Docket No.: 50-423

AUG 23 1984

Mr. William G. Counsil
Senior Vice President
Nuclear Engineering and Operations
Northeast Nuclear Energy Company
P. O. Box 270
Hartford, Connecticut 06101

Dear Mr. Counsil:

Subject: Request for Additional Information - Millstone 3 Component Support Design

In Section 3.9.3.3 of the Millstone 3 SER the staff identified an open issue regarding the design of ASME Code Class 1, 2 and 3 component supports. The staff review of this issue covered many areas in the design and construction process of component supports and resulted in several potential concerns, unresolved questions, and open issues. The enclosed evaluation describes in detail our review of the component support design issue and clarifies our position on those issues where staff concerns exist and further justification is required.

It should be noted that the two major issues the staff has identified in this area are: 1) the lack of an appropriate and consistent code or standard for support construction, with particular emphasis on welded connections as the area of support construction criteria most lacking, and 2) the absence of LOCA dynamic loads in the component supports design. The staff will contact you promptly to arrange to discuss this information.

/s/

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

Enclosure:
As stated

cc: See next page

CONCURRENCES:

DL:LB#1	DL:LB#1
ELDoolittle:es	BJYoungblood
8/23/84	8/ /84

DIST:

Docket File	ACRS (16)
NRC PDR	EJordan
Local PDR	NGrace
PRC System	
NSIC	
LB#1 Rdg	
MRushbrook	
ELDoolittle	
OELD, Attorney	

MILLSTONE

Mr. W. G. Counsil
Senior Vice President
Nuclear Engineering and Operations
Northeast Nuclear Energy Company
Post Office Box 270
Hartford, Connecticut 06141-0270

cc: Gerald Garfield, Esq.
Day, Berry & Howard
City Place
Hartford, Connecticut 06103-3499

Mr. Maurice R. Scully, Executive
Director
Connecticut Municipal Electric
Energency Cooperative
268 Thomas Road
Groton, Connecticut 06340

Robert W. Bishop, Esq.
Corporate Secretary
Northeast Utilities
Post Office Box 270
Hartford, Connecticut 06141

Mr. T. Rebelowski
Senior Resident Inspector Office
U. S. Nuclear Regulatory Commission
Millstone III
P. O. Box 615
Waterford, Connecticut 06385

Mr. Michael L. Jones, Manager
Project Management Department
Massachusetts Municipal Wholesale
Electric Company
Post Office Box 426
Ludlow, Massachusetts 01056

Mr. Thomas Murley
U. S. Nuclear Regulatory Commission,
Region I
631 Park Avenue
King of Prussia, Pennsylvania 19406

Mr. Brian Norris
Public Affairs Office
U. S. Nuclear Regulatory Commission,
Region I
King of Prussia, Pennsylvania 19406

Staff Evaluation of Millstone-3 Component Support Design

The staff review of the supports for ASME Code Class 1, 2, and 3 components is performed in accordance with the guidelines of SRP Section 3.9.3. The staff acceptance criteria are based on meeting the relevant requirements of 10 CFR Part 50 General Design Criteria 1, 2, 4, 14, and 15.

I. Background

The staff review of the Millstone-3 FSAR Sections 3.9B.3.4 ad 3.9N.3.4 found that insufficient information was provided for an adequate review of the design of ASME Code Class 1, 2, and 3 component supports. In a letter from B. J. Youngblood to W. G. Counsil dated December 5, 1983, the staff requested additional information from the applicant regarding its component support design in Question No. Q210.36. During the week of January 16, 1984 the staff met with the applicant at the Stone & Webster offices in Boston, MA to discuss the open items in the draft SER which included Question Q210.36. This item remained unresolved from the meeting. Subsequently, several discussions between the staff and applicant ensued in which Q210.36 was discussed further. As a result, the applicant provided supplemental responses to Q210.36 in letters from W. G. Counsil to B. J. Youngblood dated May 22, 1984 and June 19, 1984.

