

OPERATING ORGANIZATION GENERAL RECOMMENDATIONS

L.5.1 & 2

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ROLE OF THE OPERATING ORGANIZATION

GENERAL ROLE RECOMMENDATIONS FROM CODE

ESTABLISH A MANAGEMENT STRUCTURE

ASSESSMENT AND VERIFICATION OF SAFETY

FINANCIAL AND HUMAN RESOURCES

QUALITY ASSURANCE (MANAGEMENT)

HUMAN FACTORS

RADIATION PROTECTION

EMERGENCY PREPAREDNESS

SPECIFIC ROLE RECOMMENDATIONS FROM CODE

SAFETY IN SITING

SAFETY IN DESIGN, CONSTRUCTION AND
COMMISSIONING

SAFETY IN OPERATION, MAINTENANCE, MODIFICATION
AND UTILIZATION

SAFETY IN EXTENDED SHUTDOWN

SAFETY IN DECOMMISSIONING

FROM THE CODE

The operating organization should establish its own policies in accordance with State requirements that give safety matters the highest priority, that promote a strong nuclear safety culture and are implemented within a **management structure** having clearly defined divisions of responsibility and lines of communication.

MANAGEMENT STRUCTURE

SOURCE MATERIAL

IAEA THE OPERATING ORGANIZATION AND THE RECRUITMENT, TRAINING AND QUALIFICATION OF PERSONNEL FOR RESEARCH REACTORS, WORKING ID DS 325

SAFETY REQUIREMENTS FOR RESEARCH REACTORS, Working ID DS272, Chapter 7

CODE OF CONDUCT ON THE SAFETY OF RESEARCH REACTORS, Section VII

US GUIDELINES FOR PREPARING AND REVIEWING APPLICATIONS FOR THE LICENSING ON NON-POWER REACTORS, PARTS 1 & 2, NUREG 1537

SELECTION AND TRAINING OF PERSONNEL FOR RESEARCH REACTORS, ANSI/ANS 15.4

MANAGEMENT RESPONSIBILITIES

**SAFETY MANAGEMENT SYSTEM –
*ARRANGEMENTS MADE BY THE OPERATING
ORGANIZATION TO ENSURE THAT AN
ACCEPTABLE LEVEL OF SAFETY IS MAINTAINED
THROUGHOUT THE LIFE OF THE REACTOR***

ADMINISTRATIVE PROGRAMS

- **BUDGET (PREPARATION, OBTAIN FUNDS, MANAGEMENT, UNEXPECTED EXPENSES)**
- **PERSONNEL (HIRING, TRAINING, EVALUATION, PROMOTION, FIRING)**
- **PURCHASING (ROUTINE, SPECIAL SUCH AS NUCLEAR FUEL)**
- **OFFICE MANAGEMENT (TIME KEEPING, PAYING BILLS, INVOICING USERS, DEPOSITING RECIEPTS)**

MANAGEMENT RESPONSIBILITIES (CONTINUED)

TECHNICAL PROGRAMS

- **QUALITY MANAGEMENT**
- **TRAINING, RETRAINING AND QUALIFICATION**
- **OPERATIONS AND PROCEDURES**
- **COMMISSIONING**
- **MAINTENANCE, PERIODIC TESTING AND INSPECTION**
- **CORE MANAGEMENT AND FUEL HANDLING**
- **FIRE SAFETY**
- **EMERGENCY PLANNING**
- **PHYSICAL PROTECTION**
- **RECORDS AND REPORTS**
- **FEEDBACK OF OPERATING EXPERIENCE**
- **REACTOR UTILIZATION AND MODIFICATION**
- **RADIATION PROTECTION**
- **RADIOACTIVE WASTE MANAGEMENT**
- **SAFETY ANALYSIS AND SAFETY REVIEW**
- **MANAGEMENT OF AGING**
- **EXTENDED SHUTDOWN**
- **DECOMMISSIONING**

KEY ELEMENTS OF OPERATING ORGANIZATION

BOARD OF DIRECTORS

DIRECTOR

REACTOR SAFETY COMMITTEE

CHAIRMAN

CONDUCT OF OPERATIONS

REACTOR MANAGER

RADIATION PROTECTION

RADIATION SAFETY OFFICER

REACTOR SAFETY COMMITTEE

Proposed changes in the operational limits and conditions in the facility licence

Proposed new tests, experiments, equipment, systems, or procedures that have safety significance

Proposed modifications to items important to safety and changes in experiments that have an impact on safety

Violations of the OLCs, of the licence and of procedures that are significant to safety

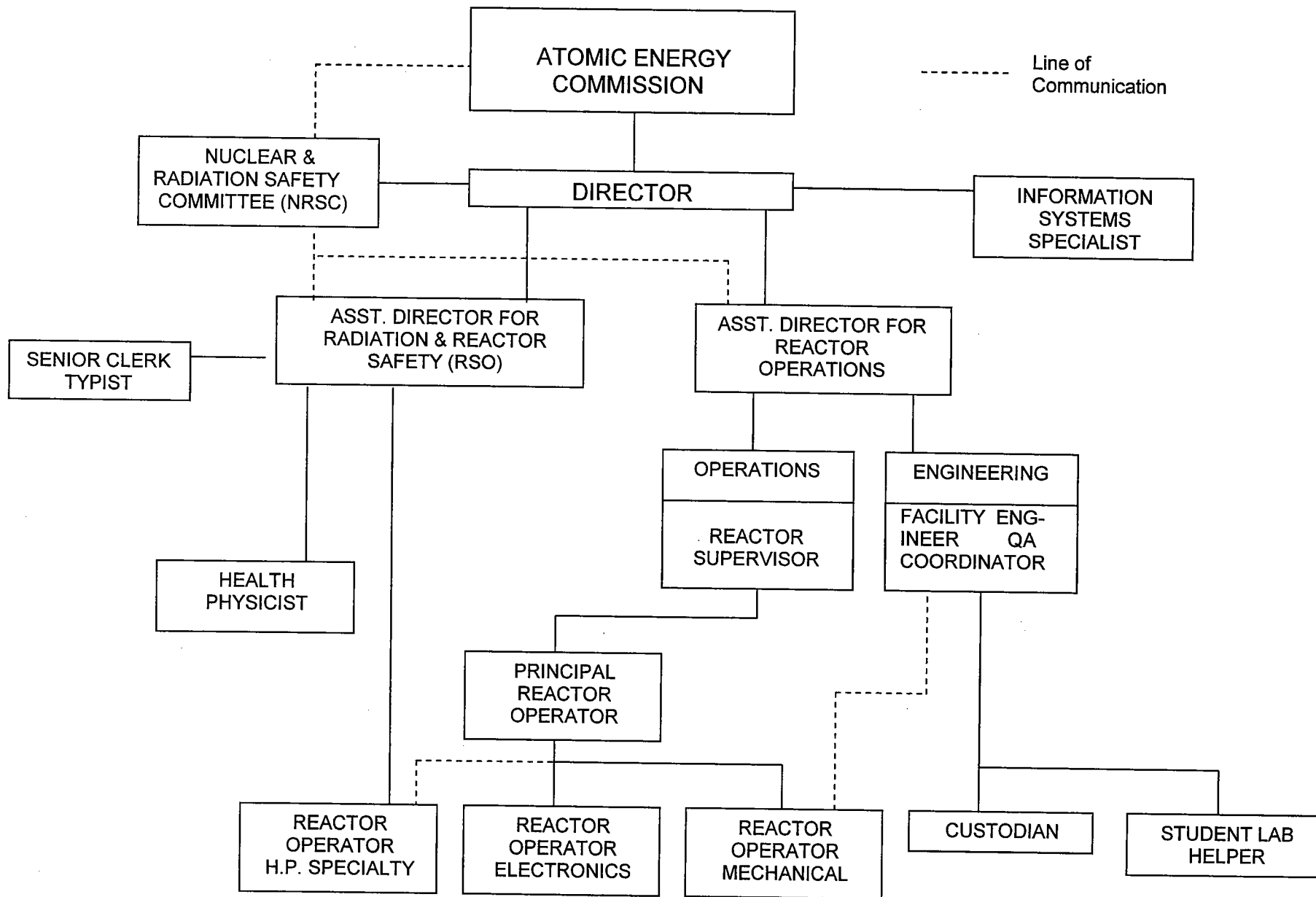
State of the nuclear fuel and reactivity control elements

Events that are required to be reported or have been reported to the regulatory body

Periodic reviews of the operational and safety performance of the facility

Reports on routine releases of radioactive material to the environment

Reports on doses to the personnel of the facility and the public



FROM THE CODE

The operating organization should: carry out a comprehensive and systematic safety assessment and prepare a **safety analysis report** before the construction and commissioning of a research reactor, and carry out **safety reviews at appropriate intervals** throughout its life, including in relation to modifications, changes in utilization and significant experimental activities and the management of ageing. The safety assessments and periodic safety reviews should include all technical, operational, personnel and administrative aspects of safety related operations. The assessments and reviews should be well documented, subsequently updated in light of operating experience and significant new safety information and reviewed under the authority of the regulatory body.

SAFETY ANALYSIS REPORT

SOURCE MATERIAL

IAEA

**SAFETY ASSESSMENT OF RESEARCH REACTORS
AND PREPARATION OF THE SAFETY ANALYSIS
REPORT, SAFETY SERIES NO. 35-G1, VIENNA (1994)**

**SOURCE TERM DERIVATION AND RADIOLOGICAL
CONSEQUENCES ANALYSIS OF RESEARCH REACTOR
ACCIDENTS, DS ???**

US

**GUIDELINES FOR PREPARING AND REVIEWING
APPLICATIONS FOR THE LICENSING OF NON-POWER
REACTORS, NUREG 1537, PART 1 FORMAT AND
CONTENT, PART 2 STANDARD REVIEW AND
ACCEPTANCE CRITERIA, FEBRUARY 1996**

SOURCE TERM EVALUATION FOR THE 10 MW ASTRA REACTOR

THE WORDS "SOURCE TERM" AS USED IN THIS DOCUMENT INCLUDE
ACCIDENT ANALYSIS AND RADIOLOGICAL CONSEQUENCES

REACTOR CHARACTERISTICS FOR ANALYSIS

10 MW POWER

20 % ENRICHMENT PLATE TYPE FUEL

FUEL IS U_xSi_y

BURN-UP IS NEAR 40%

180 DAYS CONTINUOUS OPERATION

DO PSA AND ANALYZE ACCIDENTS FOR PROBABILITY OF
OCCURRENCE $> 10^{-9}$ /YEAR

CALCULATE FRACTION OF CORE DAMAGED FOR FOLLOWING
ACCIDENTS

START-UP

FUEL HANDLING (LOADING)

FUEL CHANNEL BLOCKAGE

LOSS OF FLOW

LOSS OF COOLANT THROUGH BEAM PORT RUPTURE

$< 10^{-9}$ /YEAR. DO NOT CALCULATE

HOWEVER DO MHA (100% OF CORE MELTS)

ACTIVITY RELEASE FROM DEGRADED CORE FRACTION

ACTIVITY RELEASE INTO CONFINEMENT

ACTIVITY RELEASE FROM CONFINEMENT FOR 4 CONDITIONS OF
VENTILATION CONSIDERING RETENTION FACTORS

INCLUDES EMERGENCY VENTILATION WITH FILTRATION

CALCULATION OF RADIOLOGICAL CONSEQUENCES

CONCLUSIONS

**SAFETY REVIEWS AT APPROPRIATE
INTERVALS (SAFETY SELF ASSESSMENTS)**

SOURCE MATERIAL

IAEA

**GUIDANCE FOR THE REVIEW OF RESEARCH
REACTOR SAFETY, SAFETY SERIES 1, DECEMBER 1997**

US

**INSPECTION MANUAL, INSPECTION PROCEDURE
40750, CLASS II NON-POWER REACTORS**

**INSPECTION MANUALS, CLASS I NON POWER
REACTORS**

SAFETY SELF ASSESSMENTS (CONTINUED)

A SAFETY REVIEW IS OFTEN CALLED A SELF-ASSESSMENT

THE PRIMARY DIFFERENCE BETWEEN A REGULATORY INSPECTION AND A SELF INSPECTION IS THE INDIVIDUAL(S) PERFORMING THE INSPECTION.

