Frank Hawkins, NRC

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July 15, 1988

Jack C. Scarborough, Technical Assistant to
Commissioner Kenneth C. Rogers
US Nuclear Regulatory Commission
Washington, DC 20555

Dear Jack:

I certainly enjoyed meeting you and Commissioner Rogers at the Examiners' Conference in Downington, PA, a couple weeks ago. Pursuant to your request for a PNL document on Characterization of Management Approaches at Operating Commercial Nuclear Power Plants, I have enclosed four copies of said document.

The reason no one could find it is that it is in draft form and has not been published as a NUREG or PNL document. As I mentioned in the meeting, if you have any questions on NRR activities associated with PNL, a good person at NRC to contact is Larry Ruth who is the NRC Project Manager for Pacific Northwest Laboratory or myself here at PNL.

Please let us know if we can be of any further assistance.

Sincerely,

William C Cliff

William C. Cliff
NRC/NRR Program Manager

WCC:cjd

Enclosure (4)

cc: BD Shipp (w/o enc)
LC Ruth (1)

Wm Bailey - Lab Dir.
Dan Williams
Dennis Rearick
Adrian Roberts

Name	Approved	Date
CA GEFFEN		9/25/87

Project Number

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bcc: FILE|LB

September 25, 1987

Mr. Frank Hawkins
US Nuclear Regulatory Commission
Air Rights Building
4550 Montgomery Avenue
Bethesda, MD 20814

Dear Frank:

SUBJECT: CHARACTERIZATION OF MANAGEMENT APPROACHES AT OPERATING COMMERCIAL NUCLEAR POWER PLANTS (FIN B-2185)

The enclosed report, "Assessing Management Effectiveness in Nuclear Power Plant Operations" fulfills the requirements of the subject FIN.

The objective of this project was to identify ways in which the management related findings from the Ford Amendment Case Studies might be used in assessing management at operating nuclear power plants. This effort has been more successful than I initially thought possible. Two significant regulatory-based applications for the Case Studies results were discovered:

1) The close parallels between Case Study findings and SALP evaluation criteria attributes strongly encourages the use of the findings as empirical, broadly based support for the SALP process. A method for doing this is described in the report.

2) An application of inductive logic for relating accountability, as determined by the effectiveness of detailed procedures used by qualified staff in performing safety-related tasks, to overall management adequacy was developed. This approach allows plant management assessments to be performed solely in terms of inspectable/measureable quantities.

The application of the Case Study findings to SALP is straightforward and fully developed in the enclosed report. Some additional development, e.g., of inspection design criteria, inspector orientation/training methods, protocols, and/or temporary instructions, will probably be required prior to field applications of measures of accountability for management assessments. Guidance for responding to indications of questionable management practices will also be needed. We are prepared to assist you in these developments if you wish.

Improved approaches to assessing utility management may be particularly timely. Over the past year or so there have been several indications that industry self-regulation of management issues is not effective and that more NRC involvement in this area may be required. Apparently, the Commission is of this persuasion. This is indicated by the attached excerpt from the August 31, 1987 issue of INSIDE NRC, which underscores Commissioner Rogers' and Chairman Zech's convictions that NRC should focus more on licensee management.

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I hope that you will have an opportunity to review the enclosed report in the near future. In particular, I am interested in your judgement concerning the final disposition of this document. Should it be recast slightly and published as a NUREG/CR, or are there other options that you prefer? I look forward to your comments.

Regards,

James A. Christensen
Project Manager

JAC:bd

cc: L. Ruth, NRC
W. Scott, NRC

ROGERS SAYS NRC SHOULD FOCUS ON MANAGEMENT, NOT NEW REGULATIONS

Commissioner Kenneth Rogers says the way to increase safety at U.S. reactors is not to adopt new regulations but rather to publicly and privately pressure nuclear utilities to improve management of poorly performing plants.

"I'm very convinced that piling requirements on top of each other doesn't make a plant safer," Rogers said in an interview August 17, his first day on the job after being sworn in August 7 (INRC, August 17, 8). "There is no magic. It comes down to management, and NRC can't manage these plants."

Rogers' position that NRC needs to concentrate on improving management at nuclear utilities rather than adopting more regulations puts him squarely in agreement with the approach of Chairman Lando Zech and a majority of the five-member commission. Under Zech, the commission has stressed improving management and the quality of operations at U.S. plants rather than requiring backfits or adopting formal regulations.

But Rogers said his preference for pushing for more effective management rather than new safety requirements is not rooted in any particular philosophy. "It's not a question of philosophy," he said. "You can't regulate everything. What you try to do is everything that will evoke from a system the very best performance."

Rogers also did not rule out supporting new requirements in the area of maintenance. For example, he said he would consider supporting the adoption of general guidelines concerning maintenance programs that "leaves to some degree the specifics to the licensees." Rogers said such an approach could be a "nice mix" that would give NRC some assurance that plants are properly maintained but would avoid detailed checklist-type requirements. Rogers has also indicated he would support "some form of regulation" to assure that operators are fit for duty.

But the 57-year-old former college president said good management is the key to safe operations and stressed that, like Zech, he believes running a nuclear plant must be a highly disciplined operation. "I don't know if they (plant workers) need to salute, but there has to be a lot of discipline," Rogers said. "You've got to squeeze the sloppiness out of the system."

Rogers said NRC should try to avoid creating obstacles to good management and "do everything possible to force people to take the kind of responsibility they have to take." Asked how NRC can force management to improve at problem plants, Rogers said: "You have to be prepared to go to the very top of the corporation." "

"You have to understand what management is," Rogers said. "Management is people. People make the system work. It has to start with a commitment at the highest level of management...I'm not just talking platitudes, I've seen it happen." Rogers was appointed to the board of Public Service Electric & Gas (PSE&G) in 1974 and was a charter member of that utility's nuclear oversight committee, set up in 1983 in the wake of troubling scram failures at Salem-1. (Rogers resigned from both positions upon becoming a commissioner.)

Rogers said his involvement in PSE&G's nuclear program provides him with some insights on how NRC can push nuclear utilities to improve their plant operations. "I think I've got management experience in a different area (compared to other commissioners) and I think that can be helpful," he said. "I've got some idea about what works and what doesn't."

Rogers said public criticism of utilities by NRC is also an effective way to force management improvements at problem plants. "If NRC sends a letter to a utility, especially if it is critical, it will get out (to the public)," he said. "That alone has a certain amount of clout. I can't imagine any kind of responsible company not paying attention to that. Any organization that has any professional pride at all doesn't like to be criticized."

Other points Rogers stressed:

— The importance of maintenance: "It does a lot for you. It not only keeps the system tuned up, but also gives you information on the plant—it is the plant's life history."

—The value of training: Well-operated plants have "comprehensive, regular training programs...and their people understand what they are doing," Rogers said. Nuclear utilities need to provide all personnel with retraining "on a regular basis and of the highest quality," and nuclear plant personnel "must understand the system" they are working on. "The guy who sweeps the floor has to understand why it is important to sweep that floor."—*Dave Airozo and Brian Jordan, Washington*

DRAFT

ASSESSING MANAGEMENT EFFECTIVENESS IN NUCLEAR POWER PLANT OPERATION

James A. Christensen

September, 1987

Work Performed for the U. S. Nuclear Regulatory Commission under FIN B2185

Battelle Pacific Northwest Laboratories

DRAFT

ASSESSING MANAGEMENT EFFECTIVENESS IN NUCLEAR POWER PLANT OPERATIONS

J. A. Christensen

SUMMARY

Most serious safety-related incidents at nuclear power plants are traceable, at least in part, to management deficiencies. This was the conclusion of the Ford Amendment study of plants under construction and is borne out by the record of operating plants as well. Regulatory oversight of nuclear plants can be improved by supplementing current approaches with methods that allow more accurate and predictive assessment of licensee management performance.

The work reported here was undertaken in an effort to use the management-related findings from the Ford Amendment study to support inspection approaches that provide insight concerning licensee management effectiveness at operating nuclear power plants. The Case Studies of plants with and without major problems were a particularly rich source of management attributes that can be associated with successful plant operations. These attributes were related to existing NRC licensee assessment programs in two ways:

1. The SALP process addresses issues that closely relate to licensee management effectiveness. It was found that most of the management performance indicators that derive from the Case Studies correlated closely with one or more of the seven evaluation criteria employed in assessing SALP scores across all plant functional areas. Supplementation of the SALP system of evaluation criteria with the appropriate Case Study indicators substantially expands the basis for determining SALP scores and does so by introducing empirically based criteria that should enhance the credibility and objectivity of the SALP process.