II. Staff Evaluation of Applicant's Response to Q210.36

In Q210.36 the staff requested the applicant address for the various types of component support designs the following areas:

(a) the NF vs. AISC jurisdictional boundaries for component supports,

(b) the complete basis for the design and construction of component supports including the applicable codes and standards,

(c) the loads, load combinations, and stress limits used,

(d) the deformation limits used, and

(e) the buckling criteria used for component supports.

The applicant's response was divided into (1) balance of plant (BOP) scope for component (excluding piping) supports, (2) BOP piping supports, and (3) the NSSS scope for component supports. The NSSS does not have pipe supports in their scope of responsibility.

(1) BOP Component Supports (excluding piping)

(a) The BOP supplied component supports include "plate and shell," linear type, and component standard supports and includes main loop components normally within the purview of the NSSS. The BOP component supports are within the NF jurisdiction up to and including the welds, bolts, or threaded rods which connect to the building structure or support baseplates. The staff finds the jurisdictional boundaries for BOP component supports to be in conformance with standard industry practice and acceptable.

(b) Component supports are designed, fabricated, inspected, and installed in accordance with ASME Section III Subsection NF. Exceptions to ASME NF are the leveling devices on the reactor vessel support system, the hydraulic snubbers on the steam generator, and the hydraulic snubbers on the reactor coolant pump. The applicant has stated that these exceptions are in accordance with ASME III/NF to the greatest extent possible. The staff finds the codes and standards used for the design and construction of the BOP component supports to be acceptable except as stated below. Additionally, the staff requires clarification of the exceptions to ASME III/NF for certain of the supports.

(c) The loads and load combinations for BOP component supports are specified in FSAR Table 3.9B.10 for Class 1 supports and

Table 3.9B.11 for Class 2 supports. The staff review finds that the load combinations do not contain LOCA loads and, thus, do not meet GDC 4. The applicant has stated that a request for exemption is in progress however the staff has stated the that exemption does not apply to the design of heavy (RCL) component support. Margin for these supports is required to be unchanged even if an exception to GDC 4 is granted. The applicant has clarified that the RCL heavy component supports are designed for LOCA loads and the request for exemption to GDC 4 only applies to the balance of plant piping and supports.

The staff review of the loads and load combinations also finds that constraint of free end displacement loads (thermal expansion of the supported component and seismic anchor displacement loads) are not included in the faulted condition. Although previously permitted by earlier versions of ASME Subsection NF (NF-3231.1(c)) on the basis that a fatigue failure will not occur from a few cycles of a self-limiting load (now currently not permitted by Subsection NF), the staff requires assurance that the constraint of free end displacements applicable to BOP component supports is relatively small to preclude gross plastic deformation of the support.

(d) The applicant's response stated all component supports are designed elastic and no deformation limits are used. The staff review of the stress limits used for equipment supports finds that faulted allowables per ASME Section III Appendix F are used. These limits exceed the yield stress and may result in significant deformations. Because component supports are deformation-sensitive load-bearing elements, satisfying the service limits of ASME Section III Appendix F, particularly when pertinent loads are not considered, does not necessarily ensure their required function to maintain operability of the supported component. Thus, the staff requires further assurance that the deformation of BOP component supports has been determined and that it will not adversely affect the operability of both active and passive components.

(e) The buckling criteria was reviewed by the staff. For the reactor vessel support system, shell buckling was considered. For linear

type supports, the buckling criteria is in accordance with ASME Section III Appendix XVII-2220 with no increase in allowable for the faulted condition. The staff finds the buckling criteria to be acceptable.

(2) BOP Piping Supports

(a) The pipe supports at Millstone-3 are linear type and component standard type supports. Plate and shell type are not used for pipe supports. All nonintegral linear type supports (except dual function restraints) and component standard supports non-integral to the pressure retaining member are within the AISC jurisdictional boundaries. Integrally welded attachments to the pressure-retaining boundaries are within the same jurisdictional boundary of the pressure-retaining member. Because the effective ASME Code for piping and supports for Millstone-3 is the 1971 Edition up to and including the Summer 1973 Addenda which was prior to ASME Subsection NF, the applicable standard for pipe supports is ANSI B31.1. The ANSI standard references the standards prescribed in AISC or the equivalent for supplementary steel design. Thus, the jurisdictonal boundaries specified by the applicant appears appropriate for linear type supports. However, we believe that component standard supports should be within the jurisdictional boundaries of ANSI B31.1 not AISC.