A SAFETY SELF ASSESSMENT IS OFTEN REFERRED TO AS AN AUDIT TO DISTINGUISH IT FROM THE ACTIVITY OF THE REGULATORY BODY.

A SAFETY SELF ASSESSMENT MAY BE PERFORMED BY STAFF MEMBERS [e.g., THE REACTOR SAFETY COMMITTEE, THE DIRECTOR (if not involved in day to day operation)] OR BY COLLEAGUES FROM ANOTHER INSTITUTION.

SAFETY SELF ASSESSMENT IS CURRENTLY A “HOT” TOPIC PRIMARILY BECAUSE IT IS PROVING ITS VALUE. WHAT HAS BEEN COMMON PRACTICE AT POWER REACTORS, IS NOW BEING ENCOURAGED BY REGULATORS AND UPPER MANAGEMENT AND OTHERS AT RESEARCH REACTORS.

THE ADVANTAGES OF SAFETY SELF ASSESSMENT ARE;

- ◆ IF PERFORMED ENTHUSIASTICALLY, IT ENCOURAGES THE DEVELOPMENT OF A SAFETY CULTURE.
- ◆ THE PROCESS IS OFTEN CONTINUOUS WHICH MEANS THAT DEFICIENCIES ARE PROMPTLY DISCOVERED. OFTEN THE CONTINUOUS PROCESS IS BASED ON A QUALITY MANAGEMENT PROGRAM.

SAFETY SELF ASSESSMENTS (CONTINUED)

- ◆ THE PROCESS BRINGS PEOPLE TO THE REACTOR WHO ARE NOT A PART OF DAY TO DAY OPERATION. NEW EYES AND NEW IDEAS ARE QUICK TO DISCOVER DEFICIENCIES IF THEY EXIST.
- ◆ DEFICIENCIES DISCOVERED BY THE LICENSEE AND CORRECTED AND REPORTED AS REQUIRED BY THE REGULATORY BODY ARE USUALLY GIVEN SPECIAL TREATMENT BY THE REGULATORY BODY.
- ◆ A PROPER SAFETY SELF ASSESSMENT IS MORE VALUABLE TO THE OPERATING ORGANIZATION THAN A REGULATORY INSPECTION BECAUSE IT IS PERFORMED BY INDIVIDUALS WORKING IN THE FIELD WHO ARE FREE TO MAKE SUGGESTIONS FOR IMPROVEMENTS IN THE OPERATION. IT IS OFTEN PERFORMED IN GREATER DEPTH THAN A REGULATORY INSPECTION.
- ◆ A SAFETY SELF ASSESSMENT CAN AND SHOULD BE PERFORMED WHILE THE REACTOR OPERATES NORMALLY. THEREFOR, THE AUDITORS CAN COMMENT ON CONDITIONS AS THEY ACTUALLY ARE.
- ◆ DURING THE OPERATING LIFETIME OF A REACTOR, SMALL INDIVIDUAL CHANGES OCCUR IN THE FACILITY. BY ITSELF, EACH IS NOT TOO SERIOUS. TAKEN TOGETHER, THESE CHANGES MAY SUBTLY RECONFIGURE THE FACILITY. SAFETY SELF ASSESSMENT HELPS TO PREVENT THIS.
- ◆ SAFETY SELF ASSESSMENT IS AN EFFECTIVE MANAGEMENT TOOL.

SAFETY SELF ASSESSMENTS (CONTINUED)

IF PRACTICABLE, BEFORE AN INSPECTION OR AUDIT BEGINS, THE INSPECTOR SHOULD BECOME FAMILIAR WITH

- ◆ THE LICENSE
- ◆ THE OLC
- ◆ THE SAR
- ◆ AS-BUILT DESCRIPTION OF THE FACILITY
- ◆ THE REGULATORY BODY'S SAFETY EVALUATION REPORTS
- ◆ THE LICENSEE'S COMMITMENTS
- ◆ STANDARDS (IAEA, ANS/ANSI) OR GUIDES (IAEA, NRC DIVISION 2) WHICH REPRESENT ACCEPTED PRACTICE

THE INSPECTOR SHOULD DETERMINE THE LICENSEE'S COMMITMENT TO THE USE OF STANDARDS AND GUIDES AND INSPECT AGAINST THAT COMMITMENT

THE INSPECTOR SHOULD DETERMINE OPERATIONAL REQUIREMENTS BASED ON THE EXISTENCE OF PROCEDURES DEVELOPED BY THE LICENSEE

BEFORE BEGINNING AN INSPECTION, ITS SCOPE SHOULD BE DETERMINED. IT IS USUALLY NOT POSSIBLE TO INSPECT EVERYTHING DURING A SINGLE INSPECTION

SAMPLING SIZE (e.g., OPERATING LOGS, RELEASE RECORDS) SHOULD BE GRADED. THAT IS, DETERMINED BASED ON PAST INSPECTION HISTORY, CONDITIONS AT THE FACILITY AND SAFETY SIGNIFICANCE OF ITEM BEING SAMPLED.

THE INSPECTOR SHOULD, AS A MATTER OF COURSE, CONDUCT A FACILITY TOUR ACCOMPANIED BY LICENSEE MANAGEMENT EARLY IN THE INSPECTION. THIS TOUR SHOULD INCLUDE OBSERVATION OF FACILITY ACTIVITIES AND CONDITIONS WITH EMPHASIS ON RADIATION PROTECTION

SAFETY SELF ASSESSMENTS (CONTINUED)

THE MAJOR AREAS OF INSPECTION OR AUDIT ARE

- ◆ ORGANIZATION AND STAFFING
- ◆ OPERATIONS LOGS AND RECORDS
- ◆ PROCEDURES
- ◆ TRAINING AND REQUALIFICATION TRAINING
- ◆ OLC, INCLUDING SURVEILLANCE AND LIMITING CONDITIONS OF OPERATION
- ◆ APPROVAL ROUTE AND CONDUCT OF EXPERIMENTS AND MODIFICATIONS
- ◆ RADIATION PROTECTION
- ◆ DESIGN (CONFIGURATION) CONTROL
- ◆ COMMITTEES, AUDITS AND REVIEWS
- ◆ MAINTENANCE, PERIODIC TESTING AND INSPECTION LOGS AND RECORDS
- ◆ FUEL HANDLING LOGS AND RECORDS
- ◆ EMERGENCY PLANNING
- ◆ SECURITY
- ◆ SAFEGUARDS
- ◆ SAFETY CULTURE

IN SOME COMPILATIONS, THE ABOVE AREAS OF INSPECTION MAY BE COMBINED. FOR EXAMPLE, CONDUCT OF OPERATION MAY INCLUDE THE UNDERLINED TOPICS ABOVE.

PREPARING A SAFETY SELF ASSESSMENT

- ◆ **SELECT AND BRIEF REVIEW TEAM**
- ◆ **DEFINE OBJECTIVE AND SCOPE**
- ◆ **DETERMINE A STRATEGY (e.g., ONE LONG INSPECTION WITH ONE INSPECTOR, ONE SHORT INSPECTION WITH A TEAM, SEVERAL SHORT INSPECTIONS SPREAD OUT OVER TIME)**
- ◆ **DEVELOP A WORKING PLAN**
- ◆ **GATHER INFORMATION BEFORE THE REVIEW**
- ◆ **DETERMINE FORM OF REPORT**

CONDUCTING A SAFETY SELF ASSESSMENT

- ◆ PREPARATION OF A DETAILED WORK SESSION
- ◆ EXAMINATION AND ASSESSMENT OF DOCUMENTATION
- ◆ WALK-THROUGH OF FACILITY
- ◆ OBSERVATION OF OPERATIONAL ACTIVITIES
- ◆ DISCUSSIONS WITH FACILITY PERSONNEL

REPORTING A SAFETY SELF ASSESSMENT

- ◆ TECHNICAL NOTES
- ◆ VERBAL RECOMMENDATIONS
- ◆ EXIT CONFERENCE
- ◆ PRELIMINARY WRITTEN REPORT
- ◆ FINAL WRITTEN REPORT

REVIEW AREAS AND GUIDELINES

SEE SOURCE MATERIAL

FROM THE CODE

The operating organization should verify by analysis, surveillance, testing and inspection that the physical state and the operation of a research reactor continues to be in accordance with its design, safety analysis, applicable national safety requirements, and **operational limits and conditions** for the lifetime of the research reactor.

WHY OPERATIONAL LIMITS AND CONDITIONS (TECHNICAL SPECIFICATIONS)?

PRIOR TO ABOUT 1962, IN THOSE COUNTRIES WITH A STRONG REGULATORY PROGRAM, THE LICENSE FOR A RESEARCH REACTOR INCORPORATED ALL THE LETTERS AND DOCUMENTS WHICH WERE TRANSMITTED BETWEEN THE OPERATING ORGANIZATION AND THE REGULATORY BODY.

EVEN FOR LOW POWER, SMALL FACILITIES THIS IS A CONSIDERABLE AMOUNT OF MATERIAL.

REGULATORY INSPECTORS WERE REQUIRED TO EXAMINE THIS MATERIAL TO DETERMINE COMPLIANCE WITH THE OPERATING LICENSE.

FOR A COUNTRY WITH MANY RESEARCH REACTORS, THIS LEAD TO CONSIDERABLE WORK AND INTERPRETATION BY THE INSPECTORS AND RESULTED IN NON-UNIFORM INSPECTIONS.

