EXPANDED AUGMENTED SYSTEM REVIEW AND
TEST PROGRAM METHODOLOGY GUIDLINES

CONCURRENCE David Humenansky — 7-15-87
DAVID HUMENANSKY — Date
PROGRAM MANAGER

CONCURRENCE S.R. Knight — 7/15/87
S.R. KNIGHT — Date
DIRECTOR, QUALITY ASSURANCE

CONCURRENCE R. Croley — 7/15/87
R. CROLEY — Date
DIRECTOR, NUCLEAR TECHNICAL SERVICES

CONCURRENCE G. Carl Andognini — 7/15/87
G. CARL ANDOGNINI — Date
CHIEF EXECUTIVE OFFICER, NUCLEAR

EXPANDED AUGMENTED SYSTEM REVIEW AND TEST PROGRAM EVALUATION (EASRTP) METHODOLOGY GUIDELINES

PURPOSE AND SCOPE

THE PURPOSE OF THIS DOCUMENT IS TO PROVIDE AN OVERVIEW OF THE EASRTP PROCESS AND TO PROVIDE TEAM MEMBERS WITH GUIDELINES THAT WILL BE USEFUL IN THE CONDUCT OF THE EASRTP EVALUATIONS.

THIS PROCESS IS MODELED AFTER THE NRC AUGMENTED SYSTEM REVIEW AND TEST PROGRAM (ASRTP), THE NRC PERFORMANCE APPRAISAL TEAM AND THE SAFETY SYSTEM FUNCTIONAL INSPECTION (SSFI) TEAM TECHNIQUES. THE SYNERGY DEVELOPED WITHIN EACH TEAM FROM CREATIVE QUESTIONING, OPEN COMMUNICATION, PERSISTENT FOLLOW-UP, AND MUTUAL RESPECT PLAYS A VITAL ROLE IN THE EVALUATION PROCESS. EACH TEAM WILL DEVELOP LEADS REQUIRING INDIVIDUAL AND TEAM EFFORT TO INVESTIGATE. TEAM LEADERS WILL PRIORITIZE LEADS AND DIRECT THE TEAM TO PURSUE THOSE LEADS THAT APPEAR TO BE MOST SIGNIFICANT. HOWEVER, TEAM MEMBERS HAVE THE FLEXIBILITY TO FOLLOW LEADS AS THEY DEVELOP AND WILL NOT BE CONSTRAINED BY A MANDATORY SET OF REQUIREMENTS. THEREFORE, THERE IS ONLY AN EVALUATION PLAN. THERE ARE NOT ANY OTHER EASRTP PROCEDURES OR REQUIRED CHECKLISTS BECAUSE THEY TEND TO DETRACT FROM THE PROCESS BY REQUIRING TEAM MEMBERS TO PERFORM ACTIONS THAT MAY NOT CONTRIBUTE TO THE TEAM'S EFFECTIVENESS. INSTEAD, GUIDELINES ARE PROVIDED TO ESTABLISH A COMMON FOUNDATION FOR ALL THE TEAMS AND TO GIVE INSIGHT INTO THE GENERAL METHODOLOGY.

THESE GUIDELINES WILL ADDRESS THE TYPICAL EASRTP ROUTINE, GENERAL GUIDELINES, THE NORMAL EXPECTATIONS AND FEATURES OF THE PREPARATION, CONDUCT, AND REPORT PHASES OF THE PROCESS. THE GUIDELINES WILL FIRST COMPARE THE EASRTP EVALUATION TO THE ASRTP AND SSFI PROCESS.

COMPARISON OF EASRTPs TO NRC "FUNCTIONAL" INSPECTIONS

THE NRC SSFI IS NORMALLY A 4 WEEK INSPECTION THAT CAN BE DIVIDED INTO THE FOLLOWING ELEMENTS:

1. A ONE WEEK ENGINEERING INSPECTION CONDUCTED BY DESIGN ENGINEERS THAT IS OFTEN AT THE CORPORATE OFFICE.

2. A TWO WEEK ON-SITE INSPECTION WITH THE FULL TEAM.

3. A FOURTH AND ANY ADDITIONAL WEEKS NEEDED TO PREPARE THE REPORT.

AN NRC TEAM IS USUALLY COMPRISED OF A TEAM LEADER AND INSPECTORS WHO ARE ASSIGNED TO THE FOLLOWING AREAS:

1. MECHANICAL DESIGN
2. ELECTRICAL DESIGN
3. OPERATIONS
4. MAINTENANCE
5. TESTING
6. TRAINING
7. SYSTEM WALKDOWN
8. QUALITY ASSURANCE (LIMITED PARTICIPATION)

THE NRC PLACES HEAVY RELIANCE ON TEAM MEETINGS AND THE SYNERGISM CREATED DURING THESE MEETINGS. THE TEAM LEADER AND THE ENTIRE TEAM SPEND CONSIDERABLE TIME INTERVIEWING PLANT PERSONNEL, OBSERVING PLANT ACTIVITIES, REVIEWING DOCUMENTATION, AND FOLLOWING-UP LEADS. ANOTHER IMPORTANT ELEMENT OF THE TEAM IS THAT IT CONDUCTS DAILY DEBRIEFINGS TO THE LICENSEE. THIS HELPS TO CLEAR UP MISCONCEPTIONS, ALERTS MANAGEMENT TO PROVIDE EMPHASIS ON SIGNIFICANT ISSUES, AND ALLOWS LICENSEES TO TAKE CORRECTIVE ACTIONS.