(b) The applicant has stated that all pipe supports (except for dual function restraints) are designed, fabricated, installed, and inspected in accordance with the AISC Code and with Tables Q210.36-1 and Q210.36-2. The staff accepts the use of ANSI B31.1 (supplemented by AISC) as an appropriate standard for pipe supports for plants of this vintage of design with certain adjustments to AISC allowing for the differences between building steel and pipe support design philosophy. However, the staff review of Tables Q210.36-1 and Q210.36-2 finds that the allowable stress limits used for Millstone-3 do not meet either ANSI B31.1 or AISC allowable stress limits. Instead, a higher (less conservative) stress limit is used based on ASME Subsection NF and consequently the supports do not appear to meet the

construction requirements of any accepted standard for construction. These higher design limits of ASME Subsection NF are permitted by Subsection NF of the ASME Code based on mandatory Code requirements in the areas of material procurement, fabrication, installation, examination, and inspection which the applicant does not meet. The applicant has provided in Appendix I of its response to Q210.36, a comparison of ASME III/NF requirements to the Millstone-3 design criteria. The detailed staff evaluation of the ASME III/NF and Millstone-3 criteria is provided in Part III of this document. The staff review finds that the Millstone-3 design criteria do not provide an equivalent level of assurance as that provided by the ASME Code. Thus, the staff finds the allowable tensile stress limit of 1.2 Sy for the faulted condition to be unacceptable. In fact plants which are earlier than Millstone used 0.9 Sy or 0.95 Sy limits for supports.

The staff review of the load combinations for BOP pipe supports also finds the absence of LOCA loads. The staff considers this to be an open issue as previously discussed unless the LOCA loads which are omitted have no bearing on the design of the loop heavy component supports and the exemption from GDC 4 is found acceptable. Furthermore, the staff finds that constraint of free end displacement loads are not included in the load combination for the faulted condition. The staff finds the exclusion of constraint of free end displacement loads to be unacceptable used with ANSI B31.1 (and AISC) design criteria.

The applicant has provided a sampling study which demonstrated that when a lower stress allowable of 0.95 Sy was used and the faulted load combination included constraint of free and displacement loads, the maximum member stress met the lower stress allowable. The staff requests that the applicant provide a more detailed description of the distribution of stress values in order to reasonably ensure the yield stress is not exceeded.

(d) The applicant has stated that all pipe supports are designed elastic and no deformation limits are used. The staff review of the stress

limits used for BOP pipe supports finds that faulted allowables per ASME Section III Appendix F are used (1.2 Sy or 0.7 Su). Because component supports are deformation-sensitive load-bearing elements, satisfying the service limits of ASME Section III Appendix F does not necessarily ensure their required function to maintain operability of the supported component. Thus, the staff requires further assurance that the deformation of BOP pipe supports will not adversely affect the operability of both passive and active components in the system nor the functional capability of the supported piping.

(e) The buckling criteria for pipe supports is in accordance with AISC Code 7th Edition and no increase is allowed for upset or faulted conditions. The staff finds the buckling criteria to be acceptable.

(3) NSSS Supplied Component Supports (other than main loop components)

(a) The supports for the NSSS auxiliary tanks and heat exchangers are generally plate and shell type of supports. The supports for NSSS auxiliary pumps are linear type supports. The NSSS equipment supports are within the jurisdictional boundaries of ASME III/NF.

(b) The supports for the auxiliary tanks and heat exchangers meet the requirements of Subsection NF except for the volume control tank supports which because of thier procurement date are designed to the AISC Code. The supports for the charging and safety injection pumps meet requirements of ASME III/NF. Other Class 2 and 3 auxiliary pump supports are designed by the pump manufacturers to the stress limits associated with the pressure boundary and are maintained below yield stress. The staff finds the codes and standards used for these NSSS supplied component supports to be acceptable.

