs and new processing methods. Test authorization procedures are prepared for significant tests and are discussed below. Test results are thoroughly analyzed prior to issuing the final product and process specifications.

For complex testing, such as evaluating spacer flow characteristics under simulated reactor conditions, fuel assembly mock-up tests, or fuel license testing, a written test procedure is prepared which includes instructions for performing the tests, the test conditions to be achieved, test duration, accuracy, and detailed schedule of measurements to be recorded, and the specific responsibilities for the test preparation, approval, operation, data collection, audit, and data evaluation.

Where other than Exxon Nuclear facilities are utilized, the person assigned responsibility for the test is responsible for reviewing the capabilities of the facility to be used and for establishing the procedures, controls, and measurements required to assure conformance within the required limits. Quality Assurance may audit any or all phases of the test depending on the test complexity and data usage.

The test results are documented and evaluated for acceptability by responsible personnel. The test report is filed as a part of the permanent records.

11.1 Special Test Authorizations

Special Test Authorizations for complex testing is required to be documented and approved before work is initiated in the fabrication facility. The Special Test Authorization includes the following as appropriate:

a) Justification;

b) Identification of material and equipment to be used;

c) Requirements or acceptance limits contained in applicable design documents, if applicable;

d) Duration of test;

e) Effect on production material or processes including provision for controlled environmental condition;

f) Priority of the work;

g) Nuclear safety requirements;

h) Calibrations required;

i) Mandatory inspection or hold points, if required;

j) Assignment of responsibilities including use of appropriately trained or qualified personnel;

k) Record requirements and recording of results;

l) Disposition of material and equipment; and

m) Return of work areas to original condition.

Special Test Authorizations and test results are documented in report form and a copy is retained in the central files. Special Test Authorization changes require the same approval signatures as required for the original test authorization.

Special Test Authorization may be of several types:

a) Process Test Authorizations (PTA's);

b) Design Test Authorizations (DTA's);

11.2 Process Test Authorizations are prepared for tests using new or different manufacturing parameters or processing techniques. PTA's are prepared by the Engineer responsible for the test and approved and accepted in accordance with Appendix I. Copies of PTA's and the results are sent to the Managers Manufacturing, Fuel Process and Performance Engineering, Manufacturing Engineering, and Quality Assurance - Nuclear Fuels, as well as others who have technical interest in the test and its results. 2

11.3 Design Test Authorizations are prepared for tests designed to improve or verify the design, exclusive of tests involving irradiation in customer reactors. These are prepared in accordance with Design Control Quality Assurance Procedures. DTA's are prepared by the Engineer responsible for the test and approved in accordance with Appendix I. Copies of DTA's and results are sent to the Managers of Quality Assurance - Nuclear Fuels, and Fuel Process and Performance Engineering, as well as others who have technical interest in the test and its results. 2

12.0 Control of Measuring & Test Equipment

Procedures are established for the control of measurement and test equipment used in the fabrication and inspection of fuel and fuel components which can directly affect product quality. 2

Measuring and test equipment are defined as those devices used to measure characteristics, for the purpose of determining acceptance of items to specified product requirements; and process requirements where subsequent inspection is not performed.

12.1 Procedures

Quality Control Procedures describe the calibration program for quality control measuring and test equipment. The program is approved in accordance with Quality Control Procedures as indicated in Appendix I. The metrology Quality Control Engineer is responsible for the approved gage cards and for preparing detailed calibration procedures. Cognizant equipment engineers are responsible for preparing calibration procedures for M & TE used to monitor process performance where subsequent inspection is not performed.

12.2 Calibration and Control of Measuring & Test Equipment

The Exxon Nuclear QA Program requires the following as appropriate:

a) Traceability of calibration standards is to the National Bureau of Standards where such standards exist. In the event there are no national standards, the basis of the calibration is documented.

b) Equipment falling within the scope of this program is procured, controlled, and used as to ensure the required degree of accuracy, reproducibility, and traceability;

c) Purchase Orders for M & TE are checked to ensure that the accuracy of the equipment is sufficient for its intended use and that the specifications, certified calibration by the vendor or Exxon Nuclear, and the shipping requirements have been identified;

d) Frequencies of recalibration are established, based on required accuracy, usage, and stability of the equipment, and, where feasible, the calibration status is identified by tag or label;

e) Nonconforming equipment is clearly labeled and its use prohibited or suitably restricted until repaired or calibrated;

f) Records are maintained which indicate the calibration status and dates of previous calibrations; and

g) Where practical, measuring and test equipment (M & TE) are calibrated against working standards having an accuracy (uncertainty error) of at least four times the allowable accuracy of the M & TE. Accuracies of working standards less than four times the allowable

accuracy of the M & TE being calibrated are acceptable when limited by the state of the art, or when the end use of the M & TE being calibrated does not require this accurracy. Additionally, M & TE used to measure characteristics classified as "major" or "minor" characteristics, i.e., non-safety related characteristics, may be calibrated against working standards which are less than four times the allowable accuracy of the M & TE being calibrated. 2

12.3 Out-of-Calibration Equipment

Measuring and test equipment actively being used to determine product acceptance that is found to be out of calibration will be removed from service and recalibrated. The degree of out of calibration is determined during recalibration. An evaluation is made on a case by case basis to determine the validity of previous inspections during the period the measuring and test equipment was suspect of being out of calibration. Only when the evaluation reveals the degree of out of calibration impacts on the validity of previous inspections will action be taken regarding previous inspections.

12.4 Calibration Records

Records are maintained for M & TE showing the equipment identification number, calibration status, and results of calibrations.