THE NRC SSFI AND ASRTP ARE INNOVATIVE INSPECTION APPROACHES THAT COMBINE PROGRAMMATIC AND TECHNICAL EXPERTISE. THEY HAVE PROVEN EFFECTIVE FOR IDENTIFYING PROBLEMS THAT CAN DEGRADE THE OPERATIONAL READINESS OF SAFETY SYSTEMS. THEY ARE A MIXTURE OF PERFORMANCE APPRAISAL TEAM METHODS AND A DESIGN BASED TECHNICAL REVIEW. THEY ARE DYNAMIC INTERACTIONS THAT HAVE NOT BEEN PROCEDURALIZED BEYOND STATING OBJECTIVES AND GIVING EXAMPLES OF QUESTIONS TO ASK AND TO CONSIDER DURING THE INSPECTION. THESE OBJECTIVES AND QUESTIONS ARE PROVIDED IN APPENDIX C OF THE NRC I&E INSPECTION MANUAL. THIS IS INCLUDED AS ATTACHMENT 1 TO THESE GUIDELINES.

THE EASRTP EVALUATION WILL INCLUDE MOST OF THE ASPECTS MENTIONED ABOVE. MORE DETAIL ON EACH OF THESE IS PROVIDED IN THE FOLLOWING SECTIONS.

TYPICAL EASRTP TEAM ROUTINE

THE COMPOSITION OF EACH EASRTP TEAM IS OUTLINED IN THE EASRTP EVALUATION PLAN. TEAM COMPOSITION IS SIMILAR TO THE NRC ASRTP TEAM COMPOSITION. THE AREA OF TRAINING WILL BE EVALUATED BY THE ENTIRE TEAM AND NOT BY A SPECIFIC TEAM MEMBER.

THE EASRTP EVALUATION IS COMPOSED OF THREE PHASES: PREPARATION, CONDUCT, AND REPORT. THE TEAM SCHEDULE PROVIDES APPROXIMATELY 2 CALENDAR DAYS FOR PREPARATION, 14 FOR THE EVALUATION, AND 3 TO WRITE A REPORT. THIS TOTALS 19 DAYS PER SYSTEM. THE ACTUAL ON SITE AUDIT TIME IS SIMILAR TO THE TYPICAL NRC ASRTP ON-SITE INSPECTION TIME.

THE FIRST WEEK OF THE NORMAL NRC SSFI ROUTINE IS OMITTED FROM THE ASRTP AUDIT PROCESS DUE TO THE RECOGNIZED EFFECTIVE EFFORT ALREADY PUT INTO THE PROBLEM IDENTIFICATION PROGRAM (QCI-12) AT RANCHO SECO. INSTEAD OF HAVING DESIGN ENGINEERS SPEND A WEEK REVIEWING DESIGN DOCUMENTS IN ORDER TO PROVIDE INITIAL LEADS TO THE FULL TEAM, THE NRC TEAM TOOK ADVANTAGE OF THE PROBLEMS ALREADY IDENTIFIED IN THE SYSTEM STATUS REPORT AND USED THEM AS THEIR INITIAL SOURCE OF LEADS. THE EASRTP TEAM WILL DO LIKEWISE. IT IS EXPECTED THAT THE EASRTP DESIGN ENGINEERS WILL HAVE TO RETURN FREQUENTLY TO THE DESIGN BASES AND SOURCE DOCUMENTS TO FOLLOW-UP LEADS. THIS CORRELATES TO THE METHOD AND LOGIC EMPLOYED BY THE NRC ASRTP CONDUCTED AT RANCHO SECO BETWEEN DECEMBER 1986 AND FEBRUARY 1987.

EACH TEAM LEADER SHOULD HOLD TWO TEAM MEETINGS PER DAY - ONE IN THE MORNING AND ONE IN THE EVENING. THE MORNING MEETING SHOULD BE NO LONGER THAN 30 MINUTES. ITS OBJECTIVE IS TO ALLOW ALL TEAM MEMBERS TO BECOME FAMILIAR WITH WHAT EACH INDIVIDUAL TEAM MEMBER HAS PLANNED FOR THAT DAY'S ACTIVITIES. IT ALSO ALLOWS THE TEAM LEADER TO CONFIRM THAT HIS TEAM IS FOCUSING ITS RESOURCES ON THE MOST PROMISING ISSUES. THE EVENING MEETING SHOULD BE APPROXIMATELY 60 TO 90 MINUTES. DURING THIS MEETING, EACH TEAM MEMBER SHOULD INFORM THE REST OF THE TEAM OF THE RESULTS OF HIS DAILY ACTIVITIES. HE SHOULD BRIEFLY DESCRIBE INFORMATION PERTINENT TO THE ENTIRE TEAM AND INDICATE THOSE AREAS WHERE HE IS DEVELOPING CONCERNS OR ISSUES. EACH TEAM MEMBER SHOULD ALSO ASK FOR ADDITIONAL SUPPORT FROM OTHER TEAM MEMBERS WHEN NEEDED. IT IS ANTICIPATED THAT THESE TEAM MEETINGS WILL INVOLVE DISCUSSIONS AND QUESTIONS FROM VARIOUS PERSPECTIVES. THESE TEAM MEETINGS WILL OFTEN BE SUPPLEMENTED

WITH ADDITIONAL PERSONNEL IN ORDER TO ADD TO THE SYNERGY OF THE MEETINGS. FOR EXAMPLE, THE QA REPRESENTATIVES SHOULD ATTEND MOST TEAM MEETINGS, AND MEMBERS OF THE VARIOUS ON-SITE VERIFICATION AND REVIEW GROUPS MAY ATTEND. TEAM MEMBERS SHOULD COMMUNICATE FREQUENTLY WITH DEPARTMENT EASRTP COORDINATORS AND DEPARTMENT HEADS. WHEN CONCERNS ARE DEVELOPED THEY SHOULD BE COMMUNICATED TO THE APPROPRIATE ORGANIZATION AND DOCUMENTED SHORTLY THEREAFTER WITH A REQUEST FOR INFORMATION (RI) FORM AS DESCRIBED IN THE EASRTP EVALUATION PLAN.

