

NORTHEAST UTILITIES



THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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October 26, 1984

Docket No. 50-423

B11330

Mr. D. G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

- Reference: (1) D. G. Eisenhut to W. G. Council, Design Verification Activities - Millstone Unit No. 3, dated August 13, 1984.
- (2) W. G. Council to B. J. Youngblood, Design Verification Activities, dated October 12, 1984.

Dear Mr. Eisenhut:

Millstone Nuclear Power Station, Unit No. 3
Design Verification Activities

In Reference (1), the NRC requested that Northeast Nuclear Energy Company (NNECO) provide within 60 days any plans that we have for assuring Millstone Unit No. 3 has been designed and constructed in accordance with FSAR commitments. In Reference (2), NNECO requested a two week extension of time to respond to the NRC's request. NNECO is hereby providing documentation of our assurance that Millstone Unit No. 3 has been designed and constructed in accordance with applicable requirements.

The NRC Staff has been seeking additional assurance from applicants for operating licenses that the design process used for constructing their plants fully complies with Final Safety Analysis Report (FSAR) commitments. Reference (1) indicated that some applicants have undertaken an Independent Design Verification Program (IDVP) to review and evaluate their design process and in other cases that the staff has conducted an Integrated Design Inspection (IDI) to provide additional assurance. However, the NRC does not have a requirement for all applicants to conduct an independent design or construction verification program nor has the NRC's Committee to Review Generic Requirements (CRGR) reviewed or approved this program as an appropriate licensing requirement.

Even though an independent design verification is not a licensing requirement, we recognize that recent experience of the staff with a relatively small number of units now under construction has caused the staff to be concerned that the design processes used in constructing plants have fully complied with NRC regulations and licensing commitments. Responding to satisfying this legitimate concern does not require uniform imposition of additional design verification processes.

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The Commission stated that a case-by-case analysis is appropriate and stated that, depending on the degree of the NRC's overall confidence in an applicant's quality assurance program and regional evaluations, some applicants might be requested to perform special design reviews.⁽¹⁾ Based on the combined nuclear experience of the applicant, architect-engineer, and contractors associated with Millstone Unit No. 3, a third party review is not the only nor necessarily the best way to achieve design assurance.

The programs which have been implemented at Millstone Unit No. 3 provide necessary assurance that the unit was designed and constructed in accordance with applicable requirements. Attachment I contains a description of the various programs which, in combination, confirm the validity of our conclusion that Millstone Unit No. 3 is being designed and constructed in accordance with regulatory requirements. Although individual program elements that are described may be similar to those at other plants, the combination of all these program elements at Millstone Unit No. 3 provides a unique level of assurance that the plant has been properly designed and constructed.

In summary, we are confident of the adequacy of the design and construction programs at Millstone Unit No. 3. Our strong quality assurance and other verification programs and the NRC's own evaluations (e.g. Inspection No. 50-423/84-04 dated June 11, 1984) provide assurance that Millstone Unit No. 3 has been designed and constructed in accordance with applicable requirements and can be safely operated without additional independent reviews. We do not intend to conduct a separate IDVP for Millstone Unit No. 3 nor is there any justification for the Staff to conduct an IDI.

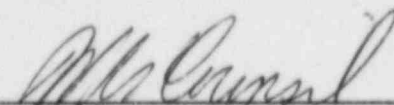
Notwithstanding the lack of a statutory or regulatory requirement, we have provided our explanation of why we have no plans to conduct an IDVP and why there is no need for either an IDVP or an IDI to be conducted at Millstone Unit No. 3. Further, we believe there is no justification to potentially jeopardize the construction schedule or increase the project cost as would result from providing necessary staff support and funding, either directly or indirectly, for further design or design process verification efforts.

Accordingly, we would appreciate a prompt response to this submittal so that this issue can be resolved by November 30, 1984.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et. al.

By NORTHEAST NUCLEAR ENERGY COMPANY
Their Agent

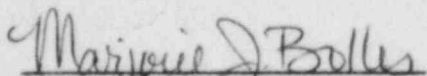


W. G. Council
Senior Vice President

⁽¹⁾N. J. Palladino to N. S. Reynolds, dated February 8, 1983.

