July 1, 1980

SECY-80-319

COMMISSIONER ACTION

For: The Commissioners

From: Victor Stello, Director,
Office of Inspection and Enforcement

Thru: Executive Director for Operations

Subject: ANALYSIS OF ALTERNATIVES FOR CONDUCTING INDEPENDENT VERIFICATION TESTING OF ENVIRONMENTALLY QUALIFIED EQUIPMENT

Purpose: To inform the Commission of the results of the subject analysis, to identify the staff's program for conducting independent verification testing and inspection of safety related equipment's environmental qualifications and to obtain the Commission's consent to implement the program.

Discussion:

Background

Prior to the electrical connector assembly failures during the 1977 Sandia methodology tests the staff's program related to equipment environmental qualification consisted of a review of the SAR to verify that the licensee committed to meet the appropriate standards and in-house review of some equipment qualification reports. Following the investigation of the connector failures several Bulletins were issued that uncovered the generic problem of gross inadequacies in safety-related equipment environmental qualifications. The staff's current program consists of reviewing the licensees responses to IE Bulletins and reviewing a backlog of environmental qualification reports submitted for equipment installed in operating plants. Effort under the current program has been aimed at catching up with the equipment qualification inadequacies in operating plants.

On April 13, 1978, the Commission issued a memorandum and order to the staff that included ten directives resulting from the Union of Concerned Scientists petition dated November 4, 1977. Directive #5 of that memorandum and order stated:

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SECY NOTE: This subject is scheduled for a Commission briefing during the week of July 7.

"Provide the Commission with an analysis of alternatives (including estimates of resource requirements and potential benefits) for conducting independent verification testing of environmentally qualified equipment which is required to operate in safety systems. Alternatives to be provided for information of the Commission in one month, with the full analysis to be completed one month later."

On June 14, 1978 the staff's plan for the analysis was submitted to the Commission in Information Report SECY-78-310. The plan consisted of an analysis of the following three alternatives each representing a course of action that provides greater NRC involvement in equipment environmental qualifications than presently exists:

(1) NRC environmental test facility

(2) NRC contract environmental testing to existing DOE or independent laboratories

(3) NRC review and witnessing of vendor tests conducted to meet NRC requirements.

Combinations of these alternatives were also considered in search of the optimum method of monitoring and controlling the adequacy of equipment qualifications. Sandia Laboratories performed the study of the alternatives in accordance with the plan developed by the staff.

The scope of the Sandia Study was limited to:

- Environmentally sensitive safety-related equipment that is located in areas potentially exposed to a harsh environment and that is required to function during or following a design basis event for safe plant shutdown or is otherwise required to mitigate the consequences of an accident. By definition, then, the analysis considered safety significant electrical, instrumentation and control, and electromechanical equipment.

- Equipment currently being supplied and installed in plants under construction starting with Comanche Peak and such equipment approved for use in the future. Comanche Peak is the first plant committed to meet IEEE 323-1974.

On May 28, 1980 the Commission requested that the staff provide a paper for independent NRC testing of electrical equipment according to current acceptable standards for environmental qualification.

Alternatives

The Sandia study considered six alternatives:

(1) Alternative 1 - An NRC owned and operated, environmental test facility capable of accommodating the equipment of interest.

(2) Alternative 2 - NRC contract for independent verification testing of equipment with existing laboratories.

(3) Alternative 3 - NRC review and witnessing of vendor tests conducted to meet NRC requirements.

(4) Combination of Alternative 1 and 2

(5) Combination of Alternative 1 and 3

(6) Combination of Alternative 2 and 3

Analysis

The study revealed twenty-eight generic equipment categories within the defined scope, which in essence represents only the high priority equipment to be environmentally qualified. For each generic equipment category, between one and five manufacturers were identified. For each manufacturer between one and four different equipment types were identified. In total the high priority equipment "Backlog" exceeds 140 separate items to be qualified to IEEE 323-1974 starting with the Comanche Peak nuclear plant.

A "Universal Test Profile" was defined using IEEE standards, regulatory guides and branch positions for the purpose of developing costs, manpower and time required to complete the equipment qualification tests.

A set of criteria identified in Enclosure 1 was used to analyse and evaluate the alternatives. To facilitate a semi-quantitative alternative selection, a 1 to 9-point value as appropriate was assigned to the alternative for each criterion. In the 1 to 9-point scoring system "1" is

most negative, "5" is neutral and "9" is most positive. The method used to score the combinations of the alternatives was the sum of the absolute difference of the individual scores against each criteria, but only when at least one of the alternatives scored greater than 6. This method assures that the combination only scores high when the alternatives complement each other. A summary of the scoring of the alternatives and the combinations is provided in Enclosure 1.