13.0 HANDLING, STORAGE, AND SHIPPING

Procedural controls are established to assure that purchased materials, shipping containers, equipment, fuel fabrication components, and completed fuel assemblies are stored, shipped, and preserved in a manner such that quality is not adversely affected. Special handling, storage, and preservation requirements are established in the Process Specifications, Product Specifications and Material Specifications. Qualified individuals accomplish the special handling, storage, and preservation in accordance with predetermined work and inspection instructions contained in Quality Assurance Procedures, Material Instructions, Standard Operating Procedures, QC Standards and QC Procedures. Where special controls are not required for handling, storage, and preservation, standard material handling and transportation methods are used to protect against physical damage.

13.1 Responsibility

The Managers of Quality Control, Fuel Process and Performance Engineering, Fuel Design Engineering, Purchasing and Logistics, Manufacturing Engineering, and Shop Operations are responsible for including in the Quality Control Standards, Process Specifications, Product Specifications, Material Instructions, and Standard Operating Procedures those quality requirements which relate to preservation, handling, storage, and shipping. The Managers of Purchasing and Logistics, Quality Control, and Shop Operations are responsible for training their personnel in these matters. (3) (3)

13.2 Preservation & Packaging

Written instructions for preservation assure that items intended for incorporation into fuel bundles and shipping containers, which are subject to deterioration or damage through exposure to air, moisture, and other environments, are protected during procurement, fabrication, processing, assembly, interim storage, and final shipping. Packaging of fuel assemblies is inspected by Quality Control per written instructions prior to shipping.

13.3 Handling

Special handling instructions are prepared where necessary for critical items that are susceptible to handling damage. Use is made of special carts, cranes, boxes, containers, and methods of transportation. Handling instructions for fuel components, rods, and assemblies in the shops are included in appropriate Standard Operating Procedures, Quality Control Standards, Quality Control Procedures, or Process Specifications. Handling instructions for both systems and physical handling of components at receipt are to be in accordance with Material Instructions.

13.4 Storage

Instructions provide requirements to prevent deterioration and damage and also include requirements for adequate safety, periodic inspection, and accountability. In addition, instructions or procedures include requirements for segregation and control of nonconforming items.

13.5 Shipping

13.5.1 Quality Assurance Certification

A final Quality Assurance Certification is prepared and approved in accordance with Appendix I for the finished fuel rods or assemblies containing special nuclear materials or nuclear poison materials leaving the Exxon Nuclear facilities and is provided to the customer. Approved waivers to Product Specifications are transmitted with the Certification if not previously transmitted to the customer. The Certification assures that the following requirements were reviewed and met:

a) The items have been produced in accordance with approved specifications or approved waivers thereto;

b) The items have been subjected to and have satisfactorily passed applicable inspections and tests and have been released by Quality Control;

c) The items are complete and fully assembled as required;

d) The items have been preserved and packaged in accordance with applicable procedures and contract requirements;

e) The packaged items have been identified and marked in accordance with applicable procedures and specifications;

f) In the absence of packing and marking requirements in the contract or subcontract, the packing and marking of the items comply with Interstate Commerce Commission and DOT rules and regulations and are readily identifiable at destination;

g) The items shipped are accompanied by necessary shipping and technical document including appropriate special handling instructions; and

h) The items were designed, procured, fabricated, and packaged in accordance with the Quality Assurance Program.

13.5.2 Formal Shipping Release

The finished fuel assemblies containing special nuclear material or poison material shipped from the Exxon Nuclear facilities are formally released and approved for shipping in accordance with Appendix I.

14.0 INSPECTION, TEST & OPERATING STATUS

Controls are established to assure that the inspection and processing status of items, which will become part of the product or are important to the manufacturing process, are adequately identified from receipt of the items to end use in order to prevent inadvertent bypassing of operations or inadvertent use.

The following controls are employed to assure that the status of materials, components, and assemblies are adequately identified:

a) Lot follower cards and station reports are utilized to identify and control lots or items and to transfer identification when several items are joined into a single unit;

b) Inspector or operator initials are entered on tags, labels, and lot follower cards to signify the completion of operations or inspections;

c) Inspection forms and travelers are controlled in accordance with Quality Control Procedures (these forms, plus Quality Control releases assure that traceability to starting material is maintained);

d) Quality Control release points are required at several points in the manufacturing process; components, subassemblies, and assemblies are not permitted to pass a release point unless required inspections, tests, and operations have been completed, except by approved conditional release;

e) Rejected items are tagged and separated from acceptable items per nonconforming material control procedures so as to prevent their inadvertent use; (3)

f) The removal of hold tags is authorized only by the Quality Control organization or by other appropriate personnel designated in Quality Assurance procedures; and

g) Small parts for which it is not practical to uniquely mark each item are identified and controlled by appropriate means, such as attaching inspection labels or tags to the container, bin, or carton in which the parts are stored.

15.0 NONCONFORMING MATERIAL, PARTS, OR COMPONENTS

Materials, parts, components, subassemblies, and assemblies that deviate from nuclear fuel product line requirements of approved specifications, standards or drawings are considered as nonconforming items. The Exxon Nuclear Quality Assurance Program requires that nonconforming items discovered during procurement, receiving inspection, manufacture, fabrication, or test activities are required to be controlled and documented in accordance with written procedures.

15.1 Nonconforming Material Control System

Items found to be nonconforming are identified, and segregated, as practical, to prevent their inadvertent use. They are withheld from furthe use unless they can be reworked within existing approved Process Specifications or a nonconforming material report has been issued and approved, which describes the disposition, detailed processing steps and reinspection and corrective action that is required. Nonconforming material reports may be originated by any Exxon Nuclear employee (normally supervision) identifying the deviation. The details of the nonconforming material report system, including distribution of nonconforming material reports to affected organization management, are described in Quality Assurance Procedures. Processing of nonconforming material reports are subject to the following controls:

a) The nonconforming item is segregated from acceptable items and is identified with a hold tag, rework card, or nonconforming material report,

b) The nonconformance is documented, including item name and description, description of nonconforming conditions and identification of requirements violated, organization originating the report, and signature of the originator and date;

c) The nonconformance is evaluated by a responsible person from Nuclear Fuels Engineering, and Quality Control and a disposition is recommended;

d) Waivers of critical characteristics to existing specifications and repair of items require approval in accordance with approved Quality Assurance procedures. These approvals signify that any areas of concern within engineering or related to the customer contract are resolved.