THIS LEAD TO THE CONCEPT OF TECHNICAL SPECIFICATIONS WHICH WERE INITIALLY BROAD STATEMENTS OF AGREEMENT BETWEEN THE OPERATING ORGANIZATION AND THE REGULATORY BODY AGAINST WHICH COMPLIANCE INSPECTIONS COULD BE PERFORMED.

LATER, MODERN FORMAT DEVELOPED.

OPERATIONAL LIMITS AND CONDITIONS

SOURCE MATERIAL

IAEA

Operational Limits and Conditions and Operating Procedures for Research Reactors, Working ID DS 261

US

Guidelines for Preparing and Reviewing Applications for the Licensing of Non-power Reactors, Part 1 & 2, Nureg 1537

The Development of Technical Specifications for Research Reactors, ANSI/ANS 15.1

OPERATIONAL LIMITS AND CONDITIONS

IAEA PRACTICE AND TERMINOLOGY

MAIN GROUP CALLED OLC AND CONTAINS

SAFETY LIMITS
SAFETY SYSTEM SETTINGS
LIMITING CONDITIONS FOR SAFE OPERATION
SURVEILLANCE REQUIREMENTS
ADMINISTRATIVE REQUIREMENTS
 ORGANIZATION, STAFFING, TRAINING AND
 RETRAINING, REVIEW, PROCEDURES,
 UTILIZATION AND MODIFICATION, RECORDS
 AND REPORTS, VIOLATION OF OLC

US PRACTICE AND TERMINOLOGY

MAIN GROUP CALLED TECHNICAL SPECIFICATIONS AND
CONTAINS

SAFETY LIMITS
LIMITING SAFETY SYSTEM SETTINGS
LIMITING CONDITIONS FOR SAFE OPERATION
SURVEILLANCE REQUIREMENTS
DESIGN FEATURES
 SITE DESCRIPTION, REACTOR FUEL, REACTOR
 BUILDING, FUEL STORAGE
ADMINISTRATIVE REQUIREMENTS
 ORGANIZATION, STAFFING, REVIEW AND
 AUDIT, OPERATING PROCEDURES,
 RECORDS AND REPORTS, VIOLATION OF
 TECHNICAL SPECIFICATIONS

**THE OPERATIONAL LIMITS AND CONDITIONS
(TECHNICAL SPECIFICATIONS)**

REPRESENT AN ENVELOPE OF PARAMETERS DEVELOPED BY THE OPERATING ORGANIZATION AND APPROVED BY THE REGULATORY BODY WHICH WILL PROTECT THE REACTOR, STAFF, GENERAL PUBLIC AND ENVIRONMENT FROM UNDO EXPOSURE IF THEY ARE NOT EXCEEDED.

ARE BASED ON AN AGREEMENT BETWEEN THE OPERATING ORGANIZATION AND THE REGULATORY BODY AND FORM AN IMPORTANT PART OF THE REQUIREMENTS FOR AUTHORIZATION OF THE OPERATION OF THE FACILITY.

OPERATIONAL LIMITS AND CONDITIONS: GENERAL

- ❖ **Boundary of parameters, limiting values, and system limiting conditions for safe operation**
- ❖ **OLCs also represent an important basis on which the license is issued**
- ❖ **OLCs normally include:**
 - **Safety limits**
 - **Safety system settings**
 - **Limiting conditions of operation**
 - **Surveillance requirements**
 - **Administrative requirements**
- ❖ **The important role of OLCs in the safe operation requires that they be:**
 - **Adequately selected**
 - **Clearly established**
 - **Appropriately justified**
 - **Well known by the staff**

OPERATIONAL LIMITS AND CONDITIONS

❖ SAFETY LIMITS

- On safety variables for all operational states

❖ SAFETY SYSTEM SETTINGS

- For triggering of protective actions

❖ LIMITING CONDITIONS OF OPERATION

- Administrative constraints (on equipment, Staffing, etc.)

❖ SURVEILLANCE REQUIREMENTS

- Frequency and methods of performing tests, Calibrations and inspections of IIS

❖ Where a safety limit is violated, the reactor shall be shut down, the regulatory body notified and a review conducted before restarting the reactor

❖ Where a limiting condition is not satisfied, the operating personnel shall ensure safe operation, investigate will follow and the regulatory body notified

OPERATIONAL LIMITS AND CONDITIONS: RESPONSIBILITIES

The Operating Organization:

- ❖ Shall prepare OLCs for all stages of reactor operation that may require a license**
- ❖ Should prepare OLCs in consultation with the designer and submit them for review by the Reactor Safety Committee before final submission to the regulatory body**
- ❖ Should ensure that the staff is knowledgeable of the OLCs**
- ❖ Should ensure compliance with the OLCs and facilitate verification of compliance**

OPERATIONAL LIMITS AND CONDITIONS: RESPONSIBILITIES (continued)

The Regulatory Body:

- ❖ Shall review and assess the OLCs for compatibility with applicable rules and regulations and ability to meet their intended purpose, and, if satisfactory, grant approval**
- ❖ Shall conduct audits and inspections of the facility to verify compliance with the OLCs**

The Reactor Management:

- ❖ Shall at all times operate the facility in compliance with the approved OLCs**

DEVELOPMENT OF THE OLCs

- ❖ **Development of the OLCs shall be based on:**
 - **Reactor design**
 - **Safety analyses and SAR**
 - **Information regarding conduct of operation**

- ❖ **The style and format of the OLCs shall fulfill the aims and purposes which underline them, namely:**
 - **To provide a boundary for safe operation**
 - **To facilitate internal and external assessment**
 - **To facilitate the continuous understanding and awareness of the staff regarding the application of and the compliance with them**

- ❖ **Attributes of each OLC**
 - **Objective**
 - **Applicability**
 - **Specification**
 - **Justification**

- ❖ **Individual OLCs should be simple and clear**

GENERAL FORMAT OF THE OLCs

Presentation of OLCs either for individual variables and systems or for a set of them having similar characteristics should consider:

- ❖ **Objective**
The purpose for which the OLC is established
- ❖ **Applicability**
Scope of the OLC, e.g., name of variable(s) or system(s) or circumstance(s) to which the OLC applies
- ❖ **Specification**
Statement defining the OLC itself. For a conservative approach, appropriate consideration should be given to calibration errors, measurement accuracy and system response
- ❖ **Basis or Justification**
Reason for which the OLC is established, based normally on calculations or on conservative arguments from previous operational experience or experimental results

GENERAL FORMAT OF THE OLCS (continued)

- ❖ Presentation of surveillance requirements should clearly state the following:**
 - Frequency and scope of test**
 - Requirements for monitoring, inspections, operability checks and calibrations, as applicable**
 - Conditions for continuing operation during repair or replacement of reactor equipment**

- ❖ Presentation of administrative requirements should consider aspects related to safety as required by the rules and regulations or by the Regulatory Body**

- ❖ Require approval of the regulatory body for changes**

**TECHNICAL SPECIFICATIONS
FOR THE
FORD NUCLEAR REACTOR**

DEFINITIONS

EXPLOSIVE MATERIAL

MOVEABLE EXPERIMENT

READILY AVAILABLE ON CALL

REPORTABLE OCCURRENCES

TIME INTERVALS (FOR OPERATIONAL FLEXIBILITY)

ANNUALLY 12-15 MONTHS

BIANNUALLY 24-30 MONTHS

MONTHLY 30-40 DAYS

WEEKLY 7-10 DAYS

SAFETY LIMIT

*SINCE THERE IS NO TEMPERATURE MEASURING DEVICE IN
THE REACTOR CORE, THE SAFETY LIMIT IS ESTABLISHED ON
OTHER PARAMETERS*

FOR FORCED CONVECTION MODE OF OPERATION

SET USING POWER, FLOW RATE, INLET
TEMPERATURE AND PRESSURE

FOR NATURAL CONVECTION MODE OF OPERATION

SET USING POWER, INLET TEMPERATURE AND
PRESSURE

SAFETY SYSTEM SETTINGS

*USED TO PREVENT A SAFETY LIMIT FROM BEING
EXCEEDED*

*A SAFETY SYSTEM SETTING IS NEEDED FOR EACH SAFETY
LIMIT*

FOR FORCED CONVECTION MODE OF OPERATION

MAXIMUM POWER, MINIMUM FLOW RATE,
MINIMUM PRESSURE, MAXIMUM TEMPERATURE

FOR NATURAL CONVECTION MODE OF OPERATION

MAXIMUM POWER, MINIMUM PRESSURE, MAXIMUM
TEMPERATURE

**TECHNICAL SPECIFICATIONS FOR THE FORD
NUCLEAR REACTOR (CONTINUED)**

LIMITING CONDITIONS FOR OPERATION

REACTIVITY LIMITS

SHUTDOWN MARGIN, CORE EXCESS, MOVEABLE
EXPERIMENTS, SECURED EXPERIMENTS, TOTAL
EXPERIMENTS, DURING FUEL MOVEMENTS,
AND SAFETY ROD REMOVAL CONTROL, REGULATING
ROD, HEAVY WATER MOVEMENTS.

SAFETY SYSTEM

CONDITIONS FOR CRITICALITY
REQUIRED INSTRUMENTATION, REQUIRED
SHIM SAFETY RODS, ROD DROP TIME
REQUIREMENTS, HOLD DOWN MECHANISM FOR
CONTROL ELEMENTS

CONFINEMENT BUILDING

EXHAUST FANS, DAMPERS, AUTOMATIC OPERATION

PRIMARY COOLANT

VOLUME, pH, CONDUCTIVITY, RADIOACTIVITY,
FLOW DISTRIBUTION

AIRBORNE EFFLUENTS

WITHIN 10CFR20

LIQUID EFFLUENTS

WITHIN 10CFR20

LIMITATIONS OF EXPERIMENTS
TEMPERATURE, CORROSIVE EFFECT, EXPLOSIVES,
FISSILE MATERIALS

FISSION DENSITY LIMIT

SURVEILLANCE REQUIREMENTS

SURVEILLANCE REQUIREMENTS ARE DRAFTED ON SAFETY SYSTEM SETTINGS AND LIMITING CONDITIONS OF OPERATION. THERE CAN BE NO SURVEILLANCE REQUIREMENT WITH A SSS OR LCO.

DESIGN FEATURES

SITE DESCRIPTION

BUILDING RESTRICTIONS, CONTROLLED AREA

FUEL ELEMENT DESIGN, MATERIALS,

ENRICHMENT

REACTOR BUILDING

STACK HEIGHT

FUEL STORAGE

CRITICALITY CONTROL

ADMINISTRATIVE CONTROLS

ORGANIZATION

STRUCTURE, LICENSING REQUIREMENTS,

REQUALIFICATION, RADIATION PROTECTION

REVIEW AND AUDIT

SAFETY COMMITTEE, AUDIT BY CONSULTANT

ACTION FOR REPORTABLE OCCURRENCE

OPERATING PROCEDURES

OPERATING RECORDS

REPORTING REQUIREMENTS

FROM THE CODE

The operating organization should make available sufficient numbers of staff qualified through appropriate education and training (initial and ongoing) for all safety related activities throughout the life of the research reactor. Appropriate training should be provided for experimenters that will use associated experimental facilities.

