

UPGRADING OF QUALITY ASSURANCE PROGRAMMATIC
REQUIREMENTS FOR OPERATING
NUCLEAR POWER PLANTS

ABSTRACT

As a result of analysis of the TMI accident and experience at several construction sites for nuclear power plants, the NRC staff has concluded that certain quality assurance programmatic modifications relative to presently existing requirements should be made. These modifications are directed toward upgrading and strengthening the quality assurance function at operating nuclear power plants to improve its effectiveness in identifying and correcting operational deficiencies to protect the public health and safety. Specific areas of QA programmatic upgrading include:

1. Improving management attitudes toward quality assurance.
2. Expanding the category of structures, systems, and components to which the QA program applies to include all items that affect safety.
3. Improving the organizational independence of the QA function from the performing functions.
4. Increasing QA staffing levels and qualification requirements for QA personnel.
5. Increasing the involvement of the QA organization in the inspection and verification of operational activities.
6. Increasing the involvement of the QA organization in the review and approval of quality-affecting documents.

The NRC has developed new requirements in the above areas and has initiated implementation on TMI-1 (Restart) and several other operational units at sites located near high population density areas. It is ultimately planned to require implementation of these new requirements for all nuclear plants under design and construction as well as in operation. These and other new requirements are also contemplated for implementation on new plants under design and construction.

As a result of the analysis of both the TMI-2 accident and recently found quality assurance deficiencies at construction sites for new nuclear power plants, the NRC staff has identified several areas of programmatic requirements needing upgrading to provide greater confidence in the effectiveness of quality assurance (QA) programs for operating nuclear power plants. The areas of upgrading are intended to provide overall strengthening of the QA program by expanding its formal coverage to additional items and activities, by improving its organizational independence, by improving staffing levels and qualifications of personnel, and, last but certainly not least, by emphasizing the need for licensee management to recognize the value of, create, and maintain an effective QA program. Because of the rather general nature of the criteria of Appendix B to 10 CFR Part 50, none of the upgrades require revision to the Regulations other than a clarification of certain language regarding the structures, systems, and components to which the QA program applies.

The specific areas of upgrading for QA programs have been identified in Task I.F. of the TMI Action Plan (NUREG-0660) for nuclear plants under design and construction as well as operational. Several of the more significant areas have been selected for earlier application to specific facilities than is otherwise called for by the Action Plan schedule.

Management Attitude Toward Quality Assurance

The attitude of the licensee's management toward quality assurance is of utmost importance to the success or failure of the QA Program. Only with a clearly positive attitude toward quality assurance transmitted from top management can an effective QA program be created and implemented. Too many utilities still view quality assurance as a costly and overdone "paper-mill" rather than a necessary and cost-effective management control tool. A properly formulated and implemented QA program can assure a higher degree of plant safety and reliability than would otherwise exist. Quality assurance should permeate all levels of management including their active involvement and should enjoy a strong commitment from above to provide the maximum potential for full effectiveness. The key activity areas where top management involvement should occur are as follows:

- a. Formulating the company's basic quality assurance policies, goals, and objectives.

- b. Establishing a highly qualified quality assurance organization with the necessary authority, organizational freedom, freedom from cost and schedule pressures, staffing levels, and management backing. Backing by management should confirm to all company personnel that the tenets of the QA program will be enforced.
- c. Periodically assessing the scope and implementation of the QA program to assure it is satisfying company objectives.

The QA program, including the organization for its implementation, must have the unqualified support and backing by all levels of management, and this attitude must be clearly demonstrated to the plant working level personnel.

Extension of the QA Program to All Items Affecting Safety

Up to the present time, the applicability of the QA program conforming to Appendix B requirements was limited to those structures, systems, and components needed to prevent or mitigate the consequences of postulated accidents that could cause undue risk to the public health and safety. Other items in the plant that had a lesser significance to safety were subjected to the provisions of General Design Criterion 1 of Appendix A to 10 CFR 50. Until now, the NRC staff has not developed specific guidance regarding the quality assurance requirements for the latter grouping of items. However, given the impetus of the TMI-2 accident in which several plant systems and components not subjected to the Appendix B QA program played an important role in the accident scenario, it became clear that such guidance is needed and could be readily made available by simply expanding the applicability of the QA program to include all items affecting safety. These items have a regulatory base in that they can be derived from the General Design Criteria given in Appendix A to 10 CFR 50 and from other pertinent regulations and include Regulatory Guide 1.29 (Positions 1 through 4) plus spare and replacement parts, and consumables and expendables needed for the various activities performed in connection with those items. Initiating such a requirement at the operating license stage means that the operational QA program would be applicable to all future activities (backfit not required) conducted in connection with these items such as maintenance, modification, repair, performance testing, surveillance testing, and replacement. As required by Criterion II, "Quality Assurance Program" of Appendix B to 10 CFR 50, the QA program shall provide control over all activities affecting the quality of the identified items to an extent consistent with the item's importance to safety. In this regard, it is expected that the