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me W. G. Council, who being duly sworn, did state that he is a Senior Vice President of Northeast Nuclear Energy Company, an Applicant herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.


Notary Public

My Commission Expires March 31, 1988

Attachment I

Millstone Nuclear Power Station, Unit No. 3 Design Verification Activities

NNECO has always been strongly committed to the concept of integrated quality assurance, that quality must be designed in rather than added later. We have implemented programs covering various aspects of the design and construction of safety-related components which complement the quality assurance program in providing verification of the design and construction of Millstone Unit No. 3:

Experience of the Utility and Its Major Subcontractors

Over the past 15 years, Northeast Utilities (NU) system companies, responsible for the design, construction and operation of four commercial nuclear power plants, have demonstrated competence and experience which has resulted in those units being among the nation's most successful and reliable nuclear power plants. We have to date accumulated over 36 plant-years of commercial nuclear plant operating experience. In addition, performance reviews and audits by the NRC continue to demonstrate that NU ranks very highly in terms of the safety and performance of its nuclear plants and personnel.

Stone & Webster Engineering Corporation (SWEC) in Boston, Massachusetts provides engineering, design and construction management services for Millstone Unit No. 3.

SWEC designed and constructed the following commercial operating nuclear power stations:

1. Yankee Nuclear Power Station (Yankee Rowe)
2. Connecticut Yankee Nuclear Station - Unit 1
3. Nine Mile Point Nuclear Station - Unit 1
4. Maine Yankee Atomic Power Station
5. Surry Power Station - Units 1 and 2
6. Beaver Valley Power Station - Unit 1
7. James A. FitzPatrick Nuclear Power Station
8. North Anna Power Station - Unit 1 and 2

In addition to Millstone Unit No. 3, SWEC is currently responsible for the design and construction of the following nuclear power stations:

1. Shoreham Nuclear Power Station - Unit 1
2. Beaver Valley Power Station - Unit 2

3. Nine Mile Point Nuclear Station - Unit 2
4. River Bend Nuclear Power Station - Unit 1

Since the inception of Millstone Unit No. 3, we have been directly and intimately involved in the review and approval of engineering, design, procurement, construction, and quality assurance processes. For the past several years, teams of experienced NU personnel with diversified backgrounds have been resident in SWEC's Boston office and at the site. One of the major functions of these teams was to perform an in-depth review of SWEC plant designs. Additionally, these teams facilitated the flow of information between the engineer/constructor and utility staff groups. Personnel assigned to the site ensured that the design is properly reflected in the as-constructed configuration and reviewed in-process site-initiated design changes for conformance with design and regulatory requirements.

Quality Assurance Program

NU is responsible for the quality control and assurance programs pertaining to the design, procurement and construction phases of Millstone Unit No. 3. NU delegated the authority to SWEC to implement these programs, but NU closely monitors the effectiveness of the SWEC quality program by performing extensive review and verification functions. In addition to NU review and approval of the SWEC Quality Program Manual and various implementing procedures (e.g., Quality Standards and Quality Assurance Directives), NU performs on-going verification functions of design, procurement and construction activities. These verification functions are performed at SWEC offices both in Boston and at the site construction offices and at vendor manufacturing facilities. A major part of these verifications is a detailed review of the design process, both of original design controls and field design changes. These verifications by NU have not noted any generic concerns with the design control process at Millstone Unit No. 3.

The NRC staff, in the Safety Evaluation Report (SER) for Millstone Unit 3 (NUREG-1031), stated that "...the staff concludes that Northeast Utilities description of QA program for operations is in conformance with applicable NRC regulations, meets the requirements of Appendix B to 10 CFR 50 and is acceptable." But NU's commitment to quality assurance is not merely to have an adequate system that meets all of the requirements. Management has committed to ensuring that quality and safety are engineered into our plants and not added on later."¹

As Mr. E. G. Greenman, Branch Chief, Division of Projects and Resident Program, observed at the ACRS Subcommittee hearing; "In trying to determine whether or not there is any statistical information that is of interest in enforcement history, my own involvement...leads me at least to think that from the standpoint of Northeast Utilities, the staff that they have

¹ W. G. Council, Advisory Committee on Reactor Safeguards Subcommittee meeting on Millstone Unit 3, Tr., August 28, 1984 at page 26.

on-site, the corporate activity involvement in their particular management indicates that we don't see repetitiveness in problems that are identified by the NRC. If a problem develops--and problems do, did and will continue to develop--this particular Licensee takes rather aggressive action to resolve those problems so they don't repeat and they don't recur."