STAFFING, TRAINING AND RE-TRAINING

SOURCE MATERIAL

**IAEA THE OPERATING ORGANIZATION AND THE
RECRUITMENT, TRAINING AND QUALIFICATION
OF PERSONNEL FOR RESEARCH REACTORS,
WORKING ID DS 325**

**US GUIDELINES FOR PREPARING AND REVIEWING
APPLICATIONS FOR THE LICENSING ON NON-
POWER REACTORS, PARTS 1 & 2, NUREG 1537**

**SELECTION AND TRAINING OF PERSONNEL FOR
RESEARCH REACTORS, ANSI/ANS 15.4**

FROM THE CODE

The operating organization should establish and implement effective quality assurance programmes with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of the research reactor. Experimenters using associated experimental facilities should be required to work within the relevant quality assurance programme and with safety arrangements established by the operating organization.

QUALITY ASSURANCE (MANAGEMENT)

SOURCE MATERIAL

IAEA

**QUALITY ASSURANCE FOR SAFETY IN NUCLEAR
POWER PLANTS AND OTHER NUCLEAR
INSTALLATIONS, IAEA Safety Series No. 50-C/SG-Q, 1996**

**GRADING OF QUALITY ASSURANCE
REQUIREMENTS - A MANUAL, IAEA TECHNICAL
REPORTS SERIES NO. 328**

US

**QUALITY ASSURANCE PROGRAM REQUIREMENTS
FOR RESEARCH REACTORS, ANSI/ANS - 15.8, 1995**

**CODE OF FEDERAL REGULATIONS, SUBPART H,
10CFR71**

ANSI/ANS NQA - 1

SOME DEFINITIONS

QUALITY

ANS THE DEGREE TO WHICH AN ITEM OR PROCESS MEETS OR EXCEEDS THE USER'S REQUIREMENTS AND EXPECTATIONS.

IAEA THE TOTALITY OF FEATURES AND CHARACTERISTICS OF AN ITEM OR SERVICE THAT BEAR ON ITS ABILITY TO SATISFY A DEFINED REQUIREMENT.

QUALITY ASSURANCE

ANS THOSE PLANNED AND SYSTEMATIC ACTIONS NECESSARY TO PROVIDE ADEQUATE CONFIDENCE THAT THE STRUCTURE, SYSTEM OR COMPONENT WILL PERFORM SATISFACTORILY IN SERVICE.

IAEA ALL THOSE PLANNED AND SYSTEMATIC ACTIONS NECESSARY TO PROVIDE ADEQUATE CONFIDENCE THAT AN ITEM OR SERVICE WILL SATISFY GIVEN REQUIREMENTS FOR QUALITY.

SOME DEFINITIONS (CONTINUED)

QUALITY CONTROL

IAEA THE VERIFICATION THAT THE REQUIRED QUALITY HAS BEEN ACHIEVED.

MANAGEMENT

ANS THOSE PERSONS WITHIN THE RESEARCH REACTOR ORGANIZATION WHOSE RESPONSIBILITY AND AUTHORITY INCLUDE THE QUALITY ASSURANCE PROGRAM.

IAEA THAT ASPECT OF THE OVERALL MANAGEMENT FUNCTION THAT DETERMINES AND IMPLEMENTS THE QUALITY POLICY.

SAFETY RELATED ITEMS

ANS THOSE PHYSICAL STRUCTURES, SYSTEMS, AND COMPONENTS WHOSE INTENDED FUNCTIONS ARE TO PREVENT ACCIDENTS THAT COULD CAUSE UNDUE RISK TO THE HEALTH AND SAFETY OF WORKERS AND THE PUBLIC OR TO THE RESEARCH REACTOR'S PROGRAMS; AND TO CONTROL OR MITIGATE THE CONSEQUENCES OF SUCH ACCIDENTS.

IAEA ITEMS OR SYSTEMS IMPORTANT TO SAFETY WHICH ARE NOT SAFETY SYSTEMS.

COMPONENTS OF A QA PLAN OR PROGRAM

A NUCLEAR POWER PLANT WILL HAVE AN INDEPENDENT QA ORGANIZATION HEADED BY A QA MANAGER WITH A STAFF. THE MANAGER OFTEN REPORTS TO A VICE PRESIDENT THROUGH THE PLANT SUPERINTENDENT.

A RESEARCH REACTOR FACILITY IS USUALLY OPERATED WITH A SMALL STAFF WHERE PERSONNEL PERFORM MULTIPLE FUNCTIONS. IT IS RARELY POSSIBLE TO HAVE A TOTALLY INDEPENDENT QA ORGANIZATION OR EVEN A QA MANAGER.

COMPONENTS OF A QA PLAN

- 1. ORGANIZATION**
- 2. QA PROGRAM**
- 3. TRAINING**
- 4. DESIGN CONTROL**
- 5. PROCUREMENT CONTROL**
- 6. INSTRUCTIONS, PROCEDURES AND DRAWINGS**
- 7. DOCUMENT CONTROL**
- 8. CONTROL OF ITEMS**
- 9. CONTROL OF SPECIAL PROCESSES**
- 10. INSPECTIONS AND TESTING**
- 11. NONCONFORMANCE CONTROL**
- 12. QA RECORDS**
- 13. QA RECORDS**

1. ORGANIZATION

SINCE SUPERVISORS (OPERATIONS, MAINTENANCE, HEALTH PHYSICS, ENGINEERING, ETC.) ARE RESPONSIBLE FOR THE WORK OF THEIR SECTIONS AND THEIR STAFFS, MAKE THESE SUPERVISORS RESPONSIBLE FOR THE QA PROGRAM IN THEIR SECTIONS.

APPOINT ONE OF THEM (USUALLY AN ENGINEER) TO BE THE QA COORDINATOR. THE REACTOR MANAGER SHOULD NOT BE THE COORDINATOR BECAUSE THE MANAGER WILL AUDIT THE PROGRAM FOR ITS EFFECTIVENESS AS A MANAGEMENT TOOL.

ALTHOUGH THE COORDINATOR MAY PREPARE A DRAFT OF THE QA PLAN, ALLOW THE SUPERVISORS TO ACTIVELY PARTICIPATE IN THE DEVELOPMENT OF THE PLAN IN ORDER TO MAKE IT THEIR PLAN.

ALLOW THE QA COORDINATOR TO REPORT THROUGH THE REACTOR MANAGER TO A LEVEL ABOVE THE MANAGER.

ARRANGE FOR INDIVIDUALS NOT DIRECTLY PERFORMING THE WORK TO VERIFY THAT QUALITY HAS BEEN ACHIEVED IN THE WORK.

DEVELOP A RESPONSIBILITY MATRIX.

DEVELOP A PLAN TO RESOLVE DIFFERENCES IN OPINION BETWEEN THE SUPERVISORS. THE REACTOR MANAGER MAY BE USED TO RESOLVE DIFFERENCES.

COMPONENTS OF A QA PLAN OR PROGRAM (CONTINUED)

2. QA PROGRAM

INCLUDE A STATEMENT CONCERNING THE GOALS OF THE PROGRAM. PROGRESS TOWARDS ACHIEVING THESE GOALS SHOULD BE MEASURABLE.

IN THE PROGRAM, IDENTIFY THE ITEMS AND ACTIVITIES TO WHICH IT APPLIES TAKING INTO ACCOUNT THE ITEM'S OR ACTIVITY'S IMPORTANCE TO SAFETY.

IF EXISTING PROCEDURES HAVE BEEN UTILIZED SATISFACTORILY, INCORPORATE THEM INTO THE PROGRAM.

CREATE QA FORMS WHICH WILL BE USED BY THE SUPERVISORS AND THEIR STAFFS FOR ALL WORK.

AN IMPORTANT FORM IS THE **WORK PERMIT** WHICH PROVIDES FOR A REVIEW OF ALL WORK.

A REPRESENTATIVE PROGRAM, INCLUDING SAMPLE QA FORMS IS ATTACHED.

COMPONENTS OF A QA PLAN OR PROGRAM

(CONTINUED)

3. TRAINING

TRAINING IS NOT ALWAYS A SEPARATE PART OF THE PROGRAM. IT IS SOMETIMES INCLUDED IN INITIAL TRAINING FOR ALL NEW EMPLOYEES.

PROVIDE FOR APPROPRIATE INDOCTRINATION AND TRAINING OF ALL INDIVIDUALS WHO PERFORM ACTIVITIES WHICH AFFECT QUALITY.

PROVIDE FOR TESTING OF TRAINED INDIVIDUALS.

PERIODICALLY MONITOR PERFORMANCE TO IDENTIFY PROGRESS TOWARDS REACHING GOALS AND TO IDENTIFY DEFICIENCIES.

VIOLATIONS OF PRACTICES SHOULD BE ADDRESSED AND DOCUMENTED, AS APPROPRIATE.

FOR INFREQUENTLY PERFORMED JOBS, PROVIDE RETRAINING BEFORE START.

A REPRESENTATIVE SECTION ON TRAINING, INCLUDING SAMPLE QA FORMS IS ATTACHED.

COMPONENTS OF A QA PLAN OR PROGRAM

(CONTINUED)

4. DESIGN CONTROL

IN GENERAL, DESIGN CONTROL REFERS TO MODIFICATIONS TO A FACILITY AND THE CONSTRUCTION NECESSARY TO ACHIEVE THE MODIFICATION.

PROVIDE FOR AN INITIAL REVIEW TO DETERMINE IF CONFIGURATION CONTROL IS AN ISSUE.

PROVIDE FOR AN EARLY REVIEW TO DETERMINE IF THE REGULATORY BODY MUST BE INVOLVED.

PROVIDE FOR DESIGN VERIFICATION BY REVIEW OF PLANS BY MULTIPLE PERSONS AND COMMITTEES.

A REPRESENTATIVE SECTION ON DESIGN CONTROL, \ INCLUDING SAMPLE QA FORMS IS PROVIDED. IF EXTENSIVE DESIGN IS INVOLVED, CONSULT STANDARDS FOR CONSIDERATION OF ALL FACTORS.

COMPONENTS OF A QA PLAN OR PROGRAM
(CONTINUED)

5. PROCUREMENT CONTROL

PROVIDE FOR QA CONTROL ON ALL PURCHASE ORDERS, REQUISITIONS AND CONTRACTS.

PROVIDE FOR VENDOR EVALUATION INCLUDING EVALUATION OF VENDOR'S QA PROGRAM.

FOR ITEMS IMPORTANT TO SAFETY, CONSIDER INDEPENDENT VERIFICATION OF VENDOR'S TEST RESULTS.

ESTABLISH CRITERIA FOR ACCEPTABILITY OF PRODUCTS AND PERFORM RECEIVING INSPECTIONS IN ACCORDANCE WITH WRITTEN PROCEDURES.