e) Copies of approved waivers are placed in the Quality Control release files for the affected material. In addition, copies are sent to customers prior to or with the records package.

f) Items rejected are physically separated from acceptable items when practical, and are either returned to the vendor for credit, held in a clearly marked storage area for future disposition, altered to prevent uncontrolled usage, or scrapped.

g) Preventative action is initiated, as appropriate, to assure that the causes of quality problems are identified and corrected. Any recommended preventative action is indicated in the nonconformance report or attachments thereto; the Manager of the group responsible for the preventative action signs as accepting the preventative action and Quality Control performs followup on preventative action. 3

h) Rework and repair operations are conducted in accordance with documented procedures which are either a part of the nonconformance report or approved as Process Specifications; the acceptability of rework or repair operations is verified by reinspection or retesting of the items as required to assure adequacy of the product; and 3

i) If agreement on disposition and/or preventative action is not reached by persons approving the nonconformance report, the matter is brought to the attention of the next higher level of management and the Manager, Quality Assurance - Nuclear Fuels for resolution. 3

16.0 CORRECTIVE ACTION

Nonconforming conditions, significant processing incidents, inspection or design inadequacies, or other events, which can adversely affect product quality, are reported to appropriate levels of management for review and assessment. Formal corrective action is promptly taken for significant incidents adverse to quality and the results are documented and reviewed for effectiveness.

16.1 Nonconforming Material

Technical review and preventative action recommendations on nonconforming material are made by those responsible for approving nonconforming material reports as specified in Section 15. Preventative action and control of nonconforming materials are also as described in Section 15. Requests for corrective action by vendors is submitted in writing by Purchasing and Logistics to the responsible vendor. Followup action to obtain vendor corrective action commitments is also the responsibility of the Manager, Purchasing and Logistics. Followup audits for Vendor Quality Assurance system deficiencies are performed by Quality Assurance - Nuclear Fuels, when required. Followup actions are documented to identify that the corrective actions were implemented and effective. 3 3 3

16.2 Incident Reviews

16.2.1 Incident Review Boards

3

Incident Review Boards are convened to investigate significant incidents involving unusual events that are determined to have a potential major adverse impact on product quality. The Incident Review Board is chaired by the Manager, QA - Nuclear Fuels. Members serving on Incident Review Boards are appointed by the Chairman and should have no direct responsibilities in the area(s) being investigated. The Incident Review Board evaluates facts relating to the incident to allow identification of probable causes, insofar as practicable, and to recommend corrective action as appropriate to minimize recurrence. As fact- finding bodies, Incident Review Boards are authorized to interview appropriate personnel and to review pertinent hardware and documentation relating to the incident. Significant incidents should be promptly reported to the Incident Review Board chairman by the Manager, Manufacturing; however, such reporting is not a prerequisite for convening an Incident Review Board.

16.2.2 Incident Review Board Reports and Follow-up

Minutes of Incident Review Board meetings are recorded by a secretary appointed by the Incident Review Board chairman. A final IRB report signed by each Incident Review Board member is issued and distributed to appropriate management responsible for directing implementation of corrective action. The Incident Review Board chairman is responsible for taking any follow up necessary to verify that appropriate corrective action has been taken and that it is effective.

16.3 Audits

Corrective action in response to customer and NRC quality assurance audits or inspections is documented by the Manager, Quality Assurance - Nuclear Fuels. Internal audits are documented in accordance with Quality Assurance procedures and Quality Control Procedures. Followup reviews are conducted, as required, to verify the implementation of corrective action. Corrective action resulting from audits is discussed further in Section 18.

17.0 QUALITY ASSURANCE RECORDS

Documents and records sufficient to characterize the product design, materials used, and process by which the product was fabricated, material and fabrication history, and the quality achieved are maintained for each contract to furnish evidence of activities which affect quality. The records are consistent with applicable codes, standards, specifications, and contracts. QA records include results of reviews, inspections, tests, audits, and material analyses; monitoring of work performance; qualification of personnel, procedures, and equipment; and other documentation such as drawings, specifications, procurement documents, calibration procedures and reports; nonconformance reports; and corrective action reports.

17.1 Record System

Quality Assurance records, which furnish documentary evidence of the quality of nuclear fuel or of activities affecting quality, provide sufficient information to permit identification between the record and the items or activities to which it applies. This includes the following types of information, as applicable: Document title; number; revision; date; references to appropriate contract; purchase order; work order; drawing; specifications; and/or procedures. Records of inspection and testing of products contain the following information, as applicable:

a) Identification of the record and the item to which it applies;

b) Description or identification of the observation;

c) Evidence of the completion of the inspection or test;

d) Date of the inspection or test;

e) Inspector; and

f) Evidence of acceptability or conditions adverse to quality.

17.2 Record Storage and Retention

Documents designated as quality assurance records are transmitted to and retained by Central Files (Document Control) or are maintained in satellite files. Satellite file stations include the quality control records area controlled by Quality Control, the vendor documentation records area controlled by Purchasing and Logistics and Quality Control, the quality assurance audit and certification records area controlled by Quality Assurance, and design records area controlled by Nuclear Fuels Engineering. Measurement, test equipment, and calibration equipment records are maintained by Quality Control. (3)

Designated Quality Assurance records not stored in the Central Files vault are stored either in two physically separated locations or in fire resistent file cabinets. 2

Designated Quality Assurance records are transferred from satellite files to Central Files within six months following shipment of the applicable reload. Either the Quality Assurance - Nuclear Fuels Manager, Auxiliary Operations Manager, or Quality Control Manager may authorize reducing the records to microfilm for storage in a safe repository.