(c) The loads and load combinations for the NSSS supplied component supports are the same as those of the supported component and are provided in FSAR Table 3.9N-4. The staff review of the loads and load combinations finds them to be acceptable.

(d) There are no permanent deformation limits for the supports for tanks and heat exchangers. However, for supports on active pumps, support deformations are limited such that critical clearances specified in the pump specifications are maintained to ensure pump operability. The staff finds the deformation criteria used for NSSS supplied component supports to be acceptable.

(e) Buckling of plate and shell type supports for Class 2 and 3 auxiliary equipment is evaluated using the appropriate provisions of Appendix XVII Subarticle VXII-2200, and Subsection NC subparagraph NC-3133.6. Buckling is limited to two-thirds critical buckling. The staff finds that the buckling criteria for plate and shell type supports for NSSS equipment are acceptable.

III. Comparison of ASME NF with Millstone-3 Criteria

The applicant has provided a comparison of ASME Section III Subsection NF requirements to the Millstone-3 design criteria in Appendix I to its reponse to Question 210.36 (letter dated May 19, 1984). The applicant's comparison addresses similarities and differences in the areas of:

1) materials,
2) design,
3) fabrication and installation,
4) examination, and
5) inspection.

The staff has reviewed the comparison with respect to compensatory requirements which can influence design in order to determine whether the higher ASME III/NF stress limits are appropriate. The staff notes that a direct item-by-item comparison was not provided for all NF requirements and, in addition, the applicant chose in some cases to only list the differences between ASME NF and Millstone-3 design criteria with no explanation or justification of why the differences were acceptable. In the following paragraphs the staff will discuss the major differences perceived in the areas of (1) material,

(2) design, (3) fabrication and installation, and (4) examination, and (5) inspection.

(1) MATERIAL (NF-2000)

The ASME Code in paragraph NF-2130 requires that material used in the construction of component supports be furnished with material certification. Certified Material Test Reports (CMTRs) are required for most Class 1 plate and shell and Class 1 linear supports. A Certificate of Compliance (C of C) or CMTR is required for all other component supports, component standard supports, and secondary members of all types and classes of component supports. Small products treated as permitted by NF-2610 in later editions of Subsection NF are acceptable.

For Millstone-3, CMTRs are required for only integrally welded attachements to pressure-retaining material. A C of C is permitted for the remainder of the supports.

The requirement for CMTRs provides a quantified basis for verifying the actual strength properties of the material whereas a C of C only provides assurance that the material is in conformance with the applicable material specification.

Thus, the staff concludes that material procurement does not meet ASME III/NF but does provide assurance that ASTM standards are met.

(2) DESIGN (NF-3000)

The applicant's comparison in the design area is minimal. The applicant provides only the loads, load combinations, and stress limits used for Millstone-3. The elastic analysis required by ASME III/NF is based on maximum stress theory in accordance with the rules of NF-3230 and Appendix XVII-2000. There is no indication that the Millstone-3 design is comparable to ASME Subsection NF design.

The staff recognizes that the Millstone-3 design of supplementary steel members in pipe supports follows the provisions of the AISC Code and that the ASME

Code excerpted pertinent material from the AISC Code for its Appendix XVII. Thus, the staff accepts the use of AISC provisions for the design of Millstone-3 pipe supports. The staff does not accept the use of higher ASME III/NF allowable stress limits for use with the AISC Code equations unless the mandatory ASME Code requirements or the equivalent in the areas of material, fabrication, installation, examination, and third party inspection are also adopted.

In addition, because the Millstone-3 pipe supports utilize almost exclusively ASTM A500 Grade B tube steel, the staff believes that appropriate design provisions uniquely associated with welded tubular structure design must be considered.

(3) FABRICATION AND INSTALLATION (NF-4000)

The ASME Code in paragraph NF-4122 requires that material for component supports carry identification markings which will remain distinguishable until the component support is fabricated or installed. The Millstone-3 criterion requires identification only by physical segregation.