2. The inspection program can be made more effective by introducing elements that focus more directly on management issues. One way to achieve this is to develop inspection approaches that concentrate on tangible, measureable work activities and products in ways that can be unequivocally

related to management adequacy. The validity of the approach developed here rests upon the proposition that, because of the technical complexity and safety significance of nuclear plant operation, a fundamental management responsibility is to assure a high degree of prescriptiveness in the guidance transmitted to levels at which safety-related work is actually performed. Nothing with safety significance should be left to chance. To assure this requires a totally comprehensive system of detailed, consistent, specific, and prescriptive procedures (including drawings, instructions, etc.) that cover all aspects of all safety-related elements of all work. These procedures must be effectively implemented by qualified, working level personnel. This combination of proceduralization and staff qualification, referred to here as "accountability", can be objectively measured during inspections. Noted deficiencies provide a general indication of management inadequacy (in effect, "taking the temperature" of the organizational system). These indications are useful in focusing follow-on inspection efforts.

In addition to the above applications, the Case Study findings, as organized and analyzed herein, are pertinent to the vested interests of all parties concerned with management of nuclear power plants. Specific uses of these indicators should be based upon the judgement of knowledgeable, authoritative individuals who have a thorough understanding of all relevant sensitivities.

BACKGROUND

During 1983 and 1984, the NRC Quality Assurance Branch conducted an in-depth study of quality assurance as it was being applied to design and construction of nuclear power plants. The study was done, at the direction of Congress, to identify and eliminate causes for the quality-related problems that were implicated in the massive cost overruns, schedule delays, and associated threats of cancellations that plagued nuclear construction projects in the early 1980's. Results of the study were reported to the Congress in **NUREG-1055, "Improving Quality and the Assurance of Quality in the Design and Construction of Nuclear Power Plants."**

NUREG-1055 documents the **results of thirteen different initiatives that were investigated as candidates for improved QA practices at plants under construction.** One investigation stands out as having best revealed the causal factors for project successes and failures. This was the series of Case Studies **of quality and quality assurance in nuclear plant design and construction as reported in Appendix A to NUREG-1055.** Six onsite Case Studies were performed, three at plants with major construction problems and three at plants with no serious problems. **From a comparison of observations of problem and non-problem plants, primary and secondary root causes of construction phase problems were deduced. These provided the principal support for the major conclusions and recommendations contained in NUREG-1055.**

The root causes for utility-based problems identified in the Case Studies are related, almost without exception, to management shortcomings on the part of the utility or its contractors. These deficiencies were, by-and-large, generic in the senses that 1) they were not intrinsically site-specific and 2) they would be recognized and similarly characterized as deficiences in any management system designed to control a large, complex, closely-regulated undertaking. On this basis, it was concluded that generic Case Study findings concerning management and management systems could be applied to operating nuclear plants as well as to plants under construction.

OBJECTIVES

The purpose of this study was to develop methods for using management-related findings from the Case Studies of plants under construction in defining success/failure oriented attributes of management and management systems at operating nuclear plants. Ideally, this process should lead to methods for proactively identifying safety-related managment weaknesses. To be functional, these methods should supplement or otherwise enhance standard NRC approaches to assessing licensee performance, e.g., SALP and the inspection program.

APPROACH

Case Studies

The case studies of plants under construction were performed by a team of eight-to-ten individuals. These included one-or-two NRC staff, one of whom was the team leader, and various consultants, the majority of whom were PNL staff. The consultants provided expertise in quality assurance, nuclear plant design and construction, project management, and organizational effectiveness. The teams devoted approximately three weeks to each study -- one week in preparation, one week on site, and one week of analysis and writing. Prior to the site visit, team members reviewed relevant, site specific background information and tailored a standard protocol to the site in question. Most of the time spent on site was devoted to subteam interviews of a cross section of utility and contractor management. Nightly team caucuses were held to assess and integrate interview results. A preliminary list of findings were developed on-site and shared with licensee management at the termination of each site visit. Subsequent to the site visits, detailed Case Study Working Papers were drafted with input from and reviews by all team members.

The Case Study Working Papers were not formally documented or distributed. They consist of lengthy, detailed discussions of each project, including its history, observations made by the case study team, and causal implications of team observations. Key findings are stated in a subjective way and often involve interactive, multiple characteristics of the systems studied. Appendix A to NUREG-1055, which summarizes the Case Studies, is similarly structured

as are the sections of the body of NUREG-1055 that derive from the Case Studies. Given this composite nature of existing documentation of the Case Studies, the first task was to identify and list all individual management and management system attributes that characterized the root causes of problems or the lack thereof at specific projects. Attributes were categorized and grouped by type. This led to a systematic, detailed characterization of the specific attributes found to be important in determining whether a project was likely to be successful (Table I). This systematic approach is basic to subsequent efforts to fit attributes or combinations of attributes to predictive methods.

The full complement of attributes (Table I) was sorted and screened to retain only those attributes with apparent relevance to management performance at operating plants. The product of this exercise (Table II) is an abbreviated collection of attributes grouped in three categories that relate to operating plants. These categories are associated: 1) directly with management, 2) indirectly with management through considerations of organizational accountability (to be defined later), and 3) more-or-less directly with management through interfacial relationships with the NRC and other influential external groups.

SALP Support

The next step involved devising ways in which the success attributes in Table II can be used to support NRC assessments of licensee management. This can be accomplished via the SALP process, which, as defined in NRC Manual Chapter 0515, Systematic Assessment of Licensee Performance, "is oriented toward furthering NRC's understanding of the manner in which: (a) licensee management directs, guides, and provides resources for assuring plant safety; and (b) such resources are used and applied." The success attributes of management at operating plants derived from the Case Studies in principle are closely aligned with this basic thrust of the SALP process. A method for applying the success attributes in performing SALPs and supporting their findings is developed in detail in the following section (RESULTS). Briefly stated, the approach involved correlating the Case Study management success attributes with the SALP "Evaluation Criteria and Attributes." This provides broad support to the SALP judgemental process across all plant functional

areas -- support that derives directly from the qualified, empirical studies of nuclear power projects that comprised the Case Studies.

Inspection Program Support

In addition to supporting the SALP process, the management success attributes should be useful in supplementing the inspection program. Ideally, inspection procedures capable of yielding objective, reliable management assessments should be developed. In practice, this is very difficult to achieve for two reasons: 1) Management, because of its complex, subjective nature, is not amendable to direct assessment by conventional, simple inspection approaches and 2) political impediments to regulatory evaluation of upper level utility management have significantly restricted NRC activities in this area.

Some management characteristics, such as training and experience, lend themselves reasonably well to analysis; but others, e.g., commitment and involvement, defy quantification. Successful management styles may encompass widely variable mixes of ill-defined, positive management attributes and may compensate apparent deficiencies in some areas by exceptional capabilities in others. In spite of the elusive nature of definitions of good management, reliable approaches to evaluating and improving management practices have been developed. Successful application of these approaches requires that the management in question be accessable for evaluation and willing to be evaluated. These conditions have not been met by the nuclear power industry in its relationship with the NRC. The nuclear industry position has been that the NRC has neither the authority nor the competence to evaluate upper utility management per se. To date, that position has, for the most part, prevailed. As a consequence and in spite of serious attempts by qualified groups, efforts to functionally evaluate licensee management from a regulatory perspective have not been conspicuously successful.

To operationalize the principles expressed by the managment success attributes (Table II) requires development of a construct that relates the collection of attributes to inspectable or otherwise measurable quantities. One method of doing this, which derives from classical logics, is to pose a subsidiary postulate that is incontrovertably and unambiguously relatable

both the attributes of good management and measureable characteristics of nuclear plant operations. This approach will support a defensible argument to the effect that, if what is measureable meets requirements, then the evoked postulate is satisfied and the intent of good management practice has been met. Conversely, if what is measureable is found wanting, the management system should be suspected of containing flaws that should be relatable to specific management attributes.