TEAM MEMBERS ARE EXPECTED TO REVIEW THEIR DAILY NOTES, AND DOCUMENT THEIR ACTIVITIES IN A LEGIBLE, LOGICAL FORMAT EACH EVENING. THEY SHOULD ALSO DETERMINE WHAT CONCERNS REQUIRE ADDITIONAL FOLLOW-UP AND PLAN THE NEXT DAY'S ACTIVITIES ACCORDINGLY.

IT IS SUSPECTED THAT EACH TEAM MEMBER WILL SPEND APPROXIMATELY SIXTY HOURS PER WEEK ON THE EVALUATION. THE TEAM LEADER WILL HAVE THE FLEXIBILITY TO DETERMINE WHICH DAYS AND HOW LONG THE TEAM SHOULD REMAIN ON SITE EACH WEEK. THE TEAMS SHOULD NOT HAVE TO WORK ON SUNDAYS. HOWEVER, SOME WORK ON SATURDAYS WILL PROBABLY BE NECESSARY. TEAM LEADERS MAY ALSO DECIDE TO CONDUCT ONE-ON-ONE SESSIONS WITH THEIR TEAM MEMBERS INSTEAD OF CONDUCTING ONE OF THE DAILY TEAM MEETINGS.

EASRTP GENERAL GUIDELINES

THERE ARE SOME GENERAL GUIDELINES THAT SHOULD BE FOLLOWED IN ANY INSPECTION AS A MATTER OF GOOD PRACTICE. A LIST OF SOME OF THOSE FOLLOW:

1. TAKE THOROUGH NOTES. SOMETIMES, SEEMINGLY IRRELEVANT INFORMATION BECOMES QUITE MEANINGFUL WHEN ANALYZING AND SUMMARIZING YOUR ACTIVITIES.

2. NOTES SHOULD INCLUDE DETAILS. FOR EXAMPLE, PROCEDURE NUMBERS, STEP DETAILS,REFERENCE INFORMATION, EQUIPMENT BASE PLATE INFORMATION, EXACT LOCATIONS OF COMPONENTS OR DEFICIENCIES, AND SPECIFIC MATERIAL DEFICIENCIES. TAKING DETAILED NOTES WILL SAVE TIME LATER WHEN WRITING A REPORT.

3. AFTER REVIEWING DOCUMENTS OR OBSERVING AN ACTIVITY, DEVELOP QUESTIONS AND ITEMS TO FOLLOW-UP SO YOU DON'T FORGET THEM.

4. ALWAYS DOCUMENT LEADS PASSED ON TO OTHER TEAM MEMBERS SO THAT THEY DON'T FORGET THE SOURCE AND MEANING OF LEADS.

5. TEAM MEMBERS MUST HAVE A QUESTIONING MIND, A PROBING INTELLECT AND A CREATIVE CURIOSITY. THEY HAVE TO BECOME CREATIVELY INQUISITIVE.

6. TEAM MEMBERS MUST CONCENTRATE ON SEEING BEYOND THE SYSTEM THEY ARE EVALUATING. THEY MUST BE ABLE TO LOOK AT SPECIFIC FACTS ASSOCIATED WITH A SYSTEM AND DETERMINE IF HAVE ANY GENERIC IMPLICATIONS FOR AN ENTIRE PLANT PROGRAM. FOR EXAMPLE, NUMEROUS MATERIAL DEFICIENCIES IN THE INSTRUMENT AIR SYSTEM MAY BE POINTING TO AN OVERALL PROBLEM IN THE BALANCE OF PLANT MAINTENANCE PROGRAM.

7. EACH TEAM MEMBER WILL HAVE AN IMPACT ON PLANT OPERATIONS. SINCE THERE ARE SIX TEAMS CONDUCTING SIX SEPARATE AUDITS IN PARALLEL, THE IMPACT WILL BE SIGNIFICANT. TEAM MEMBERS MUST BE SENSITIVE TO THESE EFFECTS.

8. FOLLOW-UP IS A VITAL PART OF THE EVALUATION. DURING FOLLOW-UP A TEAM MEMBER CONFIRMS THE ACCURACY OF HIS CONCERN, DETERMINES THE FUNDAMENTAL PROBLEM OR NEEDED IMPROVEMENT, DETERMINES THE EXTENT OF THE PROBLEM OR NEEDED IMPROVEMENT, AND DETERMINES BASIC CAUSES.

9. TEAM MEMBERS MUST KEEP IN MIND THAT WHAT THEY FIND OFTEN WILL BE ONLY INDICATORS POINTING TO A PROBLEM - RATHER THAN THE PROBLEM ITSELF.

EASRTP PREPARATION PHASE

DURING THE PREPARATION PHASE, EACH TEAM MUST REVIEW A NUMBER OF DOCUMENTS RELATED TO THE SYSTEM TO BE EVALUATED. A SAMPLE LIST OF DOCUMENTS THAT THE TEAM SHOULD HAVE AVAILABLE IS GIVEN IN THE EASRTP EVALUATION PLAN. THESE DOCUMENTS SHOULD BE REVIEWED IN ORDER TO BECOME KNOWLEDGEABLE OF THE SYSTEM DESIGN, ARRANGEMENT, AND FUNCTIONS. THE REVIEW SHOULD BE FROM A FUNCTIONAL PERSPECTIVE AND AN EMPHASIS PLACED ON DETERMINING THE OPERATING CONDITIONS UNDER WHICH EACH ACTIVE COMPONENT WILL FUNCTION DURING AN ACCIDENT OR DURING ABNORMAL CONDITIONS. TEAM MEMBERS SHOULD QUESTION IF EACH COMPONENT IS INSTALLED AS DESIGNED, BEEN TESTED TO VERIFY IT WILL FUNCTION AS DESIGNED, AND DETERMINE IF THE DESIGN BASES IS THE CORRECT ONE. IT IS RECOMMENDED THAT THE INSPECTION OBJECTIVES IN ATTACHMENT 1 BE REVIEWED FREQUENTLY DURING ALL PHASES OF THE EVALUATION. POTENTIAL QUESTIONS TO ASK AND AREAS TO CHECK FOR SPECIFIC TEAM MEMBERS ARE PROVIDED LATER.