The ASME Code in paragraph NF-4721 requires bolt holes to be 1/16 inch greater than the bolt diameter for non-fitted bolts less than or equal to 1 inch in diameter. For anchor bolts with a yield strength less than or equal to 80 ksi, the ASME Code allows a 1/8-inch oversize bolt hole. The Millstone-3 criterion permits a 1/8-inch oversize bolt hole for all bolt sizes with no restriction on bolt yield strength. The staff requires justification that high strength bolts in oversize bolt holes contain sufficient ductility to preclude shear failure in a bolt prior to all bolts becoming effective in shear.

The staff review of the welding criteria finds that ANSI B31.1 plus selected provisions from AWS D1.1 are used. ANSI B31.1 utilizes the provisions of ASME Section IX for the qualification of welding procedures and of the performance of welders and welding operators. However, ANSI B31.1 lacks sufficient detail to provide for an adequate design of a welded joint in pipe supports.

The ASME Code provides for the design of welded joints in pipe supports in Section III Appendix XVII and Subsection NF. The Millstone-3 criteria does not adopt the ASME Code for the welded joint design in pipe supports. The AISC Code utilizes the related code, AWS D1.1, for the design of welded joints in building steel. However, the Millstone-3 criteria does not fully adopt the AWS D1.1 Code for its welded joint design in pipe supports but rather is based on a project unique specificaton.

Thus, the staff concludes for the welded joint design in pipe supports that a sufficient basis has not been demonstrated showing an appropriate code or standard is used at Millstone-3. The staff considers this to be an open issue.

(4) EXAMINATION (NF-5000)

The ASME Code in paragraph NF-5211 requires for Class 1 linear type supports that all full penetration butt-welded joints in primary members be radiographed. All other joints in Class 1 primary member are required to be examined by the liquid penetrant or magnetic particle method. For Class 2 supports, all butt-welded joints in primary members are required to be examined by the liquid penetrant or magnetic particle method. All partial penetration or fillet welds in primary members with a groove depth or throat dimension greater than 1 inch and T-welded joints with throat dimensions of 1/2 inch or greater are required to be examined by the liquid penetrant or magnetic particle method. All other primary welds are required to be examined by the visual method. Class 3 supports are required to be visually examined except for primary member welded joints with a groove depth or throat dimension greater than 1 inch which is to be examined by the liquid penetrant or magnetic particle method.

The Millstone-3 criterion requires only a visual examination for all pipe support welds. Furthermore, the qualification of Millstone-3 personnel performing non-destructive examinations are not in accordance with ASME Section III paragraph NF-5521. The staff concludes that examination criteria used at Millstone-3 meets ANSI B31.1 but does not meet ASME III/NF criteria.

(5) INSPECTION (NA-5000)

The ASME Code requires a third party inspection by an Authorized Inspection Agency as provided in NA-5000. Neither ANSI B31.1 nor AISC requires such an inspection. The applicant has not addressed its requirements in the area of code data reports and stamping as provided in NA-8000.

IV. Staff Findings

The staff review of the FSAR must verify that sufficient information has been provided in accordance with SRP Section 3.9.3 in order to conclude in our safety evaluation report that the applicant has met the requirements of 10 CFR Part 50, 50.55a and GDC 1, 2, and 4 with respect to the design and service load combinations and associated stress and deformation limits specified for the supports of ASME Code Class 1, 2, and 3 components. Furthermore, the staff must ensure that component supports important to safety are designed to quality standards commensurate with their importance to safety and that these supports can accommodate the effects of normal operation as well as postulated events such as a loss-of-coolant accident (LOCA). The staff review finds that the Millstone 3 FSAR and the applicant's submittals dated May 22, 1984 and June 19, 1984 do not provide an adequate basis for the staff to make these conclusions at this time. The design of component supports is considered to be an open issue until the applicant demonstrates conclusively to the staff that they have made provisions in their support construction criteria to address all areas of the staff's concern, and thus permit the staff to reach the above conclusions relative to support acceptability.