The following is a summary of the analysis of the alternatives and the combinations:

(1) Alternative 1 (NRC test facility) offers maximum potential for direct NRC involvement in verification tests through direct ownership and/or control of a dedicated test facility. The alternative was detailed in two phases. The Phase I study developed the facility size on the basis of a minimum set of test apparatus; under Phase II the facility was sized on the basis of a desired test rate. The result of the Phase I study was a $8 million facility and a $5 million annual operating budget (at peak testing operation) with a staff of 125 people. To complete the backlog tests with the Phase I facility would require four years of full-time testing. Under Phase II, the desired test rate was established so as to complete the backlog in 1-1/2 years. This study resulted in a $15 million facility with an $8 million annual operating budget and a staff of 240 people. Either facility has, however, the strongly negative factor of implementation delay. After budget approvals, a delay of almost five years would result before the first tests are run, due to planning, construction, equipping, and shakedown of the facility.

In summary, Alternative 1 is not neutral in its scoring against the criteria; it ranks highly positive with respect to direct NRC involvement, control of prior-tests verifications, flexibility, degree of control, and conflict of interest; conversely, it is highly negative with respect to immediacy of implementation, costs, and the historical function of the NRC.*

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* See Page 2 and 4, Enclosure 1, for Summary of Scoring of all Alternatives.

(2) Alternative 2 (NRC contracts tests) makes maximum use of existing test facilities capabilities, while assuring direct NRC involvement and control through judicious contracting and subcontracting. The same equipment backlog and test profile used for Alternative 1 was used to develop the cost of this alternative and in that regard it is comparable to the Alternative 1 analysis. Alternative 2 would be implemented through a captive major contractor (who, in turn, would subcontract all testing) with a staff of 40 people and a $2 million annual payroll. Under this alternative the testing backlog is to be completed in 1-1/2 years at an estimated total subcontracting testing cost of $9 million. Even with no major capital facilities, it is estimated that three years will be required to implement the alternative, i.e., until the first test results are obtained.

In summary, Alternative 2 is somewhat neutral in its scoring to the criteria; it ranks highly positive with respect to direct NRC involvement; it is highly negative with respect to immediacy of implementation, the historical function of the NRC, and conflict of participant's interests.

(3) Alternative 3 (NRC review and witnessing of vendor tests) is a direct development of the historical and chartered function of the NRC, the review and witnessing of vendor test programs. Depending upon its level of implementation, it can be an absolutely minimal response with respect to direct, increased NRC involvement in verification tests, ranging from one additional staff and up. The alternative is unique in that no contractor is involved, no capital or test facilities are required, and no implementation delays need occur once an NRC-management decision is made to proceed. Negatively, the alternative offers no clear milestone for completion (i.e., as in Alternatives 1 and 2 which has the equipment "backlog" to complete). As a result, Alternative 3 is a long-term continuing effort. This alternative offers less direct control consequently the industry will set the pace, kind, and to some extent the quality of testing. Using the 97 plants currently docketed, Sandia estimated that through 1992 the industry may have 25 complete qualification test programs; the implication is that under this alternative, the NRC staff may be required to review and witness 25 times more tests than under Alternatives 1 and 2. Based on a 100% coverage scenario, this requires a staff of 75 NRC employees and $4 million annual budget.

In summary, Alternative 3 is not neutral in its scoring to the criteria; it ranks highly positive with respect to consistency with the historical and chartered NRC mission, conflict-of-interest, and immediacy of implementation; conversely and negatively the alternative demands large staffing from within the NRC and allows little direct control or flexibility.

(4) Alternative 4 (NRC test facility and NRC contracts tests) the combination of alternatives 1 and 2 does not score high against the criteria because that combination does not provide short term results and the cost of implementing the combination is high.

(5) Alternative 5 (NRC test facility and NRC review and witnessing of vendor tests). In the scoring of the possible dual combinations of alternatives, a clearly "optimal" alternative emerges when Alternatives 1 and 3 are considered in union; only that combination scores highly positive with respect to all criteria. This is not to imply that a combined full implementation of both alternatives is necessary; in fact, the combination of Alternatives 1 and 3 scores highly positive because they complement each other. Alternative 3 offers immediate implementation at a minimum cost. Implementation of Alternative 3 therefore produces results until Alternative 1 can be implemented.

(6) Alternative 6 (NRC contracts tests and NRC review and witnessing of vendor tests) the combination of alternatives 2 and 3 scored relatively high with respect to all criteria. This combination of alternatives also complement each other in that short term results can be obtained through the alternative 3 activity while alternative 2 is being developed.