AS PART OF THE PREPARATION PHASE, TEAM MEMBERS SHOULD BECOME FAMILIAR WITH PREVIOUS NRC SSFI FINDINGS THROUGHOUT THE INDUSTRY WITH RESPECT TO THE SYSTEM BEING AUDITED AS WELL AS TO THE GENERIC FINDINGS DEVELOPED BY THE NRC ASRTP COMPLETED IN FEBRUARY 1987. MOST OF THIS INFORMATION WILL BE PROVIDED TO THE TEAMS DURING INITIAL TRAINING ON THE EASRTP PROCESS. IN ADDITION, EACH TEAM LEADER WILL HAVE A COPY OF THE LESSON PLAN AND THE ACTUAL NRC SSFI INSPECTION REPORT FOR EACH INSPECTION REPORT COVERED IN TRAINING.

THE VALUE OF THE PREPARATION PHASE CANNOT BE OVEREMPHASIZED. DURING THIS PHASE APPROPRIATE STANDARDS, REGULATIONS, CODES, AND GUIDES MUST BE CONSIDERED IN ORDER TO ACCURATELY MEASURE THE ABILITY OF THE SYSTEM TO FUNCTION. IN ADDITION, STANDARDS OF EXCELLENCE AND INDUSTRY STANDARDS SHOULD BE REVIEWED BECAUSE THEY FORM A BENCHMARK FOR EVERY SYSTEM THAT IS REVIEWED. THE TEAM RETAINS THE FLEXIBILITY TO INDICATE THAT ALTHOUGH MINIMUM STANDARDS ARE BEING MET, CONCERNS MAY ARISE DUE TO NOT MEETING EXPECTED OR DESIRED INDUSTRY STANDARDS.

EASRTP CONDUCT

WITH RESPECT TO EASRTP'S, THERE ARE SPECIFIC AREAS THAT THE TEAM MEMBERS SHOULD EVALUATE AND SPECIFIC QUESTIONS THAT SHOULD BE CONSIDERED. ATTACHMENT 1 LISTS SOME QUESTIONS THAT WOULD APPLY TO VALVES, PUMPS, INSTRUMENTS AND SENSORS. THESE QUESTIONS ARE ONLY EXAMPLES AND ARE PROVIDED TO ACQUAINT THE TEAM MEMBER WITH THE TYPE, DEPTH, AND NATURE OF AN EASRTP. IN ADDITION, ATTACHMENT 1 PROVIDES GUIDELINE EXAMPLES FOR REVIEW OF MAINTENANCE AND TEST RECORDS, DESIGN DOCUMENTS, WALKDOWNS, AND PROCEDURES. AGAIN, THESE EXAMPLES ARE NOT ALL INCLUSIVE. ADDITIONAL GUIDELINES FOR EACH SPECIFIC AREA PROVIDED BELOW AND IN ATTACHMENT 2.

TEAM MEMBERS SHOULD KEEP IN MIND THAT THE EASRTP CONCENTRATES ON A SYSTEM. CONSEQUENTLY, WHEN THE WORK CONTROL SYSTEM OR CALIBRATION SYSTEM IS REVIEWED, THE TEAM SHOULD DETERMINE THE EFFECTIVENESS OF THOSE PROGRAMS WITH RESPECT ONLY TO THE SELECTED SYSTEM EVALUATED. IN A SIMILAR FASHION, TEAM MEMBERS SHOULD DETERMINE WHAT PLANT ACTIVITIES ARE PLANNED ASSOCIATED WITH THE SELECTED SYSTEMS. IF A SURVEILLANCE IS PLANNED TO BE CONDUCTED OR MAINTENANCE PERFORMED, THEN CONSIDERATION SHOULD BE GIVEN TO OBSERVING IT. IN ADDITION TO THE OBSERVATIONS, TEAM MEMBERS WILL CONDUCT NUMEROUS INTERVIEWS AND REVIEWS TO BETTER UNDERSTAND FACTS AND FOLLOW-UP LEADS.

EACH PLANT DEPARTMENT WILL HAVE AN EASRTP COORDINATOR WHOSE ROLE IS DEFINED IN THE EASRTP EVALUATION PLAN. ALL TEAM MEMBERS SHOULD SCHEDULE MEETINGS AND REQUEST INFORMATION THROUGH THE COORDINATOR, EVEN IF HE KNOWS SOMEONE WHO CAN PROVIDE THE SPECIFIC NEEDED INFORMATION. IT IS IMPORTANT FOR THE COORDINATOR TO UNDERSTAND THE EASRTP IMPACT OR HIS DEPARTMENT IN ORDER TO ACCOMPLISH HIS OTHER DEPARTMENT TASKS AND RESPONSIBILITIES.

SOME DESIGN ISSUES AT THE PLANT HAVE BEEN IDENTIFIED AS POTENTIAL GENERIC CONCERNS. THESE ISSUES ARE LISTED IN ATTACHMENT 3. TEAM MEMBERS SHOULD CHECK THESE ISSUES TO DETERMINE IF THESE PROBLEMS ARE IN THE SYSTEM BEING EVALUATED.