Designated Quality Assurance records are stored so as to provide for timely retrieval of information. Retention periods are indicated in Quality Assurance Procedures.

18.0 Audits

A comprehensive program of planned and periodic audits is carried out to verify compliance with all aspects of the Quality Assurance Program and to determine the effectiveness of the program. The audits include the evaluation of work areas, activities, quality-related practices, items, and reviews of documents and records. The program includes external audits of vendor activities, as well as internal audits of Exxon Nuclear activities. Audit reports are documented and distributed to appropriate management and necessary corrective actions are taken to correct noted deficiencies.

18.1 Categories of Audits

18.1.1 Quality Assurance Audits

The Quality Assurance audit program is documented in a Quality Assurance Procedure. The audit program includes: (1) Quality assurance system audits of the adequacy and implementation of criteria of the quality assurance program such as document control, fuel design control, identification and control of material; (2) documentation review audits of the adequacy and consistency of quality assurance program documentation; (3) processing/inspection audits of fuel manufacturing and inspection operations; (4) audits of fuel component vendor quality assurance programs; and (5) special audits of non-routine activities, as deemed necessary.

18.1.2 Vendor Audits

The Vendor Audit Program is described in Section 7. The responsibility for auditing vendor quality assurance system activities may be delegated to off-site inspector services, Quality Control, or other qualified personnel as designated by the Manager, Quality Assurance - Nuclear Fuels; however, he still retains full responsibility for the effectiveness of the audits. The Manager, Quality Control is similarly responsible for vendor Quality Control inspection activities and may delegate this responsiblity to other independent groups or organizations.

18.2 Procedures

Requirements governing the performance of audits are delineated in audit procedures addressing the following:

a) Types and frequency of audits;

b) Responsibility and training of lead auditors (Quality Assurance System audits only);

c) Planning and scheduling of audits;

d) Preparation of audits, including notification;

e) Conduct of audits, including conferences, as required;

f) Preparation, issuance, and distribution of audit reports;

g) Followup, including commitments, status, and reporting of open items, and reaudits; and

h) Audit records.

18.3 Audit Performance and Reports

Audits are conducted by appropriately trained, experienced personnel who have no responsibilities in the areas being audited. They are performed in accordance with written procedures or checklists. Audit personnel have access to contract requirements, technical data, design data, fabrication data, facilities, products, tooling, work instructions, materials, and data directly related to the work.

Audit results are documented in audit reports, which are distributed to appropriate management personnel. Results of external audits are issued to management of the organization audited.

Audit frequencies are based on the status and safety importance of the activities performed and are adjusted, based on such things as the results of previous audits, current problem areas identified by management, scrap and rework losses, nonconforming material reports, and quality cost data. Each QA Program criteria (element) is internally audited at least once every calendar year during the performance of functional area audits. Suppliers of nuclear fuel hardware items are audited annually if the hardware item is considered to be a major component and triennially for suppliers of other hardware items. 3

18.4 Corrective Action/Followup

Audit results are reviewed with responsible supervision or management and corrective actions established. Managers or supervisors responsible for the areas in which deficiencies are found are responsible for providing corrective actions with dates of completion to the auditors.

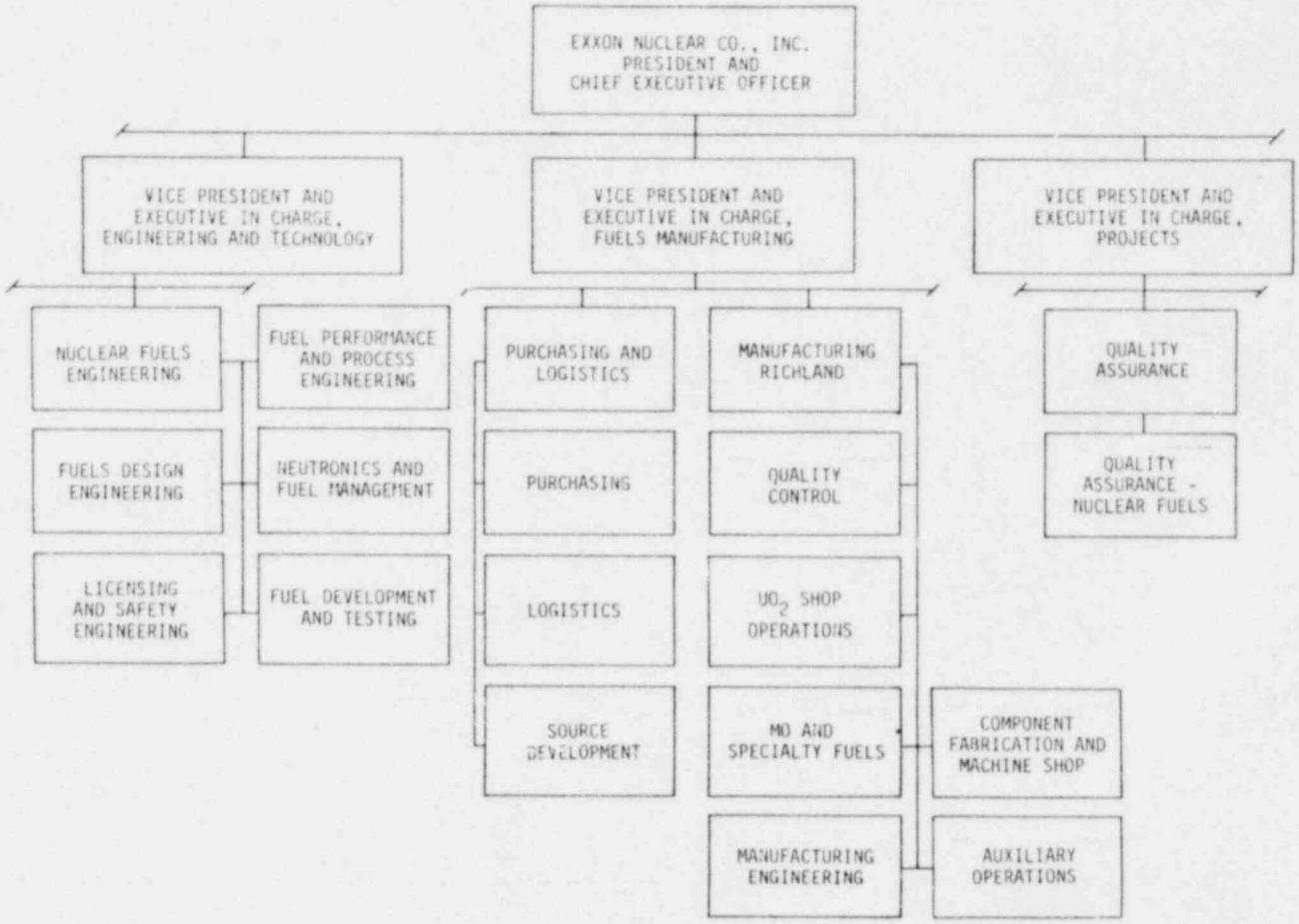
Each manager responsible for corrective action performs followup on his outstanding commitments and reports on the followup status to the auditors with a copy to the Manager, Quality Assurance - Nuclear Fuels and the Vice President and Executive in Charge, Fuels Manufacturing or the Manager, Nuclear Fuels Engineering on a timely basis until the commitment is completed and effective. 3

