VERMONT YANKEE NUCLEAR POWER CORPORATION

SEVENTY SEVEN GROVE STREET

RUTLAND, VERMONT 05701

2.C.2.1
FVY 82-37
REPLY TO:
ENGINEERING OFFICE
1671 WORCESTER ROAD
FRAMINGHAM, MASSACHUSETTS 01701
TELEPHONE 617-872-8100

April 1, 1982

United States Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Office of Nuclear Reactor Regulation
Mr. Darrell G. Eisenhut, Director
Division of Licensing

References:
a) License No. DPR-28 (Docket 50-271)
b) Letter, USNRC to VYNPC, dated February 3, 1981
c) Letter, VYNPC to USNRC, FVY 81-91, dated June 10, 1981
d) Letter, VYNPC to USNRC, dated December 30, 1975
e) Letter, VYNPC to USNRC, dated June 2, 1976
f) Letter, USNRC to VYNPC, dated January 28, 1977
g) Letter, VYNPC to USNRC, dated September 11, 1981
h) Draft TER, FRC to VYNPC, received December 14, 1981
i) Telecon, VYNPC to USNRC, dated March 15, 1982

Dear Sir:

Subject: Control of Heavy Loads

As agreed in Reference (i), this letter will address two areas of concern. One being the degree to which Vermont Yankee's lifting devices compare to ANSI 14.6-1978 design and manufacturing criteria. The other clarification of Vermont Yankee's response to Item 3d of Reference (b). This letter will also address compliance with the Interim Action Item (5) of Reference (b) and provide a status report of all actions taken to date to meet the intent of NUREG 0612.

I. Supplement to Reference (g) in regard to Guideline (4) NUREG 0612 - Special Lifting Devices:

The head strongback and the dryer/separator sling assembly have been evaluated to determine compliance with critical design criteria of ANSI N14.6-1978, particularly Section 3.1.3, 3.2.1.1, and 3.2.3. Since a stress analysis has not been furnished by the designer as required by Section 3.1.3, stress analyses were performed for these devices. Section 3.2.1.1 specifies that the device shall be capable of lifting three times the actual load without exceeding the ultimate strength. Most of the material has a well-defined yield point, so Section 3.2.3 does not apply. Although

A033
S
1/1

compliance with the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" by the American Institute of Steel Construction is not mandatory in this case, the devices were also evaluated in terms of this code in order to determine compliance with the most widely used structural code, in addition to ANSI criteria. Loads used were the static loads for the vessel head, drywell head, moisture separator, and steam dryer listed in our first report and were increased by an impact factor of 15%. Dead weights of the devices themselves were neglected in the analyses.

In these analyses, it was assumed that ultimate strength in bending is defined by the development of a plastic hinge at which the entire cross-section reaches the yield point. This ultimate moment is equal to the yield strength of the material multiplied by the plastic section modulus. It was also assumed that shear yield strength is defined by the term Fy $\sqrt{3}$.

The major findings of the evaluation are summarized below:

1. Head Strongback - The strongback was found to exceed the minimum AISC and ANSI factors of safety in all areas as shown in Table 1.

Table 1: Head Strongback - Factors of Safety

Item	AISC F.S.	ANSI Yield F.S.	ANSI Ultimate F.S.
Minimum Requirement	1.00	3.00	5.00
Lifting Arms (Bending)	2.12	3.18	6.15
Lifting Arms (Shear)	4.06	5.25	5.85
Weld Flange to Web	2.81	-	9.37
Anchor Shackles	3.54*	-	21.20
2 1/2" Turnbuckles	2.37*	-	11.90
2-3/4" Turnbuckles	2.41*	-	12.10
Lifting Lugs (Tension)	8.30	13.50	(large)
Hook Pin (Bending)	12.70	21.20	(large)

*Denotes F.S. with respect to Mfr's Safety Working Load.

2. Dryer Separator Sling - The dryer and separator sling was also found to exceed minimum AISC factors of safety in all areas as shown in Table 2.