SWEC Engineering Assurance (EA) Program

Semiannual technical audits have been conducted by SWEC on the design and construction activities for the past two years to verify that the design of systems nearing completion are consistent with licensing commitments. This is accomplished by reviewing the design control process, including design documentation, the interface between design activities and disciplines, and implementation of the design and purchase specifications and field installation.

The technical audits are performed by audit teams selected from personnel not involved with the project and include all design disciplines to assure that an independent and complete review is conducted. Key points of these audits include:

- o Duration of audit review - Normally two weeks to one month of calendar time depending on scope.
- o Approximately 2,500 manhours of effort have been expended to date, utilizing 8 full-time personnel.
- o The audits were led by the Engineering Assurance Division and performed by senior engineering personnel including personnel from the Control Systems, Engineering Mechanics, Materials Engineering, Power, Structural, Electrical, and Engineering Assurance Divisions, and the Quality Assurance Department. All of the audit team personnel were independent of any direct responsibility for performance of the activities being audited.
- o The majority of engineers selected for audits are Professional Engineers (PE) licensed in the discipline being audited.
- o Both vertical and horizontal reviews are performed during the audit. Vertical reviews are performed on selected systems to evaluate the inter-discipline activities required to develop and implement the design. Normally, horizontal reviews are implemented if questions arise during vertical review. The horizontal review evaluates these specific questions and other control systems for design processes to ensure generic problems do not exist.

This combination of vertical and horizontal reviews by individuals knowledgeable of and experienced in nuclear plant construction yet independent of the Millstone Unit 3 project provides a comprehensive review of the design and design implementation process. The conclusion of these audits provides confidence in the adequacy of the design control process similar to that which would be obtained from an IDI or an IDVP.

The NRC's Regional Inspection Programs

Since 1981, a full-time NRC resident inspector has been assigned to the Millstone Unit No. 3 site. In addition, the NRC Region I office has conducted special inspections as well as project-oriented inspections to provide supplemental evaluations; the most notable was the special safety inspection (Construction Team Inspection (CTI)) conducted in 1984.

The CTI was conducted by the NRC Region I office during March 1984.² The purpose of this inspection was to determine the effectiveness of the applicant's management in directing the construction of Millstone Unit No. 3 in accordance with the NRC requirements and the applicant's licensing commitments. This was accomplished by the NRC through performance of in-depth examinations in the areas of management controls, design controls, quality assurance, and construction. Although a variety of strengths and weaknesses were identified, there were no findings from this comprehensive inspection that would indicate the existence of any programmatic design implementation problems. In fact, in Section 4.4 of the report, it was stated that:

The Quality Assurance program at Millstone Unit 3 is effective and strong. This can be mostly credited to NU constant involvement with the architect/engineer and the emphasis they place on quality assurance. Through discussions with all levels of individuals in both organizations and review of both QA organizations, it was determined that NU and S&W each have a strong QA organization that works well with the other and with project management.

Instrumentation and Control Design Verification

NNECO performs all component and pre-operational testing for Millstone Unit No. 3. Consequently, during development of the testing procedures for instrumentation and control equipment (sensors, processing equipment, panels, display units, etc.), an independent review of the overall design was conducted by this group in order to ensure that the test procedures were properly written, and a mechanism for resolving any concerns was developed to provide formal feedback into the SWEC control change system. No generic design problems were identified in this program.

Systems Walk-down as Part of System Turnover Activities

A walk-down is performed on every system prior to turnover from construction forces to operational control for testing. The walk-down team is comprised of SWEC and NU personnel who have extensive knowledge of the system. Design documents are utilized by the teams to independently verify that the design is reflected in the as-built configuration. No generic design control problems have been identified to date for the 143 out of 239 systems now turned over.