For Quality Assurance system audits, the follow-up obtained from the managers as stated above are summarized into followup reports and issued in accordance with Quality Assurance Audit Procedures.

The Manager, Purchasing and Logistics is responsible for followup on vendor deficiencies. The status is reported to Quality Assurance - Nuclear Fuels, at a minimum, every two months until the corrective action has been satisfactorily implemented. 3

Re-auditing is conducted as determined by the Manager, Quality Assurance - Nuclear Fuels, to verify implementation of corrective actions from earlier audits.

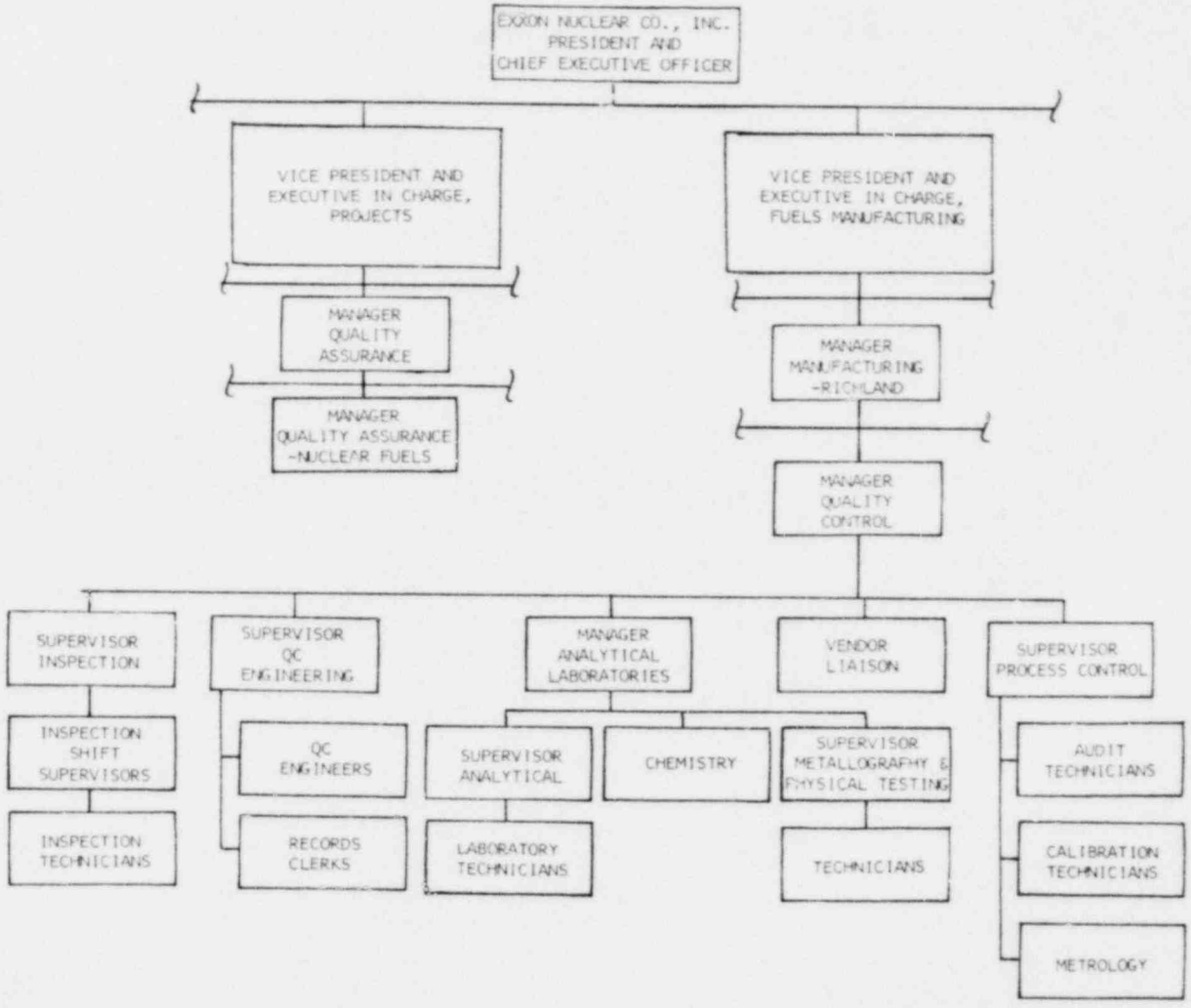
FIGURE 1.
EXXON NUCLEAR ORGANIZATION
(Related to Nuclear Fuel Design and Fabrication)



NOTE: ONLY THOSE ORGANIZATIONS HAVING SPECIFIC QUALITY ASSURANCE FUNCTIONS FOR NUCLEAR FUEL ARE SHOWN IN THIS FIGURE.