extent of applicability of the 18 criteria of Appendix B and related requirements given in the SRP, Regulatory Guides, and endorsed standards to a specific item shall be determined through a technical evaluation conducted by the Engineering and QA functions. In this way, a meaningful and efficient QA program can be established whose purpose is to assure that the specified design requirements and subsequent activities affecting safety for an item are properly implemented.

Extension of the QA program to all items important to safety should provide greater assurance of the proper attention to all safety aspects of the plant thereby contributing to improved operational safety.

Organizational Independence

In the past, organizational relationships for operating plants have been found acceptable in which the onsite quality assurance (QA) and quality control (QC) personnel functioned in separate portions of the organization and reported either directly or indirectly to the Plant Manager. While the QA and QC functions were accomplished by personnel other than those who performed the work, there is concern regarding whether sufficient independence exists from the pressures of cost and schedule attendant in maintaining a plant in an operational mode. To alleviate this concern, the independence of the QA/QC function has been strengthened by requiring the QA organization to assume responsibility for all onsite QA activities through implementation of the necessary review, inspection, surveillance, and audit functions. The quality control function would, therefore, be the responsibility of the QA organization. Further, the onsite QA organization should report technically and administratively to offsite QA management, and personnel responsible for performing the QA/QC functions should in turn report both technically and administratively to the QA organization. To assure that the QA organization performs its function in a timely manner, close communication ties (e.g., daily staff meetings) shall be maintained with the Plant Manager and his staff. We believe that such an organizational arrangement can materially assist in establishing a stronger and therefore more effective QA function.

QA Staffing and Qualification Requirements

One of the reasons for the lack of proper implementation of QA programs as determined through analysis of QA deficiencies at several construction sites, and discussions with some licensees and IE inspectors is an inadequate staff in terms of both manpower levels and qualification requirements for personnel. For this reason, necessary QA tasks may be left undone or done in an inadequate manner. In

response to this weakness in implementation, greater emphasis is being placed on the need for identifying specific tasks to be performed, the level of qualification and certification required for the assigned tasks, and the staff size necessary to perform the tasks. Special operational activities such as maintenance, modifications, refueling and insertive inspection will require augmented staffing levels. As mentioned above, close communication between the QA organization and the operating staff must be established through frequent meetings and coordinated advance planning to assure the timely availability of the required number of properly qualified QA personnel at the job site. Greater emphasis is also being placed on the qualifications and training for QA personnel to assure appropriate educational levels including the need for an engineering degree, certified professional engineer in QA, certified ASQA-QA engineer, or other related formal and on-the-job training. Training would also encompass instructions in the specific activities to which individuals are assigned such as knowledge of the governing documents; the performance of inspections, examinations, and tests; and familiarity and knowledge of the instructions for the various areas affecting quality such as instrumentation and calibration control, control room operations, radiation, technical specifications, electrical and mechanical systems, fuel handling, etc. Proficiency of QA personnel should be determined by appropriate testing and the level of qualification maintained by retraining and/or reexamining or recertifying. The overall intent of these requirements is to assure that QA personnel are not only available, but also fully qualified and knowledgeable to perform the necessary QA functions.

Involvement of QA Organization in Operational Activities

Both onsite and offsite elements of the QA organization should be actively involved in all the operational aspects of a nuclear power plant that affect safety. Up to now the QA involvement has been at best inconsistent and minimal in certain areas with the result that the effectiveness of the QA program has not attained desired standards. The extent of involvement should vary as determined by the licensee's technical and QA personnel in accordance with the specific activity and its effect on plant safety and the complexity of the related QA requirements. Responsibilities of the QA organization should include the following:

- a. Surveillance and verification of pre-operational, startup, and operational tests, maintenance, modifications, and quality activities to assure conformance with technical specifications, and insertive inspection and testing requirements.