A REPRESENTATIVE SECTION ON PROCUREMENT CONTROL, INCLUDING SAMPLE QA FORMS IS PROVIDED.

COMPONENTS OF A QA PLAN OR PROGRAM
(CONTINUED)

6. INSTRUCTIONS, PROCEDURES AND DRAWINGS

REQUIRE THAT ALL OPERATIONS BE PERFORMED ACCORDING TO WRITTEN, REVIEWED AND APPROVED PROCEDURES.

BASE THE EXTENT OF DETAIL IN A PROCEDURE ON THE COMPLEXITY OF THE TASK AND ITS IMPORTANCE TO SAFETY.

DOCUMENT THE PROCESS FOR MAKING CHANGES AND REVISIONS TO THE PROCEDURES.

PROVIDE A MECHANISM FOR CONTROL OF PROCEDURES SO THAT ONLY CURRENT, COMPLETE VERSION IS USED.

A REPRESENTATIVE SECTION ON PROCEDURES, INCLUDING SAMPLE QA FORMS IS PROVIDED.

COMPONENTS OF A QA PLAN OR PROGRAM

(CONTINUED)

7. DOCUMENT CONTROL

THE QA PLAN SHOULD DESCRIBE THE PROCESS FOR THE PREPARATION, REVIEW AND APPROVAL OF ALL DOCUMENTS.

THE QA COORDINATOR SHOULD ESTABLISH A MASTER LIST WITH THE CURRENT REVISION NUMBER FOR ALL DOCUMENTS WHICH ARE CONTROLLED. THESE ARE PROCEDURES, DRAWINGS, LICENSES, CERTIFICATES, ETC.

THE SUPERVISORS SHOULD BE ASSIGNED RESPONSIBILITY FOR ALL DOCUMENTS IN THEIR SPHERE OF RESPONSIBILITY. THE SUPERVISORS SHALL CONTROL THE DISTRIBUTION OF DOCUMENTS IN THEIR SECTIONS.

THE QA PLAN SHALL DESCRIBE THE PROCESS USED TO MAKE MAJOR CHANGES IN DOCUMENTS.

QA DOCUMENTATION FOR THE AS-BUILT FACILITY (INCLUDING FUEL ASSEMBLIES) MAY NOT MEET THE REQUIREMENTS OF THE QA PLAN DEVELOPED. HOWEVER, ALL AVAILABLE AS BUILT RECORDS SHOULD BE COLLECTED AND STORED ACCORDING TO THE REQUIREMENTS OF THE QA PLAN.

A REPRESENTATIVE SECTION ON DOCUMENT CONTROL, INCLUDING SAMPLE QA FORMS IS PROVIDED.

COMPONENTS OF A QA PLAN OR PROGRAM

(CONTINUED)

8. CONTROL OF ITEMS

CONTROL OF ITEMS IS SOMETIMES CALLED MATERIAL CONTROL.

SAFETY RELATED PARTS, COMPONENTS OR ASSEMBLIES ARE CONTROLLED BY A “MATERIAL TAGGING PROGRAM”.

THE APPLICATION AND REMOVAL OF TAGS, LABELS AND MARKINGS SHOULD BE CONTROLLED BY THE QA COORDINATOR.

QA FORMS SHOULD BE DEVELOPED FOR USE WITH THE TAGGING PROGRAM.

THE TAG FOR ITEMS WITH SPECIFIC SHELF LIFE SHALL STATE AN EXPIRATION DATE FOR THE ITEM.

THE CONTROL OF ITEMS SHOULD EXTEND TO HANDLING, STORAGE, SHIPPING AND MAINTENANCE.

A REPRESENTATIVE SECTION ON ITEM CONTROL, INCLUDING SAMPLE QA FORMS IS PROVIDED.

COMPONENTS OF A QA PLAN OR PROGRAM
(CONTINUED)

9. CONTROL OF SPECIAL PROCESSES

A SPECIAL PROCESS IS ONE IN WHICH THE RESULTS ARE HIGHLY DEPENDENT ON THE CONTROL OF THE PROCESS OR THE SKILL OF THE PERSONNEL.

DO NOT BASE THE QA PLAN ON THE MOST DIFFICULT SPECIAL PROCESS AT THE FACILITY.

A SPECIAL PROCESS MAY BE PLACED IN AN APPENDIX TO THE QA PLAN IN ORDER TO INCORPORATE REQUIREMENTS BEYOND THE NORMAL QA PLAN.

THE PREPARATION FOR AND THE SHIPMENT OF IRRADIATED FUEL ASSEMBLIES IS A SPECIAL PROCESS.

THE PURCHASE OF REPLACEMENT FUEL ASSEMBLIES IS A SPECIAL PROCESS.

CONSULTANTS ARE VERY OFTEN USED IN A SPECIAL PROCESS. THEIR RECOMMENDATIONS SHALL BECOME PART OF THE QA FILE. RESPONSIBILITY FOR ACCEPTANCE AND USE OF CONSULTANTS RECOMMENDATIONS RESTS WITH FACILITY STAFF.

ALTHOUGH THE SUPERVISORS PERFORM AS BEFORE, THE QA COORDINATOR AND/OR THE REACTOR MANAGER MAY BECOME MORE INVOLVED IN A SPECIAL PROCESS.

COMPONENTS OF A QA PLAN OR PROGRAM
(CONTINUED)

9. INSPECTIONS AND TESTING

INCLUDES EXAMINATIONS, MEASUREMENTS AND TESTS.

WRITTEN INSPECTION AND TEST PROCEDURES WHICH INCLUDE ACCEPTANCE CRITERIA SHOULD BE USED.

INSPECTION PERSONNEL SHALL BE INDEPENDENT OF THE INDIVIDUALS PERFORMING THE ACTIVITY BEING INSPECTED.

INSPECTIONS AND TESTS WHICH FAIL SHALL BE REPORTED ON A “DISCREPANCY AND NONCONFORMANCE SHEET” WHICH BECOMES PART OF THE QA RECORD.

MEASURING AND TEST EQUIPMENT SHALL BE CONTROLLED AND CALIBRATED AT SPECIFIC INTERVALS.

WHEN MEASURING AND TEST EQUIPMENT IS FOUND TO BE OUT OF CALIBRATION, A DOCUMENTED REVIEW SHALL BE MADE TO DETERMINE THE VALIDITY OF PREVIOUS USES OF THE EQUIPMENT.

COMPONENTS OF A QA PLAN OR PROGRAM (CONTINUED)

10. NONCONFORMANCE CONTROL

ALL NONCONFORMING ITEMS IMPORTANT TO SAFETY SHALL BE IDENTIFIED AND TAGGED AS NONCONFORMING.

NONCONFORMING ITEMS SHOULD BE SEGREGATED.

SUCH ITEMS SHOULD BE REPAIRED OR DISPOSED OF.

REPAIRED ITEMS SHOULD BE SUBJECTED TO THE QA PROGRAM THE SAME AS A NEWLY PURCHASED ITEM.

NONCONFORMANCE MAY REQUIRE NOTIFICATIONS TO THE VENDOR, REGULATORY BODY, ETC.

COMPONENTS OF A QA PLAN OR PROGRAM
(CONTINUED)

11. QA RECORDS

THE QA PROGRAM IS BASED UPON DOCUMENTED EVIDENCE THAT ALL ACTIVITIES HAVE BEEN PERFORMED WHICH AFFECT THE QUALITY OF SAFETY RELATED ITEMS.

DEVELOP A MATRIX WHICH SHOWS THE RECORDS WHICH MUST BE GENERATED, THE RETENTION PERIOD AND THE INDIVIDUAL RESPONSIBLE FOR THE RECORD.

RECORDS SHALL BE IDENTIFIABLE, EASILY RETRIEVABLE AND ARCHIVED.

THE RECORDS GENERATED DURING THE SHIPPING PROCESS (A SPECIAL PROCESS) SHOULD BE MAINTAINED AS A PACKAGE.

COMPONENTS OF A QA PLAN OR PROGRAM
(CONTINUED)

12. QA AUDITS

PROVIDE FOR PERIODIC AUDITS OF PROGRAM.

CAREFULLY DEFINE THE SCOPE OF THE AUDIT.

AUDIT USING WRITTEN PROCEDURES AND CHECKLISTS.

FOR SELDOM USED PORTIONS OF THE PROGRAM (SPECIAL PROCESSES), AUDIT BEFORE USE.

DEVELOP PERFORMANCE INDICATORS FOR USE DURING THE AUDIT.

CONDITIONS REQUIRING CORRECTIVE ACTIONS SHALL BE PROMPTLY REPORTED TO THE APPROPRIATE MANAGEMENT.

A REPRESENTATIVE SECTION ON AUDITS, INCLUDING SAMPLE QA FORMS IS PROVIDED.

APP. IX. QUALITY ASSURANCE MANUAL

I. Organization

The Quality Assurance Program shall be carried out under the direction of the Director, Assistant Director, Radiological Protection Officer and Reactor Facility Engineer. These supervisors shall provide for control of all activities under their jurisdiction affecting the safety related functions of structures, systems and components of the reactor and also of irradiation and experiments which utilize the reactor. Table App. APP. IX.1 presents the distribution of responsibilities.

Activities under the jurisdiction of each supervisor shall be as specified in the job descriptions of each individual and as directed by the operating organization. The qualifications of each supervisor are as stated in the section of the job description entitled "Qualifications and Experience." (See attached job descriptions and Figure App. APP. IX-1: Organization Chart).

The overall authority and responsibility for the QA program shall rest with the Director. The Director is responsible for establishing the policies, goals, and objectives of the QA Program.

All differences of opinion between the QA/QC personnel and other personnel shall be resolved by the Assistant Director or Director who have the ultimate decision making powers. In order to assure a high degree of confidence that a structure, system, component or service is satisfactory, the operating organization supervisors will provide for inspections and/or tests by themselves or others. The operating organization supervisors have the responsibility and authority to stop any unsatisfactory work, installation of non-conforming materials or processes, and other quality control activities. Individuals who disagree with the resolution of differences may present their disagreement to the operating organization or Reactor Safety Committee (RSC) for action.

By-passing of inspections, tests, and other critical operations required by the QA program is permitted provided that no license, federal or state rule, or formal agreement is violated. However, such by-passing must have the approval of the supervisor under whose jurisdiction the feature falls and the approval of the Director or Assistant Director.

II. QA Program

The Quality Assurance Program includes those design, construction, maintenance, and operational activities which affect the structures, systems and components for which specifications are established in the technical specifications, operating procedures, emergency procedures, and licenses of the operating organization and shall include those activities which affect the ability of such a structure or component to perform its safety function.

These activities include, but are not limited to designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, operating, maintaining, repairing, refueling and modifying. Where appropriate, these activities are carried out according to written procedures, instructions and drawings.

Operating procedures and emergency procedures in force at the implementation of this QA program, shall continue to be used until revised.