<u>DESIGN REVIEW</u>

THE DESIGN ENGINEERS SHOULD REVIEW SELECTED MODIFICATIONS, PERFORM A DETAILED REVIEW OF SELECTED CALCULATIONS, AND INTERFACE WITH THE NUCLEAR ENGINEERING DEPARTMENT ENGINEERS. POTENTIAL PROBLEM AREAS SUCH AS PUMP RUNOUTS MOTOR OVERSPEEDS, IMPROPER AMPACITY, INADEQUATE NET POSITIVE SUCTION HEAD, AND TANK OVERPRESSURE PROTECTION SHOULD BE REVIEWED.

<u>SYSTEM ENGINEERS</u>

FUNCTIONALITY AS OPPOSED TO "OPERABILITY" IN ALL POSSIBLE MODES OF OPERATION MUST BE CONSIDERED. THIS INVOLVES NEARLY A 100% REVIEW AT THE COMPONENT LEVEL. CHECK VALVES SHOULD BE REVIEWED TO DETERMINE IF THEY HAVE BEEN ADEQUATELY TESTED AND SURVEILLANCES REVIEWED TO DETERMINE IF ACCEPTANCE CRITERIA ARE APPROPRIATE TO DEMONSTRATE FUNCTIONALITY. THROTTLE VALVE POSITIONS SHOULD BE COMPARED TO THE POSITIONS DETERMINED BY FLOW BALANCE TESTS.

<u>MAINTENANCE</u>

THE TEAM MEMBER SHOULD REVIEW CORRECTIVE MAINTENANCE ON THE SELECTED SYSTEM DURING AT LEAST THE LAST 12 MONTHS OF PLANT OPERATION, REVIEW ALL APPLICABLE MAINTENANCE PROCEDURES, REVIEW THE PREVENTIVE MAINTENANCE PROGRAM, AND CONDUCT PLANT TOURS TO REVIEW THE ACTUAL MATERIAL CONDITION OF THE SYSTEM.

<u>OPERATIONS</u>

SYSTEM WALKDOWNS AND OPERATING PROCEDURE REVIEWS (EMERGENCY, ABNORMAL AND NORMAL) SHOULD BE CONDUCTED. SETPOINTS SHOULD BE REVIEWED TO DETERMINE THEIR ADEQUACY. PART OF THIS REVIEW WOULD BE TO FOCUS ON THOSE INDICATIONS THAT ARE NOT AVAILABLE BUT SHOULD BE. TRAINING PLANS SHOULD BE COMPARED TO AS-BUILT PLANT CONDITIONS AND THE OPERATING PROCEDURES TO DETERMINE THE ACCURACY AND QUALITY OF THE TRAINING PROGRAM FOR THE SELECTED SYSTEM.

<u>QUALITY ASSURANCE</u>

ARE SYSTEMS BEING AUDITED TO ENSURE COMPLIANCE WITH APPROPRIATE NRC REGULATIONS? ARE CORRECTIVE ACTIONS APPROPRIATE FOR THE IDENTIFIED PROBLEM AND ARE THE CORRECTIVE ACTIONS EFFECTIVE? ARE THE AUDITS CONDUCTED COMPREHENSIVE AND DETAILED ENOUGH TO FULFILL THEIR INTENDED PURPOSE?

EASRTP REPORTS

AT THE END OF EACH EASRTP AUDIT, A FORMAL REPORT WILL BE WRITTEN AND SUBMITTED TO THE PROGRAM MANAGER. ALL TEAM MEMBERS ARE ENCOURAGED TO DEVELOP WRITTEN CONCERNS THROUGHOUT THE EVALUATION IN ORDER TO MINIMIZE THE TIME NECESSARY TO WRITE THE REPORT. THIS PRACTICE WILL HELP TO ENSURE ENOUGH FOLLOW-UP HAS BEEN CONDUCTED TO SUPPORT THE TEAM MEMBER'S CONCERNS. THESE CONCERNS WILL BE DOCUMENTED ON A RI.

ADDITIONALLY, EASRTP TEAM MEMBERS MUST BE CONSISTANTLY AWARE OF THE FACT THAT THEIR NOTES MUST BE CLEAR, LEGIBLE AND LOGICAL. SUFFICIENT DOCUMENTATION STATING WHAT WAS CHECKED AND FOUND MUST BE MAINTAINED. ATTACHMENT 4 IS INCLUDED AS A SUGGESTED FORMAT. TEAM LEADERS ARE RESPONSIBLE FOR ENSURING ADEQUATE DOCUMENTATION OF THEIR TEAM'S EFFORTS IS MAINTAINED.

DETAILS CONCERNING REPORT FORMAT AND RIs ARE PROVIDED IN THE EASRTP EVALUATION PLAN.

TEAM MEETINGS SHOULD BE HELD TO DISCUSS DRAFT REPORTS SO THAT ALL TEAM MEMBERS ARE AWARE OF ANY MAJOR FINDINGS AND TO ENSURE THAT TEAM MEMBERS SUPPORT THE FINDINGS.

APPROXIMATELY 4 DAYS HAVE BEEN ALLOCATED TO WRITE AND SUBMIT A FINAL REPORT.

APPENDIX C

SAFETY SYSTEM FUNCTIONAL INSPECTION

I. INSPECTION OBJECTIVE

A. The objective of a Safety System Functional Inspection (SSFI) is to assess the operational readiness of selected safety systems by determining whether:

1. The systems are capable of performing the safety functions required by their design bases.

2. Testing is adequate to demonstrate that the systems would perform all of the safety functions required.

3. System maintenance (with emphasis on pumps and valves) is adequate to ensure system operability under postulated accident conditions.

4. Operator and maintenance technician training is adequate to ensure proper operations and maintenance of the system.

5. Human factors considerations relating to the selected systems (e.g., accessibility and labelling of valves) and the supporting procedures for those systems are adequate to ensure proper system operation under normal and accident conditions.