- b. Review of procurement documents to assure the necessary QA requirements are specified, and inspection of received items.
- c. Training and indoctrination of plant personnel responsible for performing quality-affecting activities involving safety to assure demonstrated proficiency and capability to perform assigned tasks (not including plant operators).
- d. Surveillance and verification to assure that instrument calibration programs are conducted in accordance with procedures and specification requirements.
- e. Over-view of the inservice inspection program.
- f. Active involvement (e.g., frequent visits to the plant site) by the offsite QA Manager to monitor the implementation of the QA program and to assist in the resolution of quality-related problems.
- g. Participation by the onsite QA/QC personnel in daily staff meetings (e.g., operation, maintenance, modification) associated with planning the work and schedules for the plant to assure proper QA and QC staffing levels and quality-related procedures for operational, maintenance, modification, and inservice inspection activities.
- h. Performing an overall assessment of the effectiveness of the QA program which involves developing and evaluating trend analysis, and promulgating and modifying QA policies and procedures as necessary.

Involvement of the QA organization to accomplish the above functions is fundamental and essential to gain confidence and credibility in assuring plant safety through proper implementation of operational activities.

QA Involvement in the Review/Approval of Documents Affecting Safety

Qualified individuals in the QA organization, either onsite or offsite, should be held responsible for performing reviews of documents affecting operational safety of plants and for granting approval of these documents relative to QA requirements. Again, up to now, the QA involvement in this regard has been at best inconsistent and minimal with the result that the application of QA controls to many activities

affecting safety has not reached desired levels. Examples of documents that should be subject to QA review and approval include administrative directives and procedures addressing operations, maintenance, technical specifications, inservice inspection and testing, modification, calibration, testing, fuel handling, and procurement; design change notices; drawings; specifications; and nonconformance and corrective action reports. Each document should be reviewed to a depth sufficient to assure that applicable QA requirements (e.g., the necessary inspection requirements, final documented verification of implemented procedures and check lists, methods, and acceptance criteria) have been identified and specified therein. Evidence of the review shall be documented by approval of the QA reviewer.

Involvement of the QA organization in the review and approval of all operational documents that have an affect on safety should provide greater assurance that activities addressed by these documents are subject to appropriate QA controls and are properly performed.

QA for Design and Construction

With regard to nuclear plants under design and construction, the NRC staff is also engaged in upgrading the application of QA requirements similar to that discussed above. Many of these improved requirements stem from detailed analysis of programmatic and implementation deficiencies recently identified at construction sites. Areas that will receive particular attention include:

- a. Expanding the category of structures, systems, and components to which the QA program applies to include all items affecting safety.
- b. Ensuring improved independence of the organization performing checking functions from the performing organization.
- c. Improving management control of the QA function at construction sites by requiring appropriate management levels to be full time at the site.
- d. Participation of QA personnel in the review and approval of quality-related procedures for design, construction, and installation.
- e. Establishing criteria for assigning QA requirements to specific classes of equipment.
- f. Establishing minimum qualification requirements for all QA and QC personnel.

- g. Assuring the availability of sufficient staffing levels commensurate with duties and responsibilities.
- h. Establishing procedures for preparation and maintenance of "as-built" documentation in a timely manner.
- i. Defining in a clearer manner the role of QA in design and analysis activities.

Summary and Conclusion

NRC staff analysis of the TMI-2 accident and of deficiencies noted at construction sites for new nuclear plants has resulted in the identification of several QA programmatic areas that should be emphasized and upgraded to improve the effectiveness of QA programs. Areas of improvement have been identified for operational nuclear plants and for those new plants under design and construction. The process for implementation of these requirements has been initiated for several selected operational plants, for the several near term CP plants, and for the one licensee-to-manufacture application for which approval was delayed as a result of the TMI-2 accident.

The NRC views quality assurance as an extremely vital management tool to assure the proper implementation of design, construction, and operational requirements and activities to protect the health and safety of the public. It is, therefore, necessary that an effective QA program be established and implemented to accomplish this objective. The NRC believes that the areas of QA programmatic involvement discussed herein will materially assist in strengthening the QA program to achieve this objective.