The Sandia study does not recommend the one hundred percent adoption of any one of the alternatives or any combination of alternatives. What the study recommendations say is that a course of action like that described in Alternative 3 should be adopted immediately. The reason for not recommending any particular alternative or combination exclusively is the significant cost and time associated with the total coverage approach studied. When the costs are determined for covering various percentages of the total workload, Alternatives 1 and 2 are not considered cost effective and still have the long lead implementation problem. Alternative 3 costs are, however, proportional

to the workload. Consequently a significant reduction in the coverage of the workload results in a significant cost reduction. The coverage flexibility offered by this alternative is more suitable to the NRC sampling inspection practice currently used to verify the adequacy of the licensees activities, and offers the possibility of immediate implementation and feedback of results.

Alternative 3 as defined in the study provided for total coverage of all activities related to the qualification of equipment including detailed review of all software and hardware and witnessing of the specimen preparation and testing. This total coverage was necessary in the study to make the intensity of Alternative 3, as nearly equal as possible to the other two alternatives.

Staff Views

The staff believes that indepth coverage of about ten to twenty percent of the total number of qualification tests will provide the increased confidence level that the equipment is being adequately qualified and will cause significant improvement in the industry qualification programs. The staff also believes that independent verification testing will be the most effective method of confirming the adequacy of equipment qualifications in certain situations.

The staff concludes that an alternative 6 type of program is the preferred alternative because that combination of activities offers immediate feedback through "indepth inspection" and witnessing of qualification tests and provides the least cost method of verifying the adequacy of equipment qualifications via independent verification tests for selected equipment. The total program proposed by the IE staff supplements the alternative 6 activities with a laboratory accreditation program and activities designed to improve qualification standards. A detailed outline of the IE proposed program is included in Enclosure 1.

Resource Estimates:

The estimated resources to develop and implement the alternative 6 type of program including initiation of a laboratory accreditation program are as follows:

(1). Three man years of IE's staff manpower and $150,000 for outside contract support in fiscal year 1980. The IE staff manpower will be provided at the expense of diverting two site inspectors currently reviewing environmental qualifications, two vendor inspectors

and two RCI engineers. The diversion of the two vendor inspectors will be at the expense of conducting less QA inspections at vendor facilities. The diversion of the two RCI engineers will be at the expense of vendor and site related procedure and program development. The $150,000 required for outside support and independent verification testing are available from existing 1980 funds.

(2) Six man years of IE's staff manpower and $500,000 for outside contract support in fiscal year 1981. The IE manpower (6 staff full-time) committed to the program will remain unchanged. The $500,000 for outside contract support and independent verification testing will be funded from lower priority IE programs in FY 1981.

(3) Six man years of IE's staff manpower and $750,000 for outside contract support in fiscal year 1982. FY 1982 resources are included in the IE FY 1982 budget request.

(4) The NRR resources have been estimated to be 1 1/2 manyears per year for the first two years of the program. The recent reorganization of NRR has provided manpower for this program.

Implementation of this program is not expected to cause an increase in the SD or RES manpower levels currently being applied to environmental qualification activities. The current IE manpower involved in verifying the adequacy of existing operating plant qualifications will overlap with the manpower needed to develop and implement this program. However, the IE manpower level required to maintain the program is expected to be less than the current manpower level being expended on operating plant equipment qualifications.

Recommendations:

1. That the Commission approve the development and implementation of the staff's proposed program for conducting independent verification testing and inspection of safety-related equipment's environmental qualifications.

2. That the Commission approve the initiation of the laboratory accreditation program.

Coordination: The program has been concurred in by NRR, RES, and SD. The office of ELD has no legal objection to the program.

MPA has reviewed the paper for value-impact content and offers the comments provided as Enclosure 3. IE's response to the MPA comments are attached to Enclosure 3.

Victor Stello, Jr.,
Director
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Enclosures:
1. IE Summary of Sandia Study and IE's Proposed Comprehensive Program
2. Sandia Study - Commissioners, SECY, PE & GC only
3. MPA Comments on Proposed Program

EDO Note: In my view the IE approach represents a sound and balanced proposal to achieve independent verification testing of environmentally qualified equipment. Resources are available in FY 1980 and FY 1981. Resources for FY 1982 and beyond will be dealt with in the context of the annual budget submission.

William J. Dircks
Acting Executive Director
for Operations

Commissioners' comments should be provided directly to the Office of the Secretary by c.o.b Friday, July 18, 1980.

Commission Staff Office comments, if any, should be submitted to the Commissioners NLT July 11, 1980, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional time for analytical review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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ATTACHMENT D