This process is best illustrated by application. For the problem at hand the primary challenge is to develop a postulate that relates directly and irrefutably to both management attributes and to measureable, safety related characteristics of nuclear power plant operation. This postulate must be generally, if not universally, accepted as true and and should relate, in the most significant way possible, to the essence of nuclear plant operations. From a regulatory perspective, the essence of nuclear plant operations has to do with safety, i.e., the assurance of no unacceptable risks to public health and safety. A nuclear power plant is a complex device with major potential for serious accidents. To assure the safety of the operation of such a device requires a high level of "accountability." Accountability in this context is defined as detailed, specific assurance that, at the working level, all activities with health or safety implications are correctly performed. Accountability is achieved through the documented performance of all safety-related tasks according to detailed, working level procedures (administrative, operating, and technical procedures plus instructions and drawings), implemented by qualified, working level personnel. An acceptable level of accountability will minimize judgemental latitude in all activities with safety implications. Detailed, highly prescriptive procedures and requirements for all safety-related work should be in place, understood by all involved personnel, and uniformly and invariably implemented by qualified staff. The entire process should be regularly documented, updated, and verified. Clear, detailed, written objectives for each level of each element of the organization should exist, be traceable to procedural elements, be communicated both up and down, and be reviewed periodically against performance. Performance reviews should focus on elevating standards with time.

The foregoing good accountability practices can be monitored in a straightforward way by evaluating plant procedures, the effectiveness of their implementation, and the qualifications of the personnel performing the work specified in the procedures. In assessing accountability, the procedures themselves will be the source of most of the issues to be investigated and questions to be asked.

If inspection results show that accountability is adequate, it follows that utility management is functionally adequate. This is a reflection of the related key premises of what might be termed "product side management assessment"*, namely that:

1) "Management" in isolation from the product of the activity being managed has no meaning, and
2) Quality of management can only be assessed as a reflection of the quality of the work being managed.

Inspection results that demonstrate unacceptable accountability will usually, if not always, be traceable to management deficiences. This analysis does not yield a delineation of specific management problems; but once it has been established that problems exist, it seems likely that regulatory staff familiar with the facility in question will be able to characterize them. The detailed breakdown of management success attributes (Table II) will be helpful in this process.

In summary, the rationale for employing inspectable, working level quantities in assessing management performance consists of four sequential, logic-based steps:

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* Management effectiveness is often assessed from a "top-down" perspective that can tend to isolate management issues from the rest of the organization or its products. This approach tends to produce general, subjective, observations that are difficult to apply. An alternative point of departure for assessment of management that produces more specific results is from the perspective of product adequacy. If the product, including its perception by the customer, is not found wanting, management is probably doing an effective job (Proof of the pudding principle).

1) Because of the hazardous, technically complex nature of nuclear power plant operation, all safety related activities must be done accountably, i.e., to detailed procedures effectively implemented by qualified personnel.
2) Management has a basic responsibility to maintain accountability.
3) Inspection shows that accountability is:
   (a) maintained or (b) not maintained.
(4) Management performance is, therefore:
   (a) acceptable or (b) not acceptable.

Acceptability of management performance, as judged by this process, would be with reference to questions of accountability only and would not constitute an overall endorsement of utility management. Unacceptable management performance revealed by this approach can be independently evaluated and related to specific management success attributes such as those identified in the Case Studies (Table II).

The validity of using the concept of accountability in assessing management performance is supported by the original Case Studies, which concluded: "The success of those plants without major quality problems (and the failures of those with) can be attributed in part to having adequate (or inadequate) procedures for all aspects of the project which were rigorously adhered to (or ignored). All of the Case Studies substantiated this requirement." (NUREG 1055, Appendix A, pp. vi).

From a different perspective, the use of measures of accountability to assess the overall adequacy of utility management functions is similar in concept to the use of body temperature as a measure of the overall well being of an organism. Lapses or other deficiencies in accountability are symptomatic of inadequacies in some aspect(s) of management that, when their general existance is revealed, can be specifically pursued, identified and eliminated. A fever is symptomatic of invasion of some body system(s) by threatening foreign organisms that, when their general existance is revealed, can be specifically pursued, identified, and eliminated. Body temperature is easier to measure

than organizational accountability; however, the latter can be measured by focusing on proceduralization and staff qualifications.

The absence of a fever does not demonstrate that all body systems are fully functional (cardio-vascular problems are not generally accompanied by an increase in body temperature, for example.) Neither does apparently adequate organizational accountability certify total management adequacy. Even though adequate accountability should assure that each detailed, safety-related task will be correctly performed by competent personnel, some combinations of upper management attitudes and priorities could potentially undermine what appears to be a well-functioning system of accountability. Usually these overall management characteristics will be obvious to those closely associated with the plant (e.g., NRC regional and inspection staff).

Adequate accountability, although a necessary assurance of good management of the specifics of safety related work, is not sufficient to demonstrate exemplary management in any global sense. Various management attributes of a subjective nature, e.g., leadership, ability to stimulate innovations, etc., show no obvious, direct relationship to accountability. This should not be construed as a limitation on the utility of measures of accountability for signaling management problems. From a regulatory perspective, adequate performance of all safety related work is the requirement sine qua non. Only those management attributes that influence the meeting of this requirement are legitimately subject to regulatory oversight.

RESULTS

The attributes of successful management at operating plants should be of general interest to any group with vested interests in the operation of a nuclear power plant, i.e., the licensed utility, the NRC, state regulatory bodies, industry support groups, lending agencies, stockholders, etc. From a regulatory perspective, this collection of attributes can be applied in various ways in inspection and licensee evaluation programs. As indicated in the preceding section on APPROACH, specific applications were developed in connection with the SALP process and the inspection program. These were judged

to be appropriate because the SALP process already focuses upon licensee management and the inspection program would be usefully supplemented by introducing techniques that allow management evaluation based upon inspectable quantities.

Analysis of Case Study Findings

Preparatory to assessing regulatory implications of the Case Study findings, it was necessary to restructure the information obtained during the conduct of the Case Studies into a more workable format. The first step in this process was to screen each of the six Case Study Working Papers for specific causal factors that contributed to the success or failure of various aspects of the project. These factors were then rephrased as attributes that, when observed, would be suggestive of good practices and ultimate project success. The resulting collection of positive attributes was grouped into the following set of five functional categories:

1. Management - attributes associated with management experience, understanding, commitment, qualifications, and involvement.
2. Organization - attributes associated with identifying and solving problems, assuring and documenting that objectives are met, and interfacing between organizational elements.
3. Communications and Control - attributes associated with assuring adequate internal dissemination of information and to oversee and control contractors and project interfaces.
4. Training and Qualification - attributes associated with training/certifying craftsman, QA/QC staff, and superivory personnel.
5. Interfaces - attributes associated with facilitating major project transitions and for dealing effectively with influential external groups, e.g., the NRC.

The complete collection of positive attributes grouped in the above categories is contained in Table I. All five categories contain management related attributes; however, not all attributes are relevant to management or to nuclear plant operations. The next step was to identify those attributes that have

relevance to management of operating plants. In general, this could be done by inspection. In some cases, an attribute required some modification in wording to shift the applicability from construction to operations.

The reduced set of attributes of positive management performance at operating plants could have been retained within the five category framework designed for the complete set of Case Study attributes. A more natural and useful method of classification involving three categories was developed, however. These three functional categories of operational management attributes are:

1) Management Fundamentals - experience, qualifications, organization, resources, involvement, and attitudes of utility management.
2) Accountability - effective implementation of adequate procedures by qualified personel.
3) External Interfaces - relationships with NRC and other influential bodies.

Positive attributes with relevance to operational management are grouped in the above categories in Table II. These are the management success attributes to be applied to supplementing the SALP and inspection processes.

SALP Support

In recent years, the Systematic Assessment of Licensee Performance (SALP) has been one of the basic tools used by the NRC for evaluating nuclear power plant licensees. SALPs are performed on 12-to-18 month intervals at all plants. As a product of each SALP, each plant receives a composite rating category between 1 and 3 (1 being the best). The interval between SALPs for a particular plant is proportional to how well that plant scored in previous assessments. Assessments of operating reactors apportion all safety-related activities into eleven functional areas that group similar activities.(a)

(a) The functional areas considered for operating plants are plant operations, radiological controls, maintenance, surveillance, fire protection, emergency preparedness, security, outages, quality programs, licensing activities, and training and qualifications.