Table 2: Dryer & Separator Sling - Factors of Safety

Item	AISC F.S.	ANSI Yield F.S.	ANSI Ultimate F.S.
Minimum Requirement	1.00	3.00	5.00
Socket Pin (Bending)	2.71	3.61	5.76
Bell Housing (Bending in 3/8" Plate)	2.33	3.81	5.72
Bell Housing (Bending in 1" Plate over W6x15)	2.39	3.90	5.86
Cross Beam W5x16 (Axial Compression)	10.40	(large)	(large)
Cross Beam W5x16 (Bending)	3.90	6.38	7.19
Lifting Lugs (Bending Extensions)	5.59	9.10	(large)
2 1/2" Turnbuckles	2.99*	-	14.90
1 1/2" Wire Rope	-	-	8.20
Hook Box (Bending in Cross Plates)	6.94	11.36	(large)
Hook Box (Tension)	9.82	16.10	(large)
Hook Pin (Bending)	10.40	17.30	(large)

2a. Wire Rope - It should be noted that the exact wire rope used was not specified on the drawings. G.E. Drawing No. 730E763 calls for 1 1/2" Diameter, 6/19 wire rope, non-lubricated, corrosion resistant steel by J.A. Roebling Corp. or equal. Since then, Roebling has been acquired by Bethlehem Steel and it was not possible to obtain original data from Roebling. However, "Riggers Bible" (R.P. Leach, Master Printers, 1976) lists for following breaking strengths for Roebling 1 1/2" diameter, 6x19 wire rope:

a. Bright, I.W.R.C. 98.9 Tons
b. Bright, Fiber Core 92.0 Tons
c. Galvanized, Fiber Core 82.8 Tons

We were informed by Bethlehem Steel that their catalog contains no 1 1/2" diameter, 6x19 wire rope, but does contain 1 1/2" diameter, 6x25 wire rope, which has the following breaking strength:

a. Bright, Wire Center 98.9 Tons
b. Bright, Fiber Core 92.0 Tons
c. Galvanized, Wire Center 89.0 Tons
d. Galvanized, Fiber Core 82.8 Tons

It appears that only the designation has changed (from 6x19 to 6x25; it should be noted that the old "6x19" designation allowed anywhere from 16 to 25 wires to the strand), so it was conservatively assumed that galvanized wire rope with a fiber core was used on the Vermont Yankee dryer/separator sling in determining wire rope safety factors in Table 2.

2b. Location of Load on Socket Pin - The drawings do not show the exact location of the loads from the dryer or separator as they are applied to the socket pins. The socket pin spans in the bell housing, a clear distance of 7-3/8", and has a 3/8" support plate in the middle. In determining socket pin safety factors in Table 2, it was assumed that the load is applied on the socket pin midway between 3/8" plate and the outer bell housing plate.

Based on factors of safety shown in Tables 1 and 2 for the head strongback and the dryer/separator sling assembly, it is judged that these devices satisfy the intent of ANSI N14.6-1978.

II. Clarification of Item 3d, first paragraph, page 19 of Reference (g):

"Other special and general purpose slings are covered by criteria added to load handling procedures that meet the intent of ANSI B30.9 for sling selection and use as well as inspection and maintenance."

The commonly used document that governs the manner in which wire rope slings are utilized at Vermont Yankee is the Rigger's Handbook, One Hundredth Anniversary Issue, supplied by Broderick and Bascom Rope Company. This document is based on and comparable to ANSI B30.9, therefore Vermont Yankee considers this document one and the same as ANSI B30.9. It is Vermont Yankee's intent to continue utilizing the Rigger's Handbook since it is a handy tool which our plant mechanics can easily keep in their tool storage areas.

In August of 1981, a 32 man-hour training program was completed by most of Vermont Yankee's shop personnel. This program, presented by New England Power Service Company, included hoisting, rigging, and operator training. During the Overhead Crane Portion of the program shock and dynamic loading was discussed in detail.

Vermont Yankee is confident that present sling selection practices are comparable with ANSI B30.9. However, a reference to ANSI B30.9 has already been added to OP 1200 and OP 1201, the disassembly and assembly procedures for the Reactor Vessel.

III. Statement in regard to Interim Action(5):

Upon receipt of the NRC Generic Letter 81-07, special attention was given to procedures, equipment, and personnel for the handling of heavy loads over the core. Deficiencies noted at the time were mainly in the Operator

Qualification area. These deficiencies were corrected prior to May 15, 1981 via a training session. The training session consisted of pertinent sections of ANSI B30.2 and a presentation of the consequences of a load drop per NUREG 0612.

IV. Status of actions that are the results of Vermont Yankee's review of NUREG 0612:

Several procedures are now revised along with the development of two new procedures. All subject procedures are currently in the review cycle and will be implemented by March 31, 1982 or shortly thereafter. Derating on the Refueling Floor Jib Cranes and the Refueling Platform Hoist will also be accomplished within the above timeframe.

Vermont Yankee concludes that the actions described in this letter adequately address the topics agreed upon during Reference (i); however, should you have further questions, please contact us.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Earl W. Jackson

Earl W. Jackson
Manager of Operations

EWJ/dm

VERMONT YANKEE NUCLEAR POWER CORPORATION

SEVENTY SEVEN GROVE STREET

RUTLAND, VERMONT 05701

2.C.2.1
FVY 82-37
REPLY TO:
ENGINEERING OFFICE
1671 WORCESTER ROAD
FRAMINGHAM, MASSACHUSETTS 01701
TELEPHONE 617-872-8100

April 1, 1982

United States Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Office of Nuclear Reactor Regulation
Mr. Darrell G. Eisenhut, Director
Division of Licensing

References:
a) License No. DPR-28 (Docket 50-271)
b) Letter, USNRC to VYNPC, dated February 3, 1981
c) Letter, VYNPC to USNRC, FVY 81-91, dated June 10, 1981
d) Letter, VYNPC to USNRC, dated December 30, 1975
e) Letter, VYNPC to USNRC, dated June 2, 1976
f) Letter, USNRC to VYNPC, dated January 28, 1977
g) Letter, VYNPC to USNRC, dated September 11, 1981
h) Draft TER, FRC to VYNPC, received December 14, 1981
i) Telecon, VYNPC to USNRC, dated March 15, 1982

Dear Sir:

Subject: Control of Heavy Loads

As agreed in Reference (i), this letter will address two areas of concern. One being the degree to which Vermont Yankee's lifting devices compare to ANSI 14.6-1978 design and manufacturing criteria. The other clarification of Vermont Yankee's response to Item 3d of Reference (b). This letter will also address compliance with the Interim Action Item (5) of Reference (b) and provide a status report of all actions taken to date to meet the intent of NUREG 0612.

I. Supplement to Reference (g) in regard to Guideline (4) NUREG 0612 - Special Lifting Devices:

The head strongback and the dryer/separator sling assembly have been evaluated to determine compliance with critical design criteria of ANSI N14.6-1978, particularly Section 3.1.3, 3.2.1.1, and 3.2.3. Since a stress analysis has not been furnished by the designer as required by Section 3.1.3, stress analyses were performed for these devices. Section 3.2.1.1 specifies that the device shall be capable of lifting three times the actual load without exceeding the ultimate strength. Most of the material has a well-defined yield point, so Section 3.2.3 does not apply. Although

compliance with the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildirgs" by the American Institute of Steel Construction is not mandatory in this case, the devices were also evaluated in terms of this code in order to determine compliance with the most widely used structural code, in addition to ANSI criteria. Loads used were the static loads for the vessel head, drywell head, moisture separator, and steam dryer listed in our first report and were increased by an impact factor of 15%. Dead weights of the devices themselves were neglected in the analyses.

In these analyses, it was assumed that ultimate strength in bending is defined by the development of a plastic hinge at which the entire cross-section reaches the yield point. This ultimate moment is equal to the yield strength of the material multiplied by the plastic section modulus. It was also assumed that shear yield strength is defined by the term Fy $\sqrt{3}$.

The major findings of the evaluation are summarized below:

1. Head Strongback - The strongback was found to exceed the minimum AISC and ANSI factors of safety in all areas as shown in Table 1.

Table 1: Head Strongback - Factors of Safety

Item	AISC F.S.	ANSI Yield F.S.	ANSI Ultimate F.S.
Minimum Requirement	1.00	3.00	5.00
Lifting Arms (Bending)	2.12	3.18	6.15
Lifting Arms (Shear)	4.06	5.25	5.85
Weld Flange to Web	2.81