6. Management controls including procedures are adequate to ensure that the safety systems will fulfill the safety functions required by their design bases.

II. INSPECTION METHODOLOGY

A. Review the design-basis requirements for the selected system(s) and determine the operating conditions under which each active component will function during accident or abnormal conditions. This review should determine if the design basis is met by the installed, tested component and if the design basis is the correct one.

1. For valves: What permissive interlocks are involved? What differential pressures will exist when the valve strokes? Will the valve be repositioned during the course of the event? What is the source of control/indication power?

What control logic is involved? What manual actions are required to backup and restore a degraded function?

2. For pumps: What are the flow paths the pump will experience during accident scenarios? Do the flow paths change? What permissive interlock/control logic apply? How is the pump controlled during accident conditions? What manual actions are required to back up and restore a degraded function? What suction/discharge pressures can the pump be expected to experience during accident conditions? What is the motive power for the pump during all conditions?

3. For instrumentation and sensors. What plant parameters are used as inputs to the initiation and control systems? Is operator intervention required in certain scenarios? Are the range and accuracy of instrumentation adequate? What is the extent of surveillance and/or calibration of such instrumentation?

B. Review the design of the selected system(s) as installed in the plant.

1. Determine if the as-built design and installation matches the current design/licensing basis requirements for that particular facility. For example, are fuses and thermal overloads properly sized; are current dc loads within the capacity of the station batteries; and is the instrumentation adequate in range and accessibility for operations to control the system under normal and abnormal conditions?

2. Determine if system modifications implemented since initial licensing have introduced any unreviewed safety questions. For example, have modified structures surrounding safety-related equipment, components, or structures been evaluated for seismic 2-over-1 considerations, and have modified equipment components falling under the scope of 10 CFR 50.49 been thoroughly evaluated for environmental equipment qualification considerations such as temperature, radiation, humidity?

3. Evaluate the licensee's drawing control program, the control and use of design input information, and the adequacy of design calculations from the perspective of modifications made to the selected safety system.

C. Review the maintenance and test records for the selected system(s).

1. Determine if the system components have been adequately tested to demonstrate that they can perform their safety function under all conditions they might experience in an accident situation. Determination of adequate testing may require consideration of removing all actuator power, including both electrical and pneumatic, for fail-safe valves (see IE Information Notice No. 85-84, "Inadequate In-service Testing of Main Steam Isolation Valves").

2. Determine if the system components are being adequately maintained to ensure their operability under all accident conditions. For example, are limit and torque switch settings proper; is the instrument air system adequately maintained to ensure the reliability of pneumatic valves; are fuse and thermal overload sizes correct; and are pipe supports, seismic restraints and shielding being maintained?

3. Determine the adequacy of the licensee's preventive maintenance program for the system. As a part of this assessment, refer to the appropriate vendor technical manuals.

4. Support system and plant modifications should be evaluated to the extent possible to ensure that system design capability as demonstrated by preoperational testing has not been compromised. For instance, the addition of a fire barrier in an ECCS pump room may compromise room cooling capabilities by altering air flow paths.

D. Perform walkdown of selected systems.

1. Determine if components are labeled and accessible. For example, can the components be operated locally/manually if required by the licensing basis, and is there HP/security interference?

2. Determine if MOV operators and check valves (particularly lift-type) are installed in the orientation required by the manufacturer. Additionally, a human factors assessment of component orientation (such as the direction of handwheel rotation for valves installed upside down) should be made.

3. Determine if system lineup is consistent with design/licensing basis requirements. This lineup inspection should include considerations of the normal and backup power supplies, control circuitry, indication and annunciation status, and sensing lines for instrumentation.

E. Review abnormal, emergency, and normal operating procedures; maintenance procedures; and surveillance procedures for the selected system(s).

1. Assess the technical adequacy of the procedures.

2. Determine if the procedural steps will achieve required system performance for normal, abnormal, and emergency conditions. This should include consideration of operator actions to compensate for shortcomings in design.

3. Determine if operations and maintenance personnel receive adequate training pertaining to the selected system(s) and if the degree of training provided is consistent with the amount of technical detail included in procedures. In particular, verify that operators are trained on system

response, failure modes, and required actions involved in all credible scenarios in which the system is required to function.

4. Determine if surveillance test procedures comprehensively address required system responses. For example, does the tested lineup duplicate the accident response lineup; are check valves tested to prevent reverse flow; and does the test establish any artificial initial conditions?

F. Review the operational experience of the selected system(s). This would include LERs, NPRDS, 10 CFR 50.72 reports, enforcement actions, nonconformance reports, and maintenance work requests.

1. Determine the historical reliability of the system and its components based on the review and analysis of the operational experience.

2. Determine if the licensee has aggressively pursued, identified, and corrected root causes of failures.

3. Determine the extent of the maintenance backlog and ascertain if the licensee has a program to identify, prioritize and perform timely safety-related maintenance activities. Is there a backlog of safety-related maintenance?

III. INSPECTION GUIDANCE

A. Plant Specific Probabilistic Risk Assessment should be reviewed as part of the system selection methodology, if available. Studies conducted by AEOD also can provide useful data for determining which system to select.

B. Past experience with SSFIs has demonstrated that identifying the detailed design-basis requirements for the selected safety systems can be quite difficult and time consuming for the inspection team as well as for the licensee. The difficulty in clearly identifying design-basis requirements at older plants is related to the fact that the information often has never been assembled before and is typically scattered among the records stored at the plant, at the licensee's corporate offices, at the architect engineer's offices, and at the NSSS vendor's offices. Consequently, an effort should be made to provide the licensee with adequate advanced notice regarding the safety systems to be inspected to allow the licensee time to begin collecting the needed documentation. The inspector should compare the original FSAR system design description to that contained in the USAR as part of the effort to identify detailed design-basis requirements.