Each functional area is independently assessed and awarded a rating category from 1 to 3. Assessments are based upon a set of seven evaluation criteria that are applied to each of the eleven functional areas. Overall plant rating is the mean of the resulting eleven functional area ratings.

For each of the seven SALP evaluation criteria, sets of attributes indicative of category 1, 2, and 3 performance were developed to guide and lend consistency to the assessment process. It is in supplementing these sets of attributes that the Case Studies management success attributes can most directly enhance the SALP process. The Case Studies attributes all derive from direct observations of nuclear project successes and failures. This independent, empirical origin should convey an improved sense of reality and objectivity to the SALP process.

The relationships between the management success attributes and SALP evaluation criteria is shown in Table III. Each attribute has been paired with the criterion to which it most closely relates. Indicators that support more than one criterion are matched with each related criterion. The indicator numbering system introduced in Table II is retained in the right hand column of Table III to allow cross referencing between SALP criteria and Case Studies management success attributes. The attributes listed in Table III do not convey a gradation in value judgement as is necessary to select a SALP rating category. This gradation can be easily introduced by incorporating suitable sets of modifiers into each attribute to expand it into a category 1, 2, and 3 attribute.

As Table III illustrates, supplementing the SALP criteria attributes with the management success indicators has the potential for substantially extending the attribute/criteria base upon which SALP decisions are based. Predictably, the added support base is greatest in connection with SALP Criterion 1, Management Involvement in Assuring Quality. The independent, empirical nature of the management success attributes should lend appreciable additional credibility to the SALP process.

Inspection Program Support

Inspections aimed at assessing accountability should focus on four aspects of plant operations.

1) The detailed procedures (including instructions and drawings) that guide safety related hands-on work activities.
2) The qualifications or certifications of the personnel who apply the procedures.
3) The adequacy of the resulting work.
4) Trends in work quality standards.

Procedures developed and used by the licensee can serve as the source of the detailed checklists that will be the basis for much of the inspection process. This requires that complete procedures for all aspects of plant operation be available to inspection personnel. In gathering and working with the licensee's procedures, NRC inspection personnel should segregate them based upon the SALP functional area in which they are applied. This will allow a functional-area-specific assessment of accountability that should provide useful input to the next SALP. An important aspect of assessing adequacy of the procedures is to assure that they impose consistent requirements across all plant functional areas. Secondly, and most important, the procedures should be sufficiently detailed and prescriptive to preclude significant error in their implementation because of judgemental lattitude allotted to implementing personnel. At the same time, the procedures should be brief, well organized, and understandable to discourage their non-use and minimize chances for misinterpretation. Section 2.0 of Table II lists management success attributes associated with accountability, i.e., proceduralization and staff qualifications. These attributes can be used to supplement the inspection checklist.

Personnel qualifications can be assessed on the bases of defined requirements and general experience and competence. For personnel performing safety related work, e.g., reactor operators, quality function staff, welders, etc., certification requirements based upon regulatory mandates and/or consensus

standards exist (e.g., ANSI/ANS 3.1, "Selection, Qualification and Training of Personnel for Nuclear Power Plants"). It is a relatively simple manner to determine if these staff are properly certified. Individual and overall judgements of staff qualifications and competence require a fairly high level of understanding, on the part of the inspection staff, of the skills represented at an operating nuclear plant. It is reasonable to expect an inspection team from the NRC to embody this understanding.

Work adequacy is already the subject of much of the NRC inspection effort; and the emphasis on effectiveness, as opposed to compliance, continues to broaden. The current program on performance indicators, for example, is representative of the significant recent shifts in NRC oversight focus from questions of regulatory compliance to concern over product or work quality. Total accountability is necessary to assure safety, which is a principal and absolute condition for nuclear plant operation. Broadening inspection procedures to include monitoring of accountability as a measure of management performance will further strengthen the performance orientation of the inspection program. Some additional analysis on the part of the inspection staff will be required to evaluate accountability by correlating specific indications of effectiveness, or lack thereof, with particular elements of the procedures and/or quality of staff performance. More efficient ultimate use of inspection resources should more than compensate this increased initial effort.

Quality expectations that escalate with time represent one of the most encouraging prospects for current and continuing high quality of work. This was a finding of the Case Studies that is echoed by the first of Admiral Rickover's "criteria of management competence" ("An Assessment of the GPU Nuclear Corporation Organization and Its Competence to Operate TMI-1" Admiral H.G. Rickover, USN, 19 Nov. 1983). Industry groups, e.g., INPO, and the utilities themselves have also adopted the "rising standards of excellence" theme. Assessments of accountability over time can provide indications of more general quality trends. Such assessments might be based upon a time-phased series of observations of procedural adequacy and working level staff

qualifications. A more effective and timely approach is to design inspection checklists to probe these trends during a single inspection.

Relating Accountability to Management Competence

Specific manifestations of inadequate licensee management are not a useful topic for discussion in the context of this study. As noted previously in this report, management issues are highly subjective and are not amendable to generic assessment. These issues must be evaluated on incident- and organization-specific bases by knowledgeable, high level regulatory personnel who understand all of the relevant sensitivities.

The intent of this study, with respect to licensee management, has been to design tools that can be used by regulatory oversight programs to uncover indications suggestive of current or impending management problems. These tools, as described earlier, enable inspection personnel to, in a sense, "take the temperature" of the licensee organization. Detection of a "fever" should trigger higher level concern in evaluating specific aspects of licensee management that may, because of some intrinsic deficiency, be implicated in current and, possibly, future problems. Follow-on evaluations that focus on identifying specific elements of management inadequacy may find application for the Case Studies "Intrinsic Management Success Attributes" (Section A of Table II).

TABLE I. Case Study Findings - Attributes of Successful Nuclear Power Plant Construction Projects

1.0 MANAGEMENT

- 1.1 Licensee Management
- 1.2 Project Management

2.0 PROJECT ORGANIZATION

- 2.1 Problem Identification and Solution
- 2.2 Project Control System
- 2.3 Design-Construction Coordination

3.0 COMMUNICATIONS AND CONTROL

- 3.1 Information Flow
- 3.2 Licensee Control
- 3.3 Licensee Audit

4.0 TRAINING AND QUALIFICATION

- 4.1 Training and Qualification Programs

5.0 INTERFACES

- 5.1 Construction - Operation Interfaces
- 5.2 External Interfaces

1.0 MANAGEMENT

1.1 LICENSEE MANAGEMENT

Licensee upper and middle management involvement in and understanding and awareness of the project and nuclear projects in general.

Positive Attributes[a]

- The licensee has had previous nuclear design and construction experience.
- The licensee has a diversified staff with extensive nuclear experience.
- There has been a conscious effort on the part of the licensee to learn from and benefit from the experience of other utilities in design and construction of plants.
- The licensee maintains a separate nuclear project organization independent from its fossil fuel operations for the purpose of constructing the plant.
- The responsibilities of the project team members (licensee, AE, constructor, construction manager) are clearly defined.
- The licensee separated their nuclear projects from their traditional power plant organization and made an appropriate differention between the different complexities of the two.
- The licensee and its contractors place safety and quality ahead of schedule and costs.
- There has been a conscious effort on the part of the licensee to learn from and benefit from the experience of other utilities in design and construction of plants.
- Within the licensee, there existed a high level cadre of a few leaders (sometimes only 2 or 3) who had functional, long term control of the project. This group represented the driving force behind the project.
- Leadership within the utility was clearly defined and conspicuous. It did not appear to be diffuse.
- The licensee upper management in general has a clear perception of why quality is important.
- Within the licensee's organization, licensing activities were assigned to executive levels resulting in prompt decision making.

(a) Not all attributes apply to all plants.

- The licensee has made appropriate use of qualified independent reviews of critical decisions, e.g., site selection.

- The licensee has adequate financial resources.

- Adequate contractual commitments and constraints were placed on the parties who constitute the owner group of the project. (This prevented them from reneging on commitments.)

- Procurement of components and materials was based on the consideration of getting the best available to do the job, rather than strictly on costs.

- The licensee has been adequately involved in self-evaluations.