² T. T. Martin to W. G. Council, Inspection No. 50-423/84-04, dated June 11, 1984.

Hazards Analysis Review

A comprehensive hazards analysis review has been underway for two years. It consists of a detailed evaluation of each safety-related area in the plant. A multi-discipline team performs this independent review of the as-built installation on a schedule which precedes system turnover. This review ensures that those systems required to safely shut down the plant and to mitigate the effects of postulated operational events and accidents remain functional. Areas covered in this review are:

- Seismic Interaction
- Postulated pipe rupture scenarios for high and moderate energy pressure systems, including jet impingement, pipe whip and environmental effects
- Safety/non-safety system interactions

No generic design control problems have been identified to date.

Seismic Interaction Review

An independent review of our seismic design is being conducted by Earthquake Engineering Inc. (EQE) to provide an independent assessment of our program and to determine if there are any unanticipated seismic interactions. EQE has also been retained to provide insight from their extensive experience with earthquake interaction evaluation during system installation walkdowns at the job site.

The scope of this review includes:

- Site meetings
- As-built installation reviews
- Review of the complete SWEC seismic interaction program

On-going reviews by EQE of our seismic designs and site involvement in the seismic interaction program will continue until plant completion.

Westinghouse Nuclear Engineering Systems (WNES) Review of Millstone Unit No. 3 Piping Analysis and Support Design Program

WNES has performed an independent engineering evaluation of the piping analysis and support design program. This review was performed by Westinghouse engineers qualified in the piping support discipline. The primary purpose of this independent engineering review was to validate assumptions used in the design phase of the piping and support program. Results of this independent review, as stated by WNES, was that, "the overall program is based on conservative criteria which are essential to keep procedures simple and provide design margin to account for later design and construction deviations."

Management Analysis Company (MAC) Independent Assessment

An independent appraisal of the overall project effort was initiated in 1984 to evaluate the readiness of the project organization to complete the final stages of construction. The independent assessment by MAC covered the following aspects of the project's scope:

- o Engineering
- o Construction
- o Schedule controls
- o Start-up testing
- o Quality programs

As a result of this review, it was the consensus of the independent review team that no significant deficiencies were identified in the current project's plans and efforts to complete Millstone Unit No. 3.

Institute of Nuclear Power Operations (INPO) Evaluation

INPO evaluations are aimed at identifying management control system weaknesses or weaknesses which could permit design or construction problems to occur. The INPO evaluations to date of Millstone Unit No. 3 have included an independent multi-discipline review of all aspects of the design and quality engineering process in selected areas from formation of the design principles through development, implementation, and outside verification. Interface controls between disciplines were a key area of review by INPO.

The August 1983, INPO evaluation included a review of design controls and the construction process controls being utilized and the identification of any areas requiring improvement. A portion of this evaluation consisted of a detailed vertical audit of the design and construction process, with several horizontal audits at selected points.

INPO concluded that the system for the control of quality in the design and construction of the plant was being implemented effectively. Although specific items were identified in this review as important for improvement, no significant or systematic problems were cited.

Probabilistic Risk Assessment

As requested by the NRC in a letter dated September 21, 1981, a design-specific risk study was performed for Millstone Unit No. 3. The primary objectives of the Probabilistic Safety Study (PSS) performed for Millstone Unit No. 3 were:

- o To characterize the public risk associated with the operation of Millstone Unit No. 3 resulting from both internal and external events, and to compare internal risks to those predicted in the Reactor Safety Study (RSS) as being representative of Pressurized Water Reactors;

- o To develop a set of technical tools to support management decision-making in a continuing program designed to assure the effectiveness of operations, maintenance and future plant betterment projects aimed at improving safety.

The PSS provides a comprehensive, quantitative assessment of relative public risk from the operation of this plant and documents that the operation of Millstone Unit No. 3 compares favorably with the RSS reference plant.