The QA Program shall be operated in the following fashion:

- (1). The appropriate supervisor initiating a QA activity shall obtain a "package" of QA forms QA/QC-1 through 11 and shall determine what the necessary steps to follow shall be and what forms apply to the activity or activities. QA/QC-1 and 2 shall be completed in all reports as a minimum requirement.
- (2). Prior to issuing the work to subordinates, a "work permit" (Form QA/QC-6) shall be prepared. The work permit acts as a review of the work to be carried out. Enclosed with the work permit shall be all necessary training, instructions, specifications, drawings, etc. and the signature of another supervisor familiar with the work. Work permits shall be issued to those personnel who are trained and qualified in the techniques of the activity being performed, before the work is performed.
- (3). The supervisors monitoring the activities (at least 2) shall be responsible for completing the QA forms in accordance with the other sections of this program. Upon satisfactory completion of the activity or job, the entire QA package is returned to the Reactor Facility Engineer who is in charge of the program files.

III. QA Activity Training

Personnel responsible for performing quality-affecting activities shall be instructed as to the purpose, scope, and implementation of the quality related manual, instructions, and procedures. Personnel performing quality affecting activities shall be trained and qualified in the principles and techniques of the activity being performed'

The supervisor shall test the trainee in a suitable fashion, document the results and attach to the work permit the "QA Activity Training Sheet," (Form QA/QC-8). Proficiency of personnel performing quality affecting activities is maintained by retraining, reexamination and/or re-certifying.

IV. Program Scope

The structures, systems, and components within the scope of the program include, but are not limited to the following:

- (1) reactor core, bridge, pool, dry gamma room, thermal shield and thermal column;
- (2) shim blades, regulating rods, their drives, indicators and detector systems;
- (3) the reactor building and its penetrations;
- (4) control system and its components;
- (5) ventilation systems and components;
- (6) effluent and area monitoring systems and components;
- (7) emergency generator, evacuation system, burglar systems, fire control systems and their components;
- (8) reactor fuel, reflectors, baskets, storage racks and fuel safe;

- (9) reactor handling tools, experimental tubes and devices and gas storage;
- (10) irradiation facilities, start-up experiments, calibration of control blades, critical experiments;
- (11) sources, monitoring instruments and dosimetry devices;
- (12) primary and secondary cooling systems and components;
- (13) water treatment systems and components;
- (14) effluent storage tanks, pumps and piping systems;
- (15) overhead crane system;
- (16) refueling and power distribution factors;
- (17) approvals of irradiations and experiments which utilize the reactor;
- (18) all records pertaining to operating procedures and technical specifications;
- (19) reactor spare parts and components;
- (20) quality assurance program; and
- (21) shipment of spent fuel to reprocessing.

V. Design Control and Review

The Director shall provide for a design review by the appropriate supervisors of the staff, RSC or operating organization for any modifications of or additions to those structures, systems, components or documents within the scope of the QA program as necessary. The reviews are performed by individuals or groups other than those who performed the original design. In all instances, the review assures that the design is correctly described in the approval or license application and that the contents of safety analyses are correct. Design reviews cover such items as reactor physics, thermal and hydraulic stress, accident analysis, compatibility of materials, and design interfaces and delineation of acceptance criteria for inspection and tests. The review assures that the design is adequate and complies with all applicable regulatory requirements as specified in the license or other regulations and that the design is translated correctly into specifications, drawings, procedures and instructions. Changes to documents are reviewed like original documents.

Documentation for the design verification reviews is provided in the form of QA approval applications containing the signature of at least two individuals who are familiar with the safety related functions of the affected structures, systems, components, etc. The approval application may be made in the form of an internal document (memo), a request to the RSC or an application to the NRC for an amendment to the Technical Specifications.

A QA review shall assess the scope, status, implementation and effectiveness of the QA program to assure that it is adequate and complies with 10CFR Part 71 and other applicable codes and regulations.

Assurance that an approved design is correctly translated into specifications, installation procedures, testing and operating instruction is to be accomplished by requiring that all such documents which fall within the QA program be checked by a knowledgeable individual other than the one who prepared the document and that they shall be signed by both. The use of the QA design form, QA/QC-3, and/or review form, QA/QC-7, shall be used as QA documents and shall be maintained on file with the QA documents.

VI. Procurement Document Control

In documents for procurement of materials, equipment and services, assurance that applicable regulatory requirements, design bases and other requirements such as material and component identification requirements, codes and industrial standards which are necessary to assure adequate quality are suitably included in such documents shall be accomplished by requiring that the appropriate supervisor and either the Assistant Director or Director both review and approve the specifications, drawings, processes, instructions or other documents which form part of the purchase order or contracts subject to the QA Program.

The Director or Assistant Director shall specify which quality requirements are necessary, which are capable of inspection and control and what the acceptance and rejection criteria shall be and that the document has been prepared, reviewed and approved in accordance with the QA program.

A list of qualified vendors for materials supplied in the past shall be a part of the procurement process. An original vendor who has provided satisfactory equipment, components or services is qualified to provide direct replacements without providing extensive QA documentation. That is, direct orders may be placed with them for replacement parts with only a supervisors review and a purchase requisition signed by the Assistant Director or Director.

Other purchases under the QA program must comply with the requirements of a properly completed "Procurement" sheet (QA/QC-5) being reviewed prior to placing the purchase order. A copy of the procurement sheet shall be attached to the purchase requisition.

Non-qualified vendors must submit QA documents as cited in the purchase specifications prior to actual award of the order or contract.

A copy of the purchase order, procurement sheet and attached specifications, drawings, procedures, etc. shall be maintained in the secretary files and also the QA files. The original procurement shall become part of the QA report package.

VII. Instructions, Procedures and Drawings

Activities affecting QA shall be prescribed, where appropriate, by documented instructions, procedures or drawings.

For modifications or additions to structures, systems or components within the scope of the program, such documents shall be prepared, approved as per Section V (Design Control and Review) and retained on file.

All copies of standards, tests, inspection requirements, regulatory requirements and special processes and instructions shall be also maintained on file.

VIII. Document Control

Documents relating to a particular type of activity are, in general, prepared under the direction of the supervisor having responsibility for that activity. That supervisor is delegated the

responsibility for maintaining a file on such documents, revising them to reflect approved changes and as built conditions, and clearly identifying all drafts, the document as originally approved and all revisions. Approved changes in QA documents shall be included in all instructions, procedures, drawings, etc. before the QA activity is carried out. Distribution of documents is subject to the approval of each supervisor. The proper QA report or document(s) shall be made available at the location of the QA activity prior to its commencement.

If possible, changes to documents shall be reviewed and approved by the group that performed the original review and approval, unless the Director or Assistant Director specifically designates another responsible group or organization.

The Reactor Facility Engineer shall maintain a master list with the current revision numbers of all instructions, procedures, drawings, etc. and all QA forms and reports. He will assure that approved changes are included before allowing the implementation of the change. Refer to Tables A and B for the description, location and responsibility for files and records. It shall be his responsibility to maintain a current copy of the QA manual which includes all revisions. He shall be responsible for updating all existing copies of the manual.

IX. Material Control

Identification and control of safety related parts, components or assemblies shall be used where it is necessary to identify items, through handling, storage, shipping, cleaning, installation, repair and modification. Identification shall be controlled by the operating organization "Material Tagging Program."

Material tagging shall be accomplished by completing a "Material Identification Sheet" and tagging the item with the "accepted material" tag for acceptable items or affixing a "Do Not Use-Defective" tag for unacceptable items. Tag numbers are kept on the material identification sheet and also on each tag. When a tagged item is to be used, repaired, etc., the tag is returned to the Reactor Facility Engineer. He administers the tagging program. All records are kept under his control. (See Table A). The application and removal of all tags, labels and markings are procedurally controlled by the Reactor Facility Engineer.

X. Control of Special Processes

The supervisors or such other individuals or organizations as the Director, Assistant Director, as appropriate, may designate, are assigned the responsibility for incorporating into instructions, procedures and drawings, used either for procurement or for control of internal activities within the scope of the Quality Assurance Program, the applicable portions of codes and standards in order to assure that special processes are accomplished by qualified personnel using qualified procedures. Such processes include, but are not limited to: welding, heat treating, non-destructive testing, cleaning and preparation and shipment of spent reactor fuel elements.

Vendors will be required to guarantee compliance before a contract or purchase order is issued. Vendors will be required to furnish documented evidence of qualification when applicable, including company licenses or other proof of competence.

The appropriate supervisor is responsible for surveillance of both vendor and in-house special processes and for certifying to the Director or Assistant Director in written form that the work has been accomplished as specified. The Director or Assistant Director, as appropriate, may at times involve expert counsel in special problems. The written recommendations of the consultant shall be obtained and shall be part of the QA file, but responsibility for acceptance shall be with the former individuals.

For the preparation and shipment of spent fuel elements:

- (1) Special handling, preservation, storage, clearing, packaging and shipping requirements are established and accomplished by qualified individuals in accordance with predetermined work and inspection instructions.
- (2) The departure time, arrival time, and destination of a package will be established and maintained to a degree consistent with the safe transportation of the package.
- (3) All necessary shipping papers will be prepared, as required.
- (4) All conditions of the NRC package approval and the U.S. Department of Transportation shipping requirements shall be satisfied prior to shipment.
- (5) All requirements of the addendum to this manual for preparation and shipment of irradiated fuel are met.

XI. Inspection and Testing

The operating organization inspection and testing program includes examinations, measurements and tests to assure that purchased material, equipment, services and work conform to the requirements of applicable instructions, procedures, drawings and specifications.

Acceptance criteria and any necessary test procedures are in written form and approved prior to procurement or installation.

Where necessary, the supervisors may witness special inspections and tests and shall be provided with current drawings, specifications, procedures and instructions and shall document the results of their inspections on the "Receiving, Inspection and Test" form, QA/QC-4, which is part of the QA report to be retained on file. Inspection personnel will be independent from individuals performing the activity being inspected.

Inspections or tests that fail shall be reported on a "Discrepancy and Non-conformance" sheet. The activity shall be stopped and the supervisor involved shall be notified. When the proper corrections have been made and, if re-testing is necessary, then the results shall be noted. Any "Discrepancy and Non-conformance" sheet used shall be attached as part of the QA Report, and retained. The Engineer shall also maintain a log of such discrepancies or non-conformance, duly noted on a log sheet. He shall retain these on file as part of the QA program.

Some activities cannot be proven acceptable by inspection by one person and must be subject to inspection by a second individual to assure satisfactory completion of the QA activity. All inspectors shall sign the proper QA forms used in the inspection.

Written inspection procedures, including instrument calibrations, shall be attached to the inspection and testing forms prior to actual inspection and test. They shall be retained as part of the QA report. All test instrument calibrations shall be in accordance with manufacturer instructions or with nationally known standards or procedures, including the interval between calibrations. All results shall be recorded on the "QA Instrument Calibration Sheet", QA/QC-9. When an instrument is out of calibration, it shall not be used for QA inspection and must be repaired and/or removed from use. If it is defective, it should be tagged as such (See Section IX). When measuring and test equipment is found to be out of calibration, a review will be made and documented to determine the validity of previous inspections using the equipment.