- There was a strong commitment to quality on the part of the utility and its contractors as reflected by aggressive, consistent action as well as verbal endorsement of quality.

- Senior utility management is involved in corrective action on significant conditions adverse to quality.

1.2 PROJECT MANAGEMENT

The experience levels and qualifications of the corporate entities comprising the project team and key individuals on the project team.

Positive Attributes

- The licensee staffed their nuclear organization with sufficient people who had appropriate nuclear experience.

- Main elements of the project team had previous association with other project teams on other nuclear projects prior to beginning this project.

- The licensee made a conscious and effective attempt to obtain long-term commitments of qualified people to the project, both as part of their staff and on the staff of their contractors.

- Key licensee staff were recruited nationally and the licensee was selective in filling these positions.

- The licensee hired experienced architect engineers, constructors, and construction managers.

- Although the utility has not had previous nuclear experience, they have aligned themselves with an experienced architect engineer and constructor.

- The licensee has exercised the right to approve key architect engineer and construction personnel for the project.

- The contractor's staffs are diversified and have extensive nuclear experience.
- A project team core has been preserved throughout the project.
- There was no shortage of experienced AE and construction personnel or firms when the project began, thus the licensee was able to enlist qualified contractors.
- In contracting with major contractors, the licensee required long-term commitments of key people.
- The selection of contractors and vendors is based primarily on their qualifications, irrespective of whether they were the low bidder.

2.0 PROJECT ORGANIZATION

2.1 PROBLEM IDENTIFICATION AND SOLUTION

Project team approach for finding problems and taking corrective action including the determination of and addressing of root causes.

Positive Attributes

- The licensee's project organization reviews all procurement specifications and their contractor's recommendations for successful bidders.
- Construction progress has proceeded in a timely way.
- The licensee and its contractors have consistently made deliberate, timely, and effective efforts to come to grips with quality-related problems as they arose.
- Observed failures to exercise designated responsibility and authority are rigorously pursued for corrective actions.

2.2 PROJECT MANAGEMENT SYSTEM

Project controls (e.g., QA/QC, planning, scheduling, design control) for providing assurance that project objectives are being met and for providing relevant and critical information to proper levels of management.

Positive Attributes

- The licensee's project organization established the quality assurance program for the project rather than accepting, without change, the architect engineer's program.
- Dry runs are used prior to first or other critical implementation of safety related procedures or instructions.
- Parts, materials, and components are generally available when they are needed by the crafts.
- The licensee and its main contractors use an effective and efficient method of documenting quality for all aspects of the project, e.g., construction, design, procurement, etc. These procedures are understood, rigorously applied, and adhered to at all levels of the project.
- The licensee and its contractors had adequate procedures for all aspects of the project. These were rigorously adhered to.

- The licensee and its contractors adopted a proceduralized approach early in the project for calculations, specifications, and procurement with rigid internal audits.

- Purchasing and construction work is controlled through administrative procedures such as having standard terms and conditions for contracts and purchase orders, a qualified bidders list, and work initiation procedures.

- Adequate systems and procedures have been established to monitor the project.

- The licensee and its contractors follow specific detailed procedures, with respect to quality control, concerning calculations, specifications and procurement.

- Instructions, procedures, and drawings clearly spell out responsibility and authority and are consistent with the QA program.

- Procedural steps and work methods are defined in sufficient detail to prevent wide variations in practice.

- Instructions and procedures are revised promptly when experience indicates a need to do so.

- Procedures and instructions are not too detailed to result in nonuse. Instructions, procedures, and drawings, as well as changes thereto are independently reviewed for adequacy, correctness, and clarity.

- The licensee is not excessively involved in project details, i.e., insisting upon approving everything.

- Senior licensee management is regularly informed of significant quality or QA problems.

- QA/QC managers have adequate access to top utility and contractor management.

- Procedures exist which place the responsibility for quality work directly on the crafts and their supervisors.

- The QA/QC organization has clearly defined and unconstrained stop work authority.

- Instructions and procedures are reviewed and revalidated periodically as required by the QA program.

2.3 DESIGN-CONSTRUCTION COORDINATION

Sequencing of and interfacing between design and construction.

Positive Attributes

- The licensee project organization reviews and comments on key drawings.
- The licensee project organization initiates independent design reviews and participates in periodic design review meetings.
- The licensee project organization prepared the basic data for the AE's design criteria manual for the project and reviewed the manual.
- Design was sufficiently complete before construction was started.
- The licensee approved key design drawings and either established criteria and procedures or assured that the contractors did.
- Clearly written design criteria was established prior to beginning the project and were maintained current as changes were made.
- The project has employed a detailed design scale model to anticipate and avoid design and construction problems.
- There exists a constructive, communicative, and mutually respectful relationship between the engineering function and the QA function.
- The licensee has been heavily involved in the design process and has emphasized compliance with regulation and codes.
- Design criteria for the plant were established by the licensee working together with the architect engineer.
- Instructions, procedures, and drawings as well as changes thereto are independently reviewed for adequacy, correctness, and clarity.
- Periodic and independent design reviews are employed to detect and resolve design-deficiencies in a timely manner.
- Design input data and design changes are formally transmitted to appropriate interfacing design organizations and are carefully controlled.

3.0 COMMUNICATIONS AND CONTROL

3.1 INFORMATION FLOW

The flow of essential project information vertically and horizontally within the project team.

Positive Attributes

- The licensee regularly monitors communication channels between members of the project team to assure effectiveness.
- The licensee established initially which documents produced by its contractors it should review.
- The licensee and its contractors employ modern computer based methods for record keeping.
- There exist single points of entry for all correspondence to each organization involved as members of the project team.
- Interfaces are defined and procedures are developed and in place to insure the proper flow and interpretation of information and to permit monitoring of information flow interfaces.
- The chain of command between the QA function and top utility management is not excessively long.
- The licensee encourages all employees involved with the project to openly communicate with licensee management concerning perceived quality problems.
- Nonconformance, audit, or other reports describe problems clearly enough to provide quick assessment of their significance.
- Reports on quality or QA deficiencies are issued promptly.
- Reports on quality or QA deficiencies are distributed to interested management and to senior managers.
- The licensee and its main contractors use an effective and efficient method of documenting quality for all aspects of the project, e.g., construction, design, procurement, etc. These procedures are understood, rigorously applied, and adhered to at all levels of the project.

3.2 LICENSEE CONTROL

Owner control and oversight over contractors, key subcontractors, and project interfaces.

Positive Attributes

- The licensee has been deeply involved with cost, schedule, and productivity as well as with quality.
- The licensee set the performance standard for the project rather than delegating this responsibility to the architect engineer or other contractors.
- The licensee approved key design drawings and either established criteria and procedures or assured that the contractors did.
- The licensee effectively manages the interfaces between themselves, the architect engineer, the contractor, and the construction manager.
- The licensee holds regular (quarterly, monthly, and weekly) meetings with major contractors' senior management to discuss project problems and facilitate decisions.
- The licensee reviews the work plan procedures, quality control instructions, and other procedural mechanisms which relate importantly to project quality.
- Management control within the licensee and its main contractors was centralized and unified and gave no appearance of being fragmented.
- There exists a strong project orientation within the licensee's, and AE's and the constructor's organizations.
- The licensee has clearly defined its main contractors' responsibilities for design, specification, purchasing, and hiring and managing the labor force.
- Each of the project team members clearly understood and accepted his responsibilities for design and construction of the plant.
- The licensee has made appropriate changes in the project organization and approaches as conditions warranted.
- The licensee has been aggressively involved in project management of the project.
- The licensee has made appropriate changes in the project organization and approaches as conditions warranted.
- The licensee has monitored their contractors closely (or were the contractors themselves).
- The licensee set the performance standard for the project rather than delegating this responsibility to the architect engineer or other contractors.

- Contracting methods employed by the utility have generally been of a cost plus nature and have been effectively administered.
- The licensee has generally been timely and prompt in their actions and decisions, thereby avoiding major delays.
- The licensee organization is management and detail oriented.
- The number of main contractors involved with the project is not excessive.
- The licensee maintains approval authority over staffing levels of the constructor.
- The responsibility and authority vested in contractors are completely and clearly specified in contract documents.
- The licensee project organization prepared the basic data for the AE's design criteria manual for the project and reviewed the manual.