C. The design review portion of the inspection should be performed by inspectors with extensive nuclear plant design experience, preferably comparable to the experience gained through previous employment with an architect engineering firm. It is important also that the inspectors performing the design review have a good understanding of integrated plant operations, maintenance, testing, and quality assurance so that they are able to relate their findings to the other functional areas being inspected.

D. When performing the review of maintenance and test records, it is essential for the inspector to focus on the technical details of how the activities were performed. For example, were the closing limit switches set with the motor-operated valve fully shut or four turns off the shut seat? The review of test records should go beyond a review of the in-service testing and surveillance programs for Technical Specifications. The inspector should seek the answer to the fundamental question of whether or not the safety systems and all included components have been tested to demonstrate that they will perform their intended safety functions as defined in the design basis.

E. As part of the system walkdown, the inspector should analyze the adequacy of the system lineup, accessibility, indications, relative to the most limiting design-basis conditions (e.g., degraded power and lighting, single failure, loss of non-safety-related indications, and harsh environments).

F. As was the case for the review of maintenance and test records (discussed in III.C), it is essential for the inspector to focus on the technical details of the operating, maintenance, and surveillance procedures reviewed. The inspector should verify that the emergency and abnormal operating procedures are adequate to handle the most limiting design-basis events. Where it is not reasonable for procedures to provide detailed guidance, the inspector should verify that the licensee's training program ensures that the operators are knowledgeable in the areas of concern.

G. The effectiveness of the SSFI methodology is greatly enhanced if the various inspection team members are able to benefit from each other's inspection efforts. Accordingly, frequent, even daily, team meetings are encouraged to allow the team members to share their findings. It has been the experience of the headquarters-based SSFI effort that many of the more significant findings originate from team meeting discussions that allow related inspection findings in different functional areas to be pieced together.

IV. INSPECTION APPROACH

A. Team Composition

An inspector should be assigned to each of the following areas: electrical design, mechanical design, maintenance, surveillance and testing, operations, and training. The detailed system walkdown can be done by an additional inspector participating for only part of the onsite activities, or this aspect can be covered by the operations inspector.

A full-time team leader without any specific area assignments should have the primary responsibility to provide guidance and coordinate team activities. It is recommended that the team leader have several years of inspection experience. The senior resident inspector for the site being inspected should not be assigned as a participating team member; however, his/her involvement in the inspection process should be encouraged to the extent his/her resident duties will allow.

B. Schedule of Inspection Activities

The following is a recommended schedule of inspection activities:

Week 1. The mechanical and electrical inspectors start inspection of design activities focusing on recent design changes of the selected safety system. These activities should be conducted at the licensee's engineering offices.

Week 2. The inspection team starts their onsite activities.

Week 3. No onsite or engineering office inspection activities are conducted. The licensee has time to produce requested design information. The inspection team can brief management and review the issues in-office.

Week 4. Inspection team is back on-site. The exit meeting usually is held Friday morning. A pre-exit meeting and rehearsal of inspector presentations is conducted late Thursday afternoon with the participation of NRC management representatives.

At least 2 weeks prior notification should be provided to the licensee before the inspection begins. The licensee should be told which safety system(s) will be inspected. At least 1 week of preparation time should be allowed for the inspection team members before beginning their onsite activities, and the team should establish contact with licensee systems engineers when the team arrives on-site.

C. Credit for Inspection Activities

Inspection credit input should be made to the 766 data base for the appropriate inspection procedures of IE MC 2515. Potentially appropriate inspection procedures include:

35701 - QA Program Annual Review
37700 - Design, Design Changes and Modifications
37701 - Facility Modifications
37702 - Design Changes and Modifications Program
41701 - Licensed Operator Training
42700 - Plant Procedures
61700 - Surveillance Procedures and Records
61725 - Surveillance Testing and Calibration Control Program
61726 - Monthly Surveillance Observations

62702 - Maintenance Program
62703 - Monthly Maintenance Observations
62704 - Instrumentation Maintenance (Components and Systems) Observation of Work, Work Activities, and Review of Quality Records
62705 - Electrical Maintenance (Components and Systems) Observation of Work, Work Activities, and Review of Quality Records
71707 - Operational Safety Verification
71710 - ESF System Walk Down
72701 - Modification Testing
73051 - Inservice Inspection - Review of Program
73755 - Inservice Inspection - Data Review and Evaluation

END

OTHER ITEMS FREQUENTLY CHECKED DURING SAFETY SYSTEM FUNCTIONAL INSPECTIONS

These are phrased as either questions to ask or areas to evaluate.

Topic: Calculations - assumptions:

Are they realistic?
Are they justifiable?
Are they specific or too broad?
(example: using an average fluid density value without regard for actual temperatures)

Calculations - Methodology

Is it the appropriate methodology to use?
Are conversion factors correct?
Are SU transformer impedances in calcs?
Consideration of MOV starting currents as part of initial discharge loads.
Check calcs for engineering judgements
Check calcs to determine their accuracy in reflecting as-is plant.

Topic: Check Valves - Have they been checked for tightness?

Are they tested?
Are they in the PM program?
Are they adequate for their use (excess flow check valves)
Are flow check valves used properly?
Are valves adequately sized?
How will SLB affect the system?

Topic: Battery:

Are temperatures considered in the design process?
Are room temperatures above min design specified?
Are the batteries sized correctly?
Maintained per vendor recommendations?
Equalizing and test discharge tests conducted correctly?
Specific gravities properly taken and corrected?
Reserve capacity?
Loading?
Are batteries sized correctly?
Effect on inverters reviewed?
What is the maint. history on battery?