3

FIGURE 2.
EXXON NUCLEAR QA/QC ORGANIZATIONS
(Related to Nuclear Fuel Design and Fabrication)



Appendix I

KEY TO SYMBOLS - MATRIX OF ACCOUNTABILITY AND RESPONSIBILITY - NUCLEAR FUELS

The definitions of the symbology is as follows:

P = Prepare - Lead role, primary responsibility for document preparation and coordination. Must assure, where applicable, acceptance of the documented requirements as operable, within budget and schedule.

C = Concur - The concur function signifies agreement in the individual's assigned area of responsibility including, where applicable, acceptance of the documented requirements as operable, within budget and schedule.

A = Approval - Overall approval. Denotes that factors that impact the company internally and its external relationships have been appropriately accommodated within designated area of responsibility.

Note:

1 Only those activities or documents applicable to their area of responsibility.

2 Manager, Fuel Development and Testing signs documents related to government work and developmental concepts in lieu of the Manager, Fuel Design Engineering. The signature of either Manager is sufficient. 3

3 The Design and Fabrication Package for Jet Pump BWR consists of a Parts List, Drawings and the Product Specifications. The Product Specifications are equivalent to and include both Product and Material Specifications. In addition they include a Quality Supplement if applicable, which is equivalent to Quality Control Standards. 3

4 "Minor Design Changes" include minor changes to Product and Material Specifications, Parts Lists, Drawings, and Partial Parts Lists.

5 Conditional Releases are approved only by the Manager, Quality Control when the conditional release requirement is imposed as the result of an approved Variance Report. 3

6 Design Reports include Topical Reports, Fuel Management Reports and Safety Analyses.

MATRIX OF ACCOUNTABILITY AND RESPONSIBILITY - NUCLEAR FUELS

SYMBOLS
P = PREPARE
C = CONCUR
A = APPROVE

REFERS TO TEXT OF QA PROGRAM

	QUALITY													DESIGN & FABRICATION																		PURCHASING							
	2.4 QA PROGRAM (XN-NF)	2.4 QA PROCEDURES (XN-QA)	2.4 QA PROCEDURES (XN-NF)	6.7 MINOR CHANGES TO QAPs (XN-NF)	13.5 QA PRODUCT CERTIFICATION	2.3 SPECIAL PROJECT AUTHORIZATION	5.1 QC STANDARDS & INDICES	5.1 MINOR CHANGES TO QCS & INDICES	5.1 QC PROCEDURES	8.3 CONDITIONAL RELEASE	5.5 OP., CERT. STDS. FOR SP. PROCESS		3.2 DESIGN CRITERIA	3.2 PROD & MAT'L SPEC & PARTS LIST	3.2 MINOR DESIGN CHANGES (4)	5.3 PROCESS SPECS & INDICES	5.3 MINOR PROCESS SPEC CHANGES	3.5 FINAL DESIGN REVIEW	5.2 DESIGN REPORTS	3.2 PARTIAL PARTS LIST	11.3 DESIGN TEST AUTHORIZATION	11.2 PROCESS TEST AUTHORIZATION	5.5 STD. OPER. PROC. (SHOP & ELD)	9.2 WELD QUALIF. CERTIFICATION	12.3 INSTR. REPETITIVE MAINT. PROG.	J-PUMP BWR[3] 20.1 DESIGN & FAB. PKG	J-PUMP BWR[3] MINOR CHANGES 20.1 PROD. SPEC OR DWGS.	J-PUMP BWR[3] MINOR CHANGES 20.1 QC SUPPLEMENT		7.1 VENDOR QA REQUIREMENTS	7.1 VENDOR QUALIFICATION PROGRAM	7.4 APPROVED VENDOR LIST	4.1 PURCHASE SPECS - NF HARDWARE	9.5 ESSENTIAL MATERIAL SPEC	7.5 PO RELEASE - NF HARDWARE	7.0 P&L PROCEDURE/MATERIAL INSTR.								
VP & EIC, FUELS MANUFACTURING	A																																					
MGR, MANUFACTURING			C'			C	A		A	A'				C				C			C'	C	A		A	C				A								
MGR, QUALITY CONTROL					A		P	A	P	P5	A				C		C			C			C'	C	A	P'	C	A		C	C	C	C	C	C			
MGR, MANUFACTURING ENG.									C								C'						C	PA	P													
MGR, UO2 (OR OTHER) SHOP								C'		C'					C'		C'						P	C			C'	C'										
MGR, PURCHASING & LOGISTICS			C'	C'		C'				A'				C'	C'						C'	C'	C'			P'	C'	C'		A	P	P	A	A'	A	A		
VF & EIC, ENGINEERING AND TECH.	A																																					
MGR, NUCLEAR FUELS ENGINEERING			C'			A'							A					A	A																			
MGR, FUEL DESIGN ENG. (2)				C'	A	P'	C	C'					P'	A	A	C	C	P'	P	A	A					A	A	C										
MGR, LICENSING & SAFETY ENG.													F'					P'	P'												C				C			
MGR, FUEL PERF. & PROCESS ENG.													P'	C'		A	A	P'	P'			A		C'								A'						
MGR, NEUTRONICS & FUEL MGMT.													P'	C'	C'			P'	P'							C'	C'											
MGR, FUEL DEVELOP. & TESTING				2	2	2	2	2					2	2	2		2	2	2	2	2					2	2	2			2							
VP & EIC, PROJECTS		A																																			
MGR, CORP. LIC. & COMPLIANCE													P'																									
MGR, QUALITY ASSURANCE	C	P	A																																			
MGR, QA - NUCLEAR FUELS	P		P	PA	PA	C					C							C				C															
MGR, REPORTING TO MGR APP. DOC						P		P			P			P	P	P	P				P	P	P			P	P	P				P	P	P	P			

APPENDIX II

APPLICABILITY OF ANSI STANDARDS AND REGULATORY GUIDES

As noted in Section 2, the Exxon Nuclear Quality Assurance Program satisfies the requirements of Appendix B to 10 CFR 50, "Quality Assurance Criteria for Nuclear Power Plants," NRC Regulatory Guide 1.28, "Quality Assurance Program Requirements," and ANSI N45.2 (1971), "Quality Assurance Program for Nuclear Fuel Power Plants."