3.3 LICENSEE AUDIT

The licensee audit programs and response to audit findings.

Positive Attributes

- Management of all levels within the licensee and its contractors viewed quality and safety as taking priority over project cost and schedule.
- Senior licensee management requires and participates in periodic independent assessments of the adequacy and effectiveness of the QA program.
- Responsibility and authority delegated to lower tier organizations are verified by audit or other methods.
- QA program audits include evaluation of the effectiveness of the audited organization's internal audit program.
- The QA organization is appropriately involved in trend analysis, validation of nonconformance reports, reporting items under 10 CFR PArt 50.55 (3) and 10 CFR Part 21, design reviews, audits, and surveillances to confirm that work was performed as per procedure requirements.
- Audit programs appear to be strong and effective.
- Effective trend analysis programs are employed.
- An effective corrective action program is in place.

4.0 TRAINING AND QUALIFICATION

4.1 TRAINING AND QUALIFICATION PROGRAMS

Qualification and training programs for providing craftsmen, supervisors, and QA/QC personnel with expertise commensurate with their responsibilities.

Positive Attributes

- Sufficient qualified personnel are available to carry out the procedures.
- The understanding of the importance of quality is disseminated throughout the entire project team by training, personal contact, staff incentives, and other means.
- The licensee and its contractors maintain adequate training programs for quality control and quality assurance personnel.
- Senior utility and contractor managements participate in training programs or evaluate them.
- Responsibility and authority are explicitly designated down to working levels in safety analysis reports, the QA program, or related manuals, procedures, and instructions.
- Documented responsibility and authority requirements are observed and practiced.
- QA engineers and inspectors are free to discuss quality problems with crafts or other nonmanagement personnel.
- Their exists a clear, enforced policy against intimidation of inspectors.
- Punitive action is not taken against "whistle blowers."
- QA/QC organizations are not regarded as policemen.
- Resumes and employment application information is verified for managers, engineers, and QA/QC personnel.
- The licensee has clearly defined its main contractor's responsibilities for design, specifications, purchasing, hiring, and managing the labor force.
- The licensee or its contractors have maintained workable labor arrangements.
- Procedures exist which place the responsibility for quality work directly on the crafts and their supervisors.

- The licensee and its contractors maintain adequate training programs for the crafts which emphasize quality.
- There have not been excessive labor disputes on the project.
- There has not been excessive craft turnover the project.
- Pay scales are adequate to attract and hold qualified personnel.
- There exists a sense of company and project loyalty which tends to stabilize the work force.

5.0 INTERFACES

5.1 CONSTRUCTION-OPERATION INTERFACES

Operational input to and inclusion of operational considerations in construction and planning and the licensee's program for transition from construction to operations.

Positive Attributes

- The licensee and its contractors used plant reliability as a major consideration in design and construction.
- The licensee's orientation toward quality is expressed in plant reliability goals.
- The licensee and its contractors made deliberate and effective efforts to optimize equipment capability, redundancy, and maintainability as well as materials and construction quality with the goal of maximizing plant availability and reliability.
- Quality commitment is reinforced by factors with direct financial implications, e.g., an approved rate of return for higher levels of operating efficiency, reduced maintenance costs, and greater reliability.
- Consideration of construction and operation requirements was made early in the design effort.

5.2 EXTERNAL INTERFACES

Communications between the licensee or other project team members and other influential groups, e.g., NRC, INPO, PUCs, interveners, rate payers, legislators, etc.

Positive Attributes

- The licensee itself (not their contractors) was primarily involved in responses to the NRC.
- The licensee assumed responsibility for obtaining all project permits and licensees.
- The licensee's project organization represents the licensee in all meetings with the NRC.
- The licensee will be rewarded for high operating efficiencies by their public utility commission.
- The licensee does not perceive NRC quality requirements to be excessive.

- The licensee's advertised and implemented policy is to view the regulatory process as necessary and beneficial and the philosophy is to be responsive to the regulators.
- The licensee and its contractors adjusted well to the changing regulatory environment over the life of the project.
- Intervener action has not effectively diluted the licensee's attention to the project.
- The licensee has a policy of establishing and maintaining constructive working relationships with the NRC.
- The licensee typically adopted an aggressive position in responding to NRC requirements and questions.
- The project regulators (NRC, PUC, etc.) recognize that the licensee and its contractors place a priority on safety and quality.
- The licensee has adopted the attitude that quality and safety requirements imposed by NRC were minimal levels which should, in many cases and perhaps in general, be transcended by actual operating practices at the project.
- The licensee has maintained good working relations with the NRC.
- The licensee has made deliberate and effective efforts to maintain good public relations.
- The licensee attempted to anticipate and respond positively to impending changes required by regulatory actions.
- The licensee has responded positively to the results of INPO construction audits.
- The NRC inspection presence at the project site has been regular, constant, and consistent.
- The NRC construction site resident inspection staff has been sufficient in size and expertise to appropriately inspect all phases of plant construction and construction management.
- NRC has taken action on issues that relate to quality related problems in a timely way.
- NRC inspection focus at the project has been on product quality rather than on records.
- The project regulators (NRC, PUC, etc.) recognize that the licensee and its contractors place a priority on safety and quality.

TABLE II. Case Study Findings Related to Positive Attributes of Management and Management Performance at Operating Plants

1.0 MANAGEMENT FUNDAMENTALS

- 1.1 Management Experience and Qualifications
- 1.2 Management System
- 1.3 Resources
- 1.4 Management Attitudes and Involvement

2.0 ACCOUNTABILITY

- 2.1 Procedures
- 2.2 Personnel Qualifications

3.0 EXTERNAL INTERFACES

- 3.1 Relationships with NRC
- 3.2 Relationships with Other Bodies

TABLE II. Case Study Findings Related to Positive Attributes of Management and Management Performance at Operating Plants

1.0 MANAGEMENT FUNDAMENTALS

Experience, and qualifications, organization, resources, involvement, and attitudes of utility management.

1.1 Management Experience and Qualifications

a. The licensee, including plant specific personnel, has significant nuclear plant operations experience.

b. There has been a conscious effort on the part of the licensee to learn from and benefit from the experience of other nuclear utilities.

c. Licensee management has a clear perception of why safety and quality are important.

d. The licensee exercises the right to approve key contractor personnel.

e. Licensee staff developed and implemented the quality assurance program for the plant.

f. Nonconformance, audit, or other reports describe problems clearly enough to provide quick assessment of their significance.

g. The licensee maintains workable labor arrangements.

h. The licensee deliberately and effectively tries to optimize maintenance, outages, and modifications with the goal of maximizing plant availability and reliability.

1.2 Management System

a. The licensee maintains a separate nuclear project organization independent from its fossil fuel operations.

b. The responsibilities of all plant staff including contractors are clearly defined.

c. Leadership is clearly defined and conspicuous.

d. Parts, materials, and components are generally available when they are needed by the crafts.

e. Senior licensee management is regularly informed of significant quality or QA problems.

f. The QA/QC organization has clearly defined and unconstrained stop work authority.

g. There exists a constructive, communicative, and mutually respectful relationship between the engineering function and the QA function.

h. Interfaces are defined and procedures are developed and in place to insure the proper flow and interpretation of information and to permit monitoring of information flow interfaces.

i. The chain of command between the QA function and top utility management is not excessively long.

j. Reports on significant quality or QA deficiencies are issued and distributed promptly to interested management and to senior managers.

k. The licensee and its contractors use an effective and efficient method of documenting quality for all aspects of the work. These practices are understood, rigorously applied, and adhered to at all levels.

l. The licensee maintains an in-depth and balanced involvement with cost, schedule, and productivity as well as with quality.

m. Management control is centralized and unified and gives no appearance of being fragmented.

n. The licensee has clearly defined its contractors' responsibilities.

o. The licensee organization is management and detail oriented.

p. Responsibility and authority delegated to lower tier organizations are verified by audit or other methods.

q. Audit programs appear to be strong and effective.

r. Effective trend analysis programs are employed.

s. An effective corrective action program is in place.

t. Documented responsibility and authority requirements are observed and practiced.

u. QA engineers and inspectors are free to discuss quality problems with crafts or other nonmanagement personnel.

v. Resumes and employment application information are verified for managers, engineers, and QA/QC personnel.

w. Quality commitment is reinforced by factors with direct financial implications, e.g., an approved rate of return for higher levels of operating efficiency, reduced maintenance costs, and greater reliability.