Topic: Electrical Distribution:

Are components within their period of useful life? (e.g. power filter capacitors)
What are the electrical load schedules?
What alarms when loads are lost? (e.g. 480 VAC load)
Voltage available at the component.
Cable sizing
Ampacity considerations adequate
Continuous and short circuit duty
Consideration of test type data
Check breaker sizes for adequacy
Overload protection
Overload alarms?
Feeder cable voltage drops?
Thermal insulation adequate?
Inverters and inverter loads?
Justifications for reduction of safety related loads.
Are EQ records available?
DC system power distribution correct?
Do data sheets point out special entries?
Leads and jumpers properly placed?
Will the EDG provide power under DBA and survail test?
How are breaker positions verified?
Are protective relays in calibration program?
Check calibration procedures.
Does control room have one-lines and diesel electric drawings?
Check load shedding surveillances?
Check auto sequencing on EDG (all loads).
Does EDG diff. relay have leaking capacitor?
Observe EDG operation (all team members).
Check fuse control.
Check overall electrical coordination.
Check room temps (min. & max.) in EDG & critical areas?
Check general maintenance of electrical systems
Is there a breaker load list?
Check Governor fluid change out frequency.

Topic: Mechanical:

Are relief valves adequately tested and sized?
Are component pressure ratings (pipes, bottles, tanks pumps) within design specifications.
Can components be exposed to overpressure situations?
Vacuum breakers sized and installed correctly?
Valve stroke times trended and corrective actions taken per ASME?
Are seismic 2 over 1 considerations made
effects of transverse motion on valves?

Look into class 2 over 1 equipment as compared to structures.
Combining valves for multiple spatial components for an earthquake
Installation of air cyclinders in backup air supply.
Do flow test actually mimic functional situation?
On what systems does the safety system rely for support?
Is piping adequately sized for flow, pressure and temp conditions?
Have HOVs been tested at system pressure?

Topic: Pumps:

Susceptible to run-out?
NPSH adequately considered and correct?
Are flow testing methods adequate?
Are the test measurements accurate enough to conduct the test?
Are overspeed trips of Turbine-Driven pumps and motor-driven pumps adequate?
Are any special precautions needed to start or stop the pump (e.g. time between successive starts, having to secure one before starting the other, etc)?
Pump packing procedures
Protection for pump motors
On steam driven pumps; flow, pressure and temp in spec?
What are the ramifications of long-term operation of pumps?
What is the maintenance history of pump?

Topic: Setpoints:

Are throttle valves correctly set?
Are computer setpoints correct?
Are alarm setpoints justifiable?
Are they adequate?

Topic: Measurements

Insulated versus uninsulated instrument lines and their effects on operation.
Signal accuracy and range requirements meet to ensure valid calibration?

Topic: Nitrogen System:

Is backup safety related?
Is there sufficient capacity to meet cycling needs?
Is pressure properly set?
Has the system been fully tested?

Topic: Motor Operated Valves:

Are torque switch settings specified and set correctly?
Are limit switch settings correct?
Maintenance of MOVs poor due to dirt, missing and caps, etc?
Proper power source?
Proper maintenance procedure per tech manual?
What is the OP history of MOVs

Topic: Other:

Is there evidence of independent design reviews?
Are procedure references current and available (specially for design)?
Are all positions of a switch tested?
Sensing line single failure impacts?
Comparison of Fabrication drawings to installation?
Potential leakage paths in air systems?
Check controlled drawings for accuracy (incorrect valve positions and locked positions).
Coordination of post-mod and surv. tests.
Instrument index contained errors/omissions.
Isolation of Control Room Isolation Remote Shut-down Instrument.
Is there a good preventive maintenance program in place?
What is Physical Appearance of system components?
Have personnel been properly trained to procedures?
Have 50.59 evaluations covered all safety questions?
How are safety classifications determined?
Have IE, INPO & LER bulletins been reviewed?
Check communication practices!
Check vendor requirements for component PM and surveillance.
Check human factors!
Check alarm procedures for LOP and blown fuse.

POTENTIAL GENERIC ISSUES

The following are potential generic issues:

DESIGN CONTROL PROCEDURES INADEQUATE (I.E., NO CHECKING RQD. BY PROC.)

1. Loss of design control with potential to violate plant licensing commitments:

   - Approve design packages prior to completion of supporting calls.
   - Temporary modifications affecting licensing commitments
   - No evidence to assure that required design changes completed/approved prior to plant mode requiring change
   - Calcs. not performed in accordance with procedures

     A. Incorrect methods

     B. Inadequate/missing assumptions

     C. Inadequate/missing references

     D. Inadequate/missing Acceptance Criteria

   - Design drawings/calculations do not reflect as-built condition
   - No evidence of valve throttling, or set point documentation

2. Design process fails to address all licensing requirements (General Design Criteria)

   - App. R
   - HELB
   - Flooding, missiles
   - Seismic qualification
   - Environmental qualification
   - Separation (safety/non-safety)
   - Single failure
   - Appropriate transient modes for class I pipe stress
   - Pipe classification boundaries on P&IDs

3. Failure to analyze all potential modes of operation, including transients

- Inadequate NPSH for all modes
- Failure to consider pump shutoff in calculating system pressures
- Failure to consider component/system capability
- Failure to consider run out conditions
- Failure to consider turbine overspeed
- Failure to provide adequate pump protection (i.e., mini-flow recirc.)
- Inadequate relief valve setting/sizing
- Inadequate sys. capacities
- Failure to address loss of offsite power
- Inadequate N_2 backup system sizing
- Inadequate over current protection
- Inability of system to supply required flow for all operating modes
- Inability of system to perform in required time frame

4. Use of commercial components in safety related systems without upgrade or suitable design review.

EASRTP DOCUMENT SHEET

System Code ____

ITEM CHECKED:

Source of Information: (Document, Interview, Observation)

Results:

ATTACHMENT 4