Since the Quality Assurance requirements and guidelines of the Regulatory Guides and ANSI Stndards were initiated to apply to nuclear power plants, interpretation is required to determine their applicability to the design and manufacture of a plant component such as nuclear fuel. The Exxon Nuclear Quality Assurance Program follows the guidelines set forth in Section 17.1 of the NRC Standard Review Plan insofar as it applies to fuel design and fabrication activities performed by Exxon Nuclear. The extent to which the ANSI Standards and Regulatory guides referenced in the Standard Review Plan are deemed to be applicable to nuclear fuel design and fabrication activities is summarized in the table which follows. The listed ANSI Standards apply only to the extent the requirements contained therein pertain to nuclear safety-related activities. Specific exceptions to the documents are included with appropriate justification. Standards or Guides referenced by the Standard Review Plan which are deemed not applicable to fuel design and fabrication have been omitted.

APPENDIX II

APPLICABILITY OF ANSI STANDARDS AND REGULATORY GUIDES

Item No.	Document Number and Date	Subject and Applicability
1.	Safety Guide 28 (dated 6/7/72)	Quality Assurance Program Requirements (Design and Construction)
	ANSI N45.2-1971	Quality Assurance Program Requirements For Nuclear Power Plants Applicability - Fully applicable
2.	Reg. Guide 1.38 (Rev. 2, May 1977)	Quality Assurance Requirements For Packaging, Shipping, Receiving, Storage and Handling of Items For Water-Cooled Nuclear Power Plants
	ANSI N45.2.2-1972	Packaging, Shipping, Receiving, Storage and Handling of Items For Nuclear Power Plants Applicability ANSI N45.2.2, Section 2.7.1 (3), defines nuclear fuel as a Level A item. As such, ANSI N45.2.2, Section 3.2.1, Items 1-9, apply with the following exceptions: (1) ANSI N45.2.2, Section 3.2.1, Item 1 is amended to eliminate the need for temperature and humidity controls. (2) The serial number of the fuel assembly constitutes adequate item identification as required by Section 3.2.1, Item 9 of ANSI N45.2.2. Shipping container marking shall comply with the requirements of applicable state and federal regulations governing nuclear fuel shipments. Additionally, the following sections of ANSI N45.2.2 are deemed to apply: 4.6, 5.1, 5.2.1 (5), 5.2.2 (7), 5.2.2 (8), 5.2.2 second paragraph (2) and (4), 5.3, 5.4, 5.5, 5.7, 6.1 (at fuel fabrication site only and with exception of temperature and humidity controls. Storage in shipping containers may satisfy the requirement of Section 6.1 of ANSI N45,2,2), and 7.1.

Item No.	Document Number and Date	Subject and Applicability
3.	Reg. Guide 1.58 (Aug. 1973)	Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel
	ANSI N45.2.6-1973	Qualification of Inspection, Examination, and Testing Personnel for the Construction Phase of Nuclear Power Plants
		Applicability
		Applicable with the following clarifications: (1) levels of capability, as specified by Section 3.1 and 4 of ANSI N45.2.6, are applicable only to special processes as defined by SNT-TC-1A; (2) Level I inspectors are allowed to evaluate and interpret inspection results; and (3) practical experience and on-the-job training times may very from the SNT-TC-1A classifications. Other inspections and testing qualifications, while formalized, are not deemed to require designation of levels of capability. In addition, physical examinations after initial certification are verified biennially in lieu of annually per Section 3.2.1, since this is company policy.
4.	Reg. Guide 1.64 (Rev. 2, June 1976)	Quality Assurance Requirements for the Design of Nuclear power Plants
	ANSI N45.2.11-1974	(Same Title as Reg. Guide 1.64)
		Applicability
		Applicable with the following clarifications and exceptions which make the standard more consistent with Nuclear Fuel design: (1) Paragraph 3.2 of ANSI N45.2.11 is changed to read as follows: "The design shall be such as to be capable of accommodating the following where applicable: 1. Basic functions of each structure, and component. 2. Performance requirements.

1

Item No.	Document Number and Date	Subject and Applicability
4.	(continued)	3. Codes, standards, and regulatory requirements including the applicable issue and/or addenda. 1 4. Design conditions such as pressure and temperature. 5. Loads such as seismic, thermal, and dynamic where required. 6. Environmental conditions anticipated during fabrication, storage, and operation such as pressure, temperature, humidity, corrosiveness, and nuclear radiation. 7. Interface requirements including definition of the functional and physical interfaces involving structures and components. 8. Material requirements including such items as compatibility and corrosion resistance. 9. Mechanical requirements such as vibration, etc. 10. (Not applicable) 11. Hydraulic requirements such as allowable pressure drops and fluid velocities. 12. (Not applicable) 13. (Not applicable) 14. Layout and arrangement requirements. 15. Operational requirements under various conditions, such as plant startup, normal plant operation, plant shutdown, plant emergency operation, special or infrequent operation, and system abnormal or emergency operation. 16. Provision for accommodating installation of necessary instrumentation. 17. (Not applicable) 18. (Not applicable) 19. Failure effects requirements of structures, and components, including a definition of those events and accidents which they must be designed to withstand. 20. Test requirements including in-plant tests and conditions under which they will be performed. 21. Accessibility, maintenance, repair and in-service inspection requirements for the fuel including the conditions under which these will be performed.