1.3 Resources

a. The licensee has adequate financial resources and anticipates no major economic problems.

b. Procurement of components and materials is based on the consideration of getting the best available to do the job, rather than strictly on costs.

c. The licensee makes a conscious and effective attempt to obtain long-term commitments of qualified people, both as part of their staff and on the staff of their contractors.

d. The licensee hires experienced contractors for safety-related activities.

e. The selection of contractors and vendors is based primarily on their qualifications irrespective of whether they are the low bidder.

f. The licensee and its contractors employ modern, computer based methods for record keeping.

g. Responsibilities and authorities vested in contractors are completely and clearly specified in contract documents.

h. The licensee and its contractors place safety at least on a par with schedule and costs.

1.4 Management Attitudes and Involvement

a. There is a strong commitment to quality on the part of the utility and its contractors as reflected by aggressive, consistent action as well as verbal endorsement of quality.

b. Senior utility management is involved in corrective action on significant conditions adverse to quality.

c. The licensee and its contractors have consistently made deliberate, timely, and effective efforts to come to grips with quality-related problems as they arose.

d. Licensee management has been adequately involved in self-evaluations.

e. Observed failures to exercise designated responsibility and authority are rigorously pursued for corrective actions.

f. QA/QC managers have adequate access to top management.

g. The licensee requires, at a minimum, compliance with regulations and codes.

h. The licensee encourages all employees to openly communicate with management concerning perceived quality problems.

i. The licensee sets a performance standard for the project that transcends minimal NRC requirements.

j. Management at all levels views safety as taking priority over cost and schedule.

k. Senior management requires and participates in periodic independent assessments of the adequacy and effectiveness of the QA program.

l. QA/QC organizations are not regarded as policemen.

m. There exists a sense of company and plant loyalty that tends to stabilize the work force.

2.0 ACCOUNTABILITY

Effective implementation of adequate procedures by qualified personnel.

2.1 Procedures

a. The licensee and its contractors follow specific detailed procedures with respect to quality control, calculations, specifications, and procurement.

b. Instructions, procedures, and drawings clearly spell out responsibility and authority and consistent with the QA program.

c. Procedural steps and work methods are defined in sufficient detail to prevent significant variations in practice.

d. Instructions and procedures are revised promptly when experience indicated a need to do so.

e. Procedures and instructions are not too detailed to result in nonuse.

f. Instructions, procedures, and drawings, as well as changes thereto are independently reviewed for adequacy, correctness, and clarity.

g. Extensive reviews and dry runs are used prior to first or other critical implementation of safety related procedures or instructions.

h. Instructions and procedures are reviewed and revalidated periodically as required by the QA program.

i. Instructions, procedures, and drawings as well as changes thereto are independently reviewed for adequacy, correctness, and clarity.

j. Procedures exist that place the responsibility for quality work directly at the working level.

k. The licensee generates and reviews work plan procedures, quality control instructions, and other procedural mechanisms that relate on a day-to-day basis to quality.

l. Purchasing and contracting are controlled through administrative procedures that require standard terms and conditions for contracts and purchase orders, a qualified bidders list, and work initiation procedures.

m. QA program audits include evaluation of the effectiveness of the audited organization's internal audit program.

n. The QA organization is appropriately involved in trend analysis, validation of nonconformance reports, reporting items under 10 CFR Part 50.55 (3) and 10 CFR Part 21, design reviews, audits, and surveillances to confirm that work was performed as per procedure requirements.

o. Responsibility and authority are explicitly designated down to working levels in safety analysis reports, the QA program, or related manuals, procedures, and instructions.

p. Procedures exist which place the responsibility for quality work directly on the crafts and their supervisors.

2.2 Personnel Qualifications

a. Sufficient qualified personnel are available to carry out the procedures.

b. The understanding of the importance of quality is disseminated throughout the entire staff by training, personal contact, staff incentives, and other means.

c. The licensee maintains adequate training programs for quality control and quality assurance personnel.

d. Senior management participates in training programs or evaluates them.

e. The licensee and its contractors maintain adequate training programs for the crafts. These emphasize quality.

f. There has not been excessive turnover of operators, QA/QC staff, or supervisory/management staff.

g. Pay scales are adequate to attract and hold qualified personnel.

3.0 EXTERNAL INTERFACES

- Relationships with NRC and other influential bodies.

3.1 Relationships with NRC

a. The licensee's advertised and implemented policy is to view the regulatory process as necessary and beneficial and the philosophy is to be responsive to the regulators.

b. The licensee has adjusted well to changing regulatory requirements.

c. The licensee has a policy of establishing and maintaining constructive working relationships with the NRC.

d. The licensee typically adopts an aggressive, positive position in responding to NRC requirements and questions.

e. The project regulators (NRC, PUC, etc.) recognize that the licensee places a priority on safety and quality.

f. The licensee has adopted the attitude that quality and safety requirements imposed by NRC are minimal levels that should, in many cases and perhaps in general, be transcended by actual operating practices at the project.

g. The licensee attempts to anticipate and respond positively to impending changes required by regulatory actions.

h. The licensee assumed responsibility for obtaining all project permits and licensees.

i. The NRC inspection presence at the plant has been regular, constant, consistent, and adequate.

j. NRC inspection focus at the project has been on product quality rather than on records.

3.2 Relationships with Other Bodies

a. The licensee is rewarded for high operating efficiencies by their public utility commission.

b. The licensee makes deliberate and effective efforts to maintain good public relations.

c. The licensee has responded positively to the results of INPO audits.

TABLE III. Relationship of Case Study Findings to SALP Evaluation Criteria[a]

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 1 - Management Involvement in Assuring Quality	
Attributes (Category 1)[b]	
Consistent evidence of prior planning and assignment of priorities; well stated, controlled and explicit procedures for control of activities.	1.1 a. The licensee, including plant-specific personnel, has has significant nuclear plant operations experience.
	b. There has been a conscious effort on the part of the licensee to learn from and benefit from the experience of other nuclear utilities.
Well stated, disseminated, and understandable policies.	c. Licensee management has a clear perception of why safety and quality are important.
Decision making consistently at a level ensures adequate management review.	d. The licensee exercises the right to approve key contractor personnel.
Corporate management frequently involved in site activities.	e. Licensee staff developed and implemented the quality assurance program for the plant.
Reviews timely, thorough, and technically sound.	f. Nonconformance, audit, or other reports describe problems clearly enough to provide quick assessment of their significance.
Records complete, well maintained, and available.	g. The licensee maintains workable labor arrangements.
Procedures and policies strictly adhered to.	h. The licensee deliberately and effectively tries to optimize maintenance, outages, and modifications with the goal of maximizing plant availability and reliability.
Corrective action is effective, as indicated by lack of repetition.	1.2 a. The licensee maintains a separate nuclear project organization independent from its fossil fuel operations.

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 1 - (contd)	b. The responsibilities of all plant staff including contractors are clearly defined. c. Leadership is clearly defined and conspicuous. d. Parts, materials, and components are generally available when they are needed by the crafts. e. Senior licensee management is regularly informed of significant quality or QA problems. f. The QA/QC organization has clearly defined and unconstrained stop work authority. g. There exists a constructive, communicative, and mutually respectful relationship between the engineering function and the QA function. h. interfaces are defined and procedures are developed and in place to insure the proper flow and interpretation of information and to permit monitoring of information flow interfaces. i. The chain of command between the QA function and top utility management is not excessively long. j. Reports on significant quality or QA deficiencies are issued and distributed promptly to interested management and to senior managers. k. The licensee and its contractors use an effective and efficient method of documenting quality for all aspects of work. These practices are understood, rigorously applied, and adhered to at all levels.