Directly upon the completion of each inspection or test, the inspector must sign the form to prevent inadvertent by-passing.

Recommendations may be made for QA corrective procedures, specifications, drawings, etc. to help minimize the recurrence of deficiencies. Such recommendations shall be made through the use of the "review sheet" or in the form of a "memo" attached to a review sheet. They shall be part of the QA program and be retained on file.

XII. Non-conforming Materials, Parts, Structures and Systems

All non-conforming safety related materials, parts, structures and systems shall be identified as described in Section IX. These items shall be segregated and shall either be repaired or disposed of. Disposition of these non-conforming items shall be accomplished after a review by the supervisor. Any items repaired shall go through the QA program the same as newly purchased items. Notification to affected organizations will be made. Form QA/QC-10 should be completed.

XIII. Quality Assurance Records

The QA program is based upon documentary evidence of all activities affecting quality of safety related items.

Records maintained shall include as a minimum: QA reports, logs, inspection and test results, results of QA reviews, monitoring actions, audits, materials analyses, procedures used in QA program records, modification records, and records of personnel involved in the quality related activities.

All records shall be identifiable and retrievable. Retention requirements will be established for these records. (See the attached Table A).

In the case of those records which define the "as built" condition of the system, the retention period shall be for the life of the system.

Quality control reports shall be composed of the Quality Control Report Sheets and the necessary attached forms and retained on file.

XIV. Audits

Audits shall be performed at least annually. The audit shall be conducted in accordance with the provisions of the Audit Report Sheet, QA/QC-11, and the results shall be documented and reported to the operating organization. The audits may be scheduled or unscheduled. The audit shall be conducted for the operating organization by the Director and shall include the scope, status and effectiveness of the program.

Deficient areas will be noted and corrective actions taken. Deficient areas will be re-audited on a timely basis to verify implementation of corrective actions taken to minimize the possibility of reoccurrence of the deficiencies.

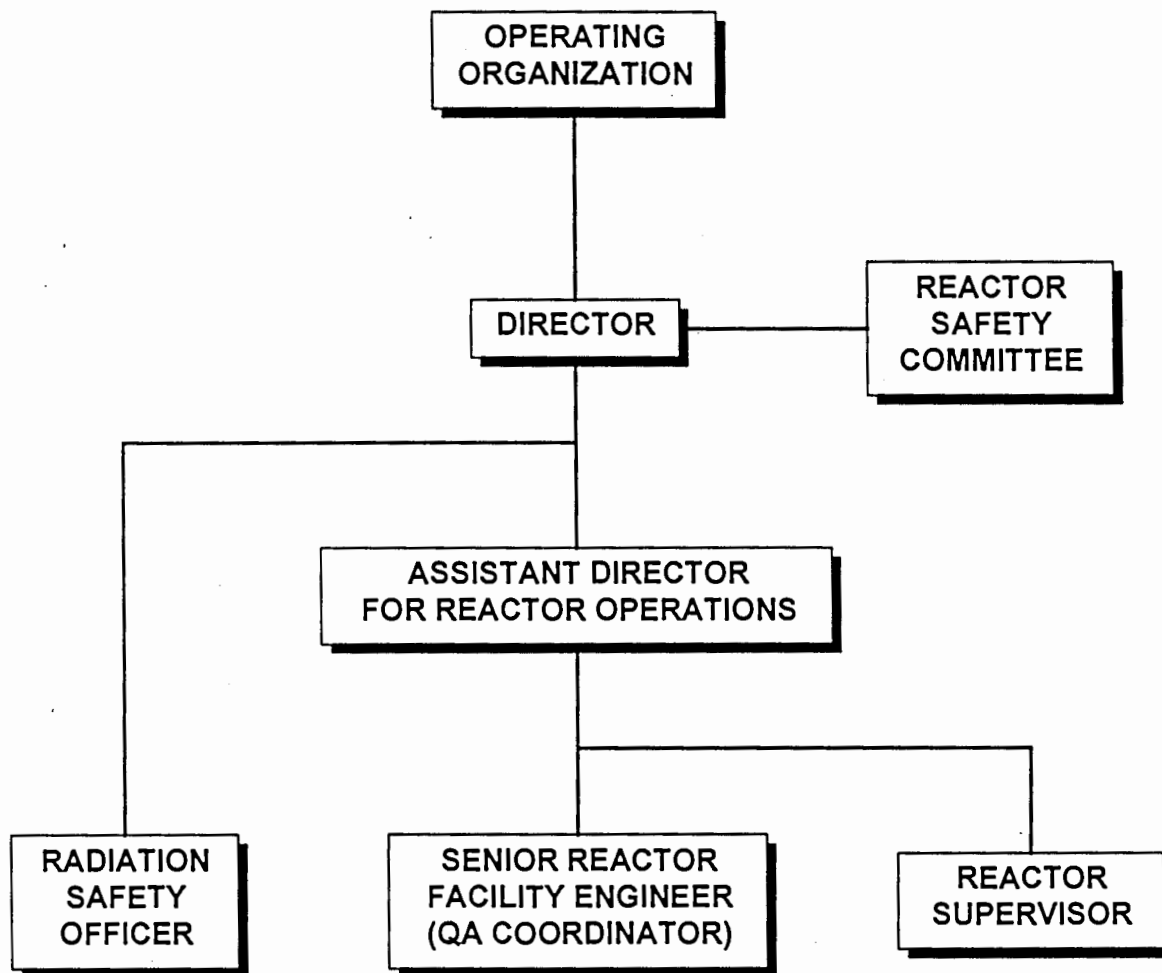


Figure App. APP. IX-1: Organization Chart

Table App. APP. IX.1: Distribution of QA Responsibilities

RECORD	LOCATION	RESPONSIBILITY	RETENTION CODE
Operations Log Books	Safe or control room	Asst. Director	A
Maintenance Log	Control room files	Engineer	A
Purchase Orders	Secretary files	Asst. Director	C
Visitor Log	Secretary files	Asst. Director	A
Recorder Charts	Storage file	Asst. Director	A
Pre-startup Check Sheets	Control room file	Asst. Director	A
Shift Record Data Sheets	Control room file	Asst. Director	A
Engineering Drawings	Engineering office or control room	Engineer	A
Instrument Calibration Log	Radiation Protection Office	Rad. Protection Officer	A
Personnel Monitoring Records	Radiation Protection Office	Rad. Protection Officer	A
Irradiation Requests	Asst. Director office	Asst. Director	A
Experiments File	Radiation Protection and Asst. Director office	Rad. Protection Officer Asst. Director	A
Inventory of Radioactive Materials	Radiation Protection Office	Rad. Protection Officer	A
Source Leak Tests Record	Radiation Protection Office	Rad. Protection Officer	A
Survey Records and Bioassays	Radiation Protection Office	Rad. Protection Officer	A
Reactor Security Checklist	Control room files	Asst. Director	A
Engineering	Engineer's office	Engineer	A
Air Flow Systems Logs	Engineer's office	Engineer	A
QA/QC Reports QA Log and Tags	Engineer's office	Engineer	A
Campus Guards Reports	Engineer's office	Engineer	C
Reactor Operator Re-qualifications	Director's office	Asst. Director	A
QA Procedures	Engineer's office	Asst. Director	A
Reactor Safety Committee Reports	Director's office	Asst. Director	A
BMI-1 Cask QA Forms and Log	Engineer's office	Engineer	A
Fuel Element History Records	Director's office	Director	A

Retention Codes: A - Duration of operation + 2 years
 B - Until item disposed of + 2 years
 C - 3 years

QUALITY CONTROL REPORT

QA/QC REPORT #

(Check the applicable enclosed forms)

- 1. QA Activity Check List
- 2. QA Design Sheet
- 3. QA Procurement Sheet
- 4. QA Receiving Inspection & Test Sheet
- 5. QA Work Permit
- 6. QA Review Sheet
- 7. QA Activity Training Sheet
- 8. QA Instrument Calibration Sheet
- 9. QA Discrepancy or Non-conformance Sheet
- 10. QA Audit Sheet
- 11. *Discrepancy or Non-conformance Log
- 12. *Material Identification Sheet

* Note: Filled out only-retained in QA files

QA/QC REPORT APPROVALS

DATE COMPLETED

- 1. Director
- 2. Assistant Director
- 3. Radiological Protection Officer
- 4. Reactor Facility Engineer
- 5. AEC
- 6. Reactor Safety Committee

QUALITY CONTROL ACTIVITY CHECK LIST

Check the applicable items below and attach to the QA/QC report.

PROCUREMENT	<input type="checkbox"/>	DESIGN	<input type="checkbox"/>
MODIFICATION	<input type="checkbox"/>	REPAIR	<input type="checkbox"/>
REFUELING	<input type="checkbox"/>	ERECTING	<input type="checkbox"/>
SHIPPING	<input type="checkbox"/>	RECEIVING	<input type="checkbox"/>
HANDLING	<input type="checkbox"/>	CLEANING	<input type="checkbox"/>
STORING	<input type="checkbox"/>	IDENTIFICATION	<input type="checkbox"/>
TAGGING	<input type="checkbox"/>	REVIEW	<input type="checkbox"/>
PREOPERATIONAL TEST	<input type="checkbox"/>	OPERATIONAL TEST	<input type="checkbox"/>
INSPECTION	<input type="checkbox"/>	AUDIT	<input type="checkbox"/>
PROCEDURE WRITING	<input type="checkbox"/>	DRAWING (S)	<input type="checkbox"/>
DOCUMENT CONTROL	<input type="checkbox"/>	CALIBRATION	<input type="checkbox"/>
PERSONNEL	<input type="checkbox"/>	SPECIFICATION	<input type="checkbox"/>
QUALIFICATIONS	<input type="checkbox"/>	WRITING	<input type="checkbox"/>
MAINTENANCE	<input type="checkbox"/>	OTHER	<input type="checkbox"/>

DATE: _____ INITIATED BY: _____

RESPONSIBILITY DELEGATED: FROM: _____

TO: _____

DATE: _____

Form completed by: _____

DESIGN SHEET

Initiator: _____ Designer(s): _____
Quality Control Activity: _____ Date: _____

Project Description:

Activity Acceptance Criteria: (Specifications, Calculations, Drawings, Procedures, etc.)

QA/QC References, Documents, etc.:

QA/QC Approvals: [Two (2) required]

1. Name: _____ Title: _____

2. Name: _____ Title: _____

RECEIVING. INSPECTION AND TESTING FORM

Item: New ___ or Repaired ___ Surplus ___

Date Received: By: _____

Purchase Order #:

Reference Criteria: (Drawing #, Parts List, Model # etc.)