Item No.	Document Number and Date	Subject and Applicability
4.	(continued)	22. Personnel requirements and limitations including qualification and number of personnel available for testing and inspection and permissible personnel radiation exposures for specified areas and conditions. 23. Transportability requirements such as size and shipping weight, limitations, and DOT regulations. 24. Handling, storage and shipping requirements. 25. Other requirements to prevent undue risk to the health and safety of the public. 26. Materials, processes, parts and equipment suitable for application. 27. Safety requirements for preventing personnel injury including such items as radiation hazards, restricting the use of dangerous materials." (2) If in an exceptional circumstance the designer's immediate Supervisor is the only technically qualified individual available, this review can be conducted by the Supervisor, provided that: a) The other provisions of the Regulatory Guide are satisfied, and b) The justification is individually documented and approved in advance by the Supervisor's managements, and c) Quality Assurance audits will cover the frequency and effectiveness of the use of immediate Supervisors as design verifiers to guard against abuse. (3) The requirement of Section 6.3.3 for incorporation of design test acceptance limits into test procedures is not deemed applicable if the purpose of the test is to produce data for design inputs. Additionally, not all qualification tests are conducted under the worst conceivable design conditions.

APPENDIX II (Cont'd)

Item No.	Document Number and Date	Subject and Applicability
5.	Reg. Guide 1.74 (Feb. 1974)	Quality Assurance Terms and Definitions
	ANSI N45.2.10-1973	(Same Title as Reg. Guide 1.74)
		Applicability - Fully applicable
6.	Reg. Guide 1.88 (Rev. 2, Oct. 1976)	Collection, Storage, and Maintenance of Nuclear Power Plant Quality Assurance Records
	ANSI N45.2.9-1974	Requirements for Collection, Storage and Maintenance of Quality Assurance Records for Nuclear Power Plants
		Applicability
		Applicable with the following exceptions: (1) The Exxon Nuclear vault has no provision for drainage as recommended by Section 5.6 (6); however, there is no credible mechanism (e.g., sprinkler system) for entry of water into the vault; (2) calibration records are maintained in the calibration laboratory as these are not subject to vault storage; and (3) quality control records and procurement records need not be transferred to vault storage until reasonable time after fuel shipment. 2A
7.	ANSI N45.2.12-1976 (Draft 3, Rev. 4, 2/22/74)	Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants
		Applicability
		Applicable with the following exceptions: (1) with respect to the annual audit frequency requirements of paragraph 3.4.2, the term "Applicable elements---" is interpreted within the following context. Exxon Nuclear conducts comprehensive internal QA audits of important quality functional areas. Each functional area audit may address implementation of one or more of the QA Program criteria (elements) applicable to that area. Each QA Program criteria is audited at least once every calendar year during the performance of functional area audits. In determining the audit scope, an evaluation of the area being audited may 2 2B

APPENDIX II (Cont'd)

Item No.	Document Number and Date	Subject and Applicability
		be useful. The evaluation may include some or all of the following: prior quality assurance program audits, results of audits from other sources, nature and frequency of identified discrepancies, significant changes in the organization or quality assurance program, and the corrective actions taken to correct discrepancies. Suppliers of nuclear fuel hardware items are audited annually if the hardware item is considered to be a major component and triennially for suppliers of other hardware items. Where a current supplier having an active contract with ENC is not audited within a calendar year, a documented interim evaluation of the supplier will be performed annually. As an exception to the foregoing, audits of suppliers are not necessarily performed for procurement actions where acceptance of the product is in accordance with Section 10.3.2 of ANSI N45.2.13-1976. In the case of both internal and external audits, audit frequency is adjusted as necessary from these minimum requirements depending on the importance and status of the organization/area being audited. (2) Concerning paragraph 4.5.2.1, a written reply to the audit report is obtained only if required by the audit report or the audit report transmittal. Written responses to individual adverse findings (Corrective Action Requests) are obtained in accordance with paragraph 4.5.1. 2B 2
8.	Reg. Guide 1.123 (Rev. 1, July 77)	Quality Assurance Requirements for Control of Procurement Items and Services for Nuclear Power Plants
	ANSI 45.2.13-1976	(Same title as Reg. Guide 1.123)
		Applicability - Fully applicable

APPENDIX III

MATRIX CHART OF EXXON NUCLEAR'S NUCLEAR FUEL DESIGN AND FABRICATION QA PROGRAM AND QA PROCEDURES RELATED TO QA CRITERIA

10 CFR 50, APPENDIX B QA CRITERIA		EXXON NUCLEAR - NUCLEAR FUEL	
		QA PROGRAM Topical Report Sections	QA PROCEDURES By Number
I	Organization	1	All listed QA Procedures
II	QA Program	2	XN-NF-P00,019 and 036
III	Design Control	3	XN-S00,002
IV	Procurement Document Control	4	XN-S00,012
V	Instructions, Procedures and Drawings	5	All listed QA Procedures
VI	Document Control	6	XN-S00,001 and 011
VII	Control of Purchased Material	7	XN-S00,018
VIII	Identification and Control of Materials and Parts	8	XN-S00,015 and 027
IX	Control of Special Processes	9	XN-S00,001 and 002; XN-64
X	Inspection	10	XN-S00,020
XI	Test Control	11	XN-S00,020
XII	Calibration of Equipment	12	XN-10, Section 2.4 and 7.5
XIII	Handling, Storage and Shipping	13	XN-S00,001 and 002 and 028
XIV	Inspection, Testing and Operating Status	14	XN-S00,027 and 020
XV	Nonconforming Material	15	XN-S00,002 and 022 and 027
XVI	Corrective Action	16	XN-S00,005 and 021 and 022
XVII	QA Records	17	XN-S00,023
XVIII	Audits	18	XN-S00,005