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 1 - (contd)	l. The licensee maintains an in-depth and balanced involvement with cost, schedule, and productivity as well as with quality.
	m. Management control is centralized and unified and gives no appearance of being fragmented.
	n. The licensee has clearly defined its contractors' responsibilities.
	o. The licensee organization is management and detail oriented.
	p. Responsibility and authority delegated to lower tier organizations are verified by audit or other methods.
	q. Audit programs appear to be strong and effective.
	r. Effective trend analysis programs are employed.
	s. An effective corrective action program is in place.
	t. Documented responsibility and authority requirements are observed and practiced.
	u. QA engineers and inspectors are free to discuss quality problems with crafts or other nonmanagement personnel.
	v. Resumes and employment application information are verified for managers, engineers, and QA/QC personnel.

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 1 - (contd)	w. Quality commitment is reinforced by factors with direct financial implications, e.g., an approved rate of return for higher levels of operating efficiency, reduced maintenance costs, and greater reliability.
1.3	a. The licensee has adequate financial resources and anticipates no major economic problems.
	b. Procurement of components an materials is based on the consideration of getting the best available job, rather than strictly on costs.
	f. The licensee and its contractors employ modern, computer based methods for record keeping.
	h. The licensee and its contractors place safety at least on a par with schedule and costs.
2.1	a. The licensee and its contractors follow specific detailed procedure with respect to quality control, calculations, specifications, and procurement.
	b. Instructions, procedures, and drawings clearly spell out responsibility and authority and consistent with the QA program.
	c. Procedural steps and work methods are defined in sufficient detail to prevent significant variations in practice.
	d. Instructions and procedures are revised promptly when experience indicated a need to do so.

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 1 - (contd)	e. Procedures and instructions are not too detailed to result in nonuse. f. Instructions, procedures, and drawings, as well as changes thereto are independently reviewed for adequacy, correctness, and clarity. g. Extensive reviews and dry runs are used prior to first or other critical implementation of safety related procedures or instructions. h. Instructions and procedures are reviewed and revalidated periodically as required by the QA program. i. Instructions, procedures, and drawings as well as changes thereto are independently reviewed for adequacy, correctness, and clarity. j. Procedures exist that place the responsibility for quality work directly at the working level. k. The licensee generates and reviews work plan procedures, quality control instructions, and other procedural mechanisms that relate on a day-to-day basis to quality. l. Purchasing and contracting are controlled through administrative procedures that require standard terms and conditions for contracts and purchase orders, a qualified bidders list, and work initiation procedures.

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 1 - (contd)	o. Responsibility and authority are explicitly designated down to working levels in safety analysis reports, the QA program, or related manuals, procedures, and instructions.
	p. Procedures exist which place the responsibility for quality work directly on the crafts and their supervisors.
SALP Criterion 2 - Approach to the Resolution of Technical Issues from a Safety Standpoint	
Attributes (Category 1)(b)	
Clear understanding of issues demonstrated.	1.2 c. The leadership is clearly defined and conspicuous.
	d. Parts, materials, and components are generally available when they are needed by the crafts.
Conservatism routinely exhibited when potential for safety significance exists.	e. Senior licensee management is regularly informed of significant quality or QA problems.
	f. The QA/QC organization has clearly defined and unconstrained stop work authority.
Technically sound and thorough approaches in almost all cases.	h. Interfaces are defined and procedures are developed and in place to insure the proper flow and interpretation of information and to permit monitoring of information flow interfaces.
Timely resolutions in almost all cases.	j. Reports on significant quality or QA deficiencies are issued and distributed promptly to interested management and to senior managers.

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 2 - (contd)	1. The licensee maintains an in-depth and balanced involvement with cost, schedule, and productivity as well as with quality.
	o. The licensee organization is management and detail oriented.
	q. Audit programs appear to be strong and effective.
	r. Effective trend analysis programs are employed.
	s. An effective corrective action program is in place.
	1.4 a. There is a strong commitment to quality on the part of the utility and its contractors as reflected by aggressive, consistent action as well as verbal endorsement of quality.
	b. Senior utility management is involved in corrective action on significant conditions adverse to quality.
	c. The licensee and its contractors have consistently made deliberate, timely, and effective efforts to come to grips with quality-related problems as they arose.
	d. Licensee management has been adequately involved in self-evaluations.
	i. The licensee sets a performance standards for the project that transcends minimal NRC requirements.
	k. Senior management requires and participates in periodic independent assessments of the adequacy and effectiveness of the QA program.

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 3 - Responsiveness to NRC Initiatives Attributes (Category 1)(b) Meets deadlines. Timely resolution of issues. Technically sound and thorough responses in almost all cases. Acceptable resolutions proposed initially in most cases.	3.1 a. The licensee's advertised and implemented policy is to view the regulatory process as necessary and beneficial to the philosophy is to be responsive to the regulators. b. The licensee has adjusted well to changing regulatory requirements. c. The licensee has a policy of establishing and maintaining constructive working relationships with the NRC requirements and questions. d. The licensee typically adopts an aggressive, positive position in responding to NRC requirements and questions. e. The project regulators (NRC, PUC, etc.) recognize that the licensee places a priority on safety and quality. f. The licensee has adopted the attitude that quality and safety requirements imposed by NRC are minimal levels that should, in many cases and perhaps in general, be transcended by actual operating practices at the project. g. The licensee attempts to anticipate and respond positively to impending changes required by regulatory actions.

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 4 - Encroachment History Attributes (Category 1)(b) Major violations are rare and are not indicative of programmatic breakdown. Minor violations are not repetitive and not indicative of programmatic breakdown. Corrective action is prompt and effective.	1.2 j. Reports on significant quality or QA deficiencies are issued and distributed promptly to interested management and to senior managers. q. Audit programs appear to be strong and effective. s. An effective corrective action program is in place. 3.1 a. The licensee's advertised and implemented policy is to view the regulatory process as necessary and beneficial and the philosophy is to be responsive to the regulators. d. The licensee typically adopts an aggressive, positive position in responding to NRC requirements and questions.
SALP Criterion 5 - Operational and Construction Events Attributes (Category 1)(b) Few significant operational or construction events, attributable to causes under the licensee's control, have occurred that are relevant to this functional area. Events are promptly and completely reported. Events are properly identified and analyzed.	

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 6 - Staffing (Including Management)	
Attributes (Category 1)(b)	
Positions are identified, authorities and responsibilities are well defined.	1.1 a. The licensee including plant specific personnel, has significant nuclear plant operations experience.
	g. The licensee maintains workable labor arrangements.
Vacant key positions are filled on a priority basis.	1.2 t. Documented responsibility and authority requirements are observed and practiced.
	v. Resumes and employment application information are verified for managers, engineers, and QA/QA personnel.
Staffing is ample as indicated by control over backlog and overtime.	
Experience levels for management and operations personnel exceed commitments made by licensee at tie of licensing.	1.3 c. The licensee makes a conscious and effective attempt to obtain long-term commitments of qualified people, both as part of their staff and on the staff of their contractors.
	d. The licensee hires experienced contractor for safety-related activities.
	e. The selection of contractors and vendors is based primarily on their qualifications irrespective of whether they are the low bidder.
	g. Responsibilities and authorities vested in contractors are completely and clearly specified in contract documents.

TABLE III. (contd)

SALP Evaluation Criteria	Related Case Study Findings: Attributes of Successful Plants
SALP Criterion 6 - (contd)	2.2 a. Sufficient qualified personnel are available to carry out the procedures.
	f. There has not been excessive turnover of operators, QA/QC staff, or supervisory/management staff.
	g. Pay scales are adequate to attract and hold qualified personnel.
SALP Criterion 7 - Training and Qualification Effectiveness	
Attributes (Category 1)(b)	
Training and qualification program makes a positive contribution, commensurate with procedures and staffing, to understanding of work and adherence to procedures with few personnel errors.	2.2 b. The understanding of the importance of quality is quality is disseminated throughout the entire staff by training, personal contact, staff incentives, and other means.
	c. The licensee maintains adequate training programs for quality control and quality assurance personnel.
Training program is well defined and implemented with dedicated resources and a means for feedback experience; program is applied to nearly all staff.	d. Senior management participates in training programs or evaluates them.
Inadequate training could rarely be traced as a root cause of major or minor events or problems occurring during the rating period.	e. The licensee and its contractors maintain adequate training programs for the crafts. These emphasize quality.

(a) Evaluation criteria and attributes are reproduced from the U.S. NRC Manual, Chapter 0516 "Systematic Assessment of Licensee Performance."
(b) Category 1 is the highest of the three ratings awarded by the SALP process.