Packing Slip Enclosed _____ Returned to Secretary _____

INSPECTION AND TESTING

1. Visual Inspection Results: By _____

- A.
- B.

2. Special Procedures, Codes or Instructions Applicable: (attach) By _____

3. Vendor Documents (Guarantee, Test Results, etc.): By _____

4. Calibration Procedures and Results:
Instruction Cal. Sheet Required _____yes _____no

5 Test Results:
Conformance: _____
Non-conformance: _____ Retest Required _____
Discrepancy: Noted on QA/QC-9

Tested by: _____ Date: _____

6. Recommendations:

Accept _____
Return _____ Repair By Vendor _____

Required Approvals: (At least 2 required)

- 1. Director: _____
- 2. Assistant Director: _____
- 3. Health Physicist: _____

QA/QC PROCUREMENT FORM

QA Initiator _____ Date _____

Purchase Order or Requisition # _____

QA/QC Report # _____

Item Description (Include specifications, drawings etc.) _____

Acceptance or rejection criteria: _____

Applicable codes and standards: _____

Test and inspection requirements: _____

Special process instructions: _____

Vendor documents and QA/QC requirements _____

NSC APPROVALS

TITLE

(1) _____

(2) _____

NOTE:

Attach copy to: Purchase Requisition

Retain original in QA Report

QA/QC WORK PERMIT

Prior approvals required before any work is done:

(1) QA Activity Training Sheet Completed and Enclosed: _____

(2) Job Description: _____

(3) Attach Procedures, Drawings, etc., (copies at site): _____

(4) Protective Measurements To Be Used: _____

(5) Name and Title of Personnel Required:

(a) _____

(b) _____

(c) _____

(d) _____

(6) Copies of Necessary Licenses and Permits: _____

(7) If Radiological Surveys are Necessary, Contact the RSO and Attach Results:

(8) QA Testing Equipment Calibrated (if applicable): _____

QA SIGNATURES (2 Required)

- (1) Director
- (2) Assistant Director
- (3) Radiological Safety Officer
- (4) Reactor Facility Engineer

Instructor Approval: _____ Date: _____

Trainee Signature: _____ Date: _____

Form # NSC-QA/QC-7

Rev.# _____

REVIEW SHEET

DATE: _____ REVIEWED BY: _____

DESCRIPTION OF AREA(S) OF REVIEW:

OFFICIAL RECOMMENDATIONS:

REQUIRED APPROVALS: [At Least Two (2) Individuals]

1. DIRECTOR: _____

2. ASSISTANT DIRECTOR: _____

3. RADIATION SAFETY OFFICER: _____

4. ENGINEER: _____

5. AEC: _____

6. RSC: _____

DISCREPANCY OR NON-CONFORMANCE REPORT SHEET

QA Report # _____

DWG/Spec. No.	Rev. No.	Item/System Identification	Date
_____	_____	_____	_____

Vendor/Contractor: _____ Discrepancy Noted _____

Discrepancy or Non-conformance: _____ Receiving _____
 _____ Inspection _____
 _____ Test _____
 _____ Other _____

Signature: _____ Signature: _____
 Title: _____ Title: _____

DISPOSITION / ACTION TAKEN

Director Notification: _____yes _____no ACTION TAKEN
 Assistant Director Notification: _____yes _____no
 Radiation Safety Officer: _____yes _____no
 Reactor Facility Engineer: _____yes _____no

Corrective Action Required: _____yes _____no

Re-inspection Required _____yes _____no

Inspector Signature: _____ Supervisor Signature: _____

Distribution:

- 1. QA Report
- 2. QA Files
- 3. Purchase Order

QA AUDIT SHEET

QA/QC Report # _____

Date: _____

Criteria Being Audited: _____

Audit Plan: _____

Personnel Contacted: _____

Audit Team Members: _____

Corrective Actions or Non-conformance Issued Against Audit: _____

Follow-up Activities: _____

Audit Team Leader: _____ Approved: _____
Title: _____ Date: _____

Distribution:

FROM THE CODE

The operating organization should establish, and maintain by training and exercises, appropriate emergency plans in accordance with established criteria of the regulatory body, and in co-operation with appropriate bodies, to provide an effective response to emergencies.

EMERGENCY PLANNING

SOURCE MATERIAL

Method for the development of emergency response preparedness for nuclear or radiological accidents,
IAEA, March 1997.

Contains specific material for research reactor emergency plans and procedures using a ten task approach.

International response technical manual and InterRAS model Reactor accident assessment, IAEA, March 1997.

Most of contents is specific for power reactors. However many of the techniques and tables are useful for research reactors of intermediate and high power level.

Emergency Planning for Research Reactors,
ANSI/ANS 15.16.

Officially adopted by the NRC and used in the US for emergency planning for licensed research reactors.

SOURCE MATERIAL (continued)

Standard Review Plan for the Review and Evaluation of Emergency Plans for Research and Test Reactors, USNRC, NUREG-0849, 1983 and updates.

Contains specific material for research reactors including a ten step approach to developing a plan and implementing procedures.

Development of Technical Specifications for Research Reactors, ANSI/ANS 15.1.

Contains recommendations for determination of Source Terms for beyond design basis accident used for emergency planning.

Research Reactor Accident Source Term, IAEA, in preparation.

Will contain recommendations for accident source term for research reactors.

EMERGENCY PLANNING

GENERAL

THE EMERGENCY PLAN ADDRESSES THE NECESSARY PROVISIONS FOR COPING WITH RADIOLOGICAL EMERGENCIES. ACTIVATION OF THE PLAN IS IN RESPONSE TO EMERGENCY ACTION LEVELS.

THE EMERGENCY PLAN SHOULD CONTAIN 10 ELEMENTS AS FOLLOWS:

1. INTRODUCTION
2. DEFINITIONS
3. ORGANIZATION AND RESPONSIBILITIES
4. EMERGENCY CLASSIFICATION SYSTEM
5. EMERGENCY ACTION LEVELS
6. EMERGENCY PLANNING ZONES
7. EMERGENCY RESPONSE
8. EMERGENCY FACILITIES AND EQUIPMENT
9. RECOVERY
10. MAINTAINING EMERGENCY PREPAREDNESS

1. INTRODUCTION

A DESCRIPTION OF THE' REACTOR
A DESCRIPTION OF THE LOCATION
IDENTIFICATION OF THE OWNER/OPERATOR
OBJECTIVE OF THE PLAN

2. DEFINITIONS

WORDS OR PHRASES WITH MEANINGS SPECIFIC TO
FACILITY

3. ORGANIZATION AND RESPONSIBILITIES

FUNCTION OF FEDERAL, STATE, AND LOCAL
GOVERNMENTS AND THE ASSISTANCE THEY WOULD
PROVIDE

REACTOR EMERGENCY ORGANIZATION FOR COPING WITH
EMERGENCY, RECOVERY AND MAINTAINING
EMERGENCY PREPAREDNESS

WRITTEN ARRANGEMENTS AND AGREEMENTS WITH
LOCAL SUPPORT ORGANIZATIONS WHICH AUGMENT
CAPABILITY OF FACILITY STAFF

BLOCK DIAGRAM SHOWING THE INTERRELATIONSHIPS OF
TOTAL RESPONSE ORGANIZATION

CAPABILITY FOR AROUND THE CLOCK OPERATION

TITLE OF EMERGENCY DIRECTOR, INCLUDING LINE OF
SUCCESSION, AUTHORITY, AND RESPONSIBILITIES
WHICH CANNOT BE DELEGATED

TITLE OF EMERGENCY COORDINATOR

TITLE OF PUBLIC RELATIONS PERSON

TITLE OF PERSON WITH RESPONSIBILITY FOR ON-SITE
AND OFF-SITE DOSE ASSESSMENTS AND RECOMMENDING
PROTECTIVE ACTIONS

TITLE OF PERSON WHO MAY AUTHORIZE REENTRY

TITLE OF PERSON WHO MAY TERMINATE AN EMERGENCY
AND BEGIN RECOVERY OPERATIONS

TITLE OF PERSON WHO MAY AUTHORIZE VOLUNTEERS TO
INCUR RADIATION EXPOSURES IN EXCESS OF NORMAL
LIMITS

4. EMERGENCY CLASSIFICATION SYSTEM

NOTIFICATION OF UNUSUAL EVENT

MAN MADE OR NATURAL
SLOW ACTING
NO RADIOACTIVITY INVOLVED

EXAMPLES

BREACH OF SECURITY
TORNADO, EARTHQUAKE OF MINOR INTENSITY
FIRE
FOSSIL PRODUCT RELEASE

ALERT

OF RADIOLOGICAL SIGNIFICANCE TO NOTIFY
EMERGENCY ORGANIZATION
UNLIKELY OFF-SITE RESPONSE NECESSARY
REACTOR PROBABLY SHUT DOWN
PROTECTIVE ACTIONS AND ISOLATION PROBABLE

EXAMPLES

FUEL CLAD FAILURE
SEVERE RADIOACTIVE RELEASE FROM EXPERIMENT
FAILURE

SITE AREA EMERGENCY

OFF-SITE RESPONSE PROBABLY NECESSARY
MONITORING AT SITE BOUNDARY NECESSARY

EXAMPLES

SEVERE FAILURE OF FUEL CLAD
FAILURE OF FUELED EXPERIMENT

GENERAL

NOT CREDIBLE FOR RESEARCH REACTORS

5. EMERGENCY ACTION LEVELS

ESTABLISH ACTION LEVELS APPROPRIATE TO THE
FACILITY AND CONSISTENT WITH EMERGENCY
CLASSES

6. EMERGENCY PLANNING ZONES

PLAN MUST ESTABLISH ZONES

USE GUIDANCE PROVIDED (IN US)

7. EMERGENCY RESPONSE

RELATED TO THE CLASSES AND ACTION LEVELS

CALL LIST

CONTENT OF MESSAGES

IMPACT OF RELEASE AND RECOMMENDED OFF-SITE
ACTIONS

CONDITIONS FOR EVACUATION OF ON-SITE PERSONNEL

PERSONNEL ACCOUNTABILITY

EXPOSURE GUIDELINES

8. EMERGENCY FACILITIES AND EQUIPMENT

DESCRIBE FACILITIES, TYPES OF EQUIPMENT, LOCATIONS

EXAMPLES

PORTABLE AND FIXED RADIATION MONITORS

SAMPLING EQUIPMENT

PERSONNEL MONITORING EQUIPMENT

PORTABLE AIR SAMPLERS

REACTOR EQUIPMENT

FACILITIES FOR DECONTAMINATION

COMMUNICATIONS

9. RECOVERY

RECOVERY PROCEDURES WILL BE WRITTEN AS NEEDED

10. MAINTAINING EMERGENCY PREPAREDNESS

TRAINING PROGRAM

MONITORING

FIRST AID

DRILLS, WITH CRITIQUES

MODIFICATIONS

PREPARATION OF IMPLEMENTING PROCEDURES