To assure the production of a high-quality study to satisfy these objectives, a three-level review process was established. The Level I Review was the normal engineering Quality Assurance conducted by the organization responsible for that portion of the data or analysis. The Level II Review was performed by a team fully independent from the personnel performing the analysis and the Level I Review, and it was responsible for verification of the analysis and the adequacy of the analytical approach taken by the personnel performing the analysis and the Level I Review. The Level III review was conducted by an independent Review Board, consisting of Dr. N. Rasmussen (MIT Nuclear Engineering Department), Mr. S. Levine (NUS Corporation) and Dr. P. Wood (formerly Wood-Leaver Associates), who are recognized experts in the field of probabilistic risk assessment, with two principle responsibilities:

- o To assess the process employed to perform the PSS to assure that the methodology being employed was consistent with the study objectives and with the state-of-the-art;
- o To assess the quality of the product of the PSS both by evaluating the consistency between the study as implemented and the defined methodology, and by reviewing the study results in light of the experience of the reviewers.

The Review Board concluded in their report as follows: "On balance the MP3 PSS represents the product of a carefully planned program which was implemented in a competent and timely manner. ...(the study) planning and implementation was carried out with continuous attention to the dual objectives implicit in satisfying both the NRC and in-house needs."

The PSS also provided an engineering tool that has already proven to be valuable in helping us better understand the integrated performance of the plant systems and to identify ways where reliability and safety can be improved in a cost-effective manner. The design changes and insights resulting from the PSS include the following:

- o Identification of Emergency Generator Load Sequencer (EGLS) input logic improvements,
- o Identification of EGLS AC power supply improvements,
- o Recommendation of administrative controls to reduce the probability of a boron dilution event,
- o Insights into dry cavity effects, and

- o Insights into impact of deliberate hydrogen igniters.

Examples of beneficial operator actions identified by the PSS include the following:

- o Decreasing quench spray to conserve refueling water storage tank water for small LOCA with failure of recirculation,
- o Use of loop isolation valves in the long term for the reactor coolant pump seal LOCA and SGTR induced core melt,
- o Alternative means of charging and safety injection pump cooling in the event of total loss of service water, and
- o Monitoring the containment sump water level for incore instrument tube rupture/small LOCA.

Conclusion

Millstone Unit No. 3 has been demonstrated to be an uncommonly well-designed, engineered and constructed plant, which was accomplished by competent and experienced personnel supported by a strong management commitment to safety, quality and competence.

This report has described, albeit in very summary fashion, the program elements and actions taken during project design and construction that provide, in combination, assurance that additional measures, such as an IDVP or an IDI, are not necessary for providing confidence to the NRC Staff in the appropriateness of plant design and design processes.

A number of the activities described are similar in approach, scope and technique, and provide similar insight, to that of an IDVP. We have not described industry-wide activities, such as the American Society of Mechanical Engineers' Section III Code audits or those conducted by organizations such as Hartford Steam Boiler and Inspection Company or American Nuclear Insurers, and other engineering design confirmation programs that have been undertaken from time to time because they are not directly pertinent to the issues of apparent concern to NRC staff, although these audits and verification programs provide further confirmation of the quality of the general design and construction process.

A recent Integrated Design Inspection (IDI) of the River Bend project reflects the adequacy of the design control process that SWEC utilizes at all its plants. Although there were concerns identified by the IDI, the overall program was found to be adequate and no significant or generic problems were identified. The concerns identified by the River Bend IDI are being reviewed by the Millstone Unit No. 3 project to determine whether they are relevant to Millstone Unit No. 3.

It should also be noted that the NRC's own evaluations, through the Systematic Appraisal of Licensee Performance program, have consistently rated Millstone Unit No. 3 above average in the great majority of evaluation

categories.³ In addition, the Advisory Committee on Reactor Safeguards, summarizing in its evaluation of Millstone Unit No. 3, stated in part: "We conclude that the Applicant is well qualified to operate Millstone Unit 3."⁴

³ For example, Mr. E. G. Greenman, Branch Chief, Division of Projects and Resident Programs, testified before the Advisory Committee on Reactor Safeguards Subcommittee meeting on Millstone Unit 3; "The bottom line: I consider this utility to be by and large a category one performer." Tr., August 28, 1984 at page 15.

⁴ J. C. Ebersole to N. J. Palladino, dated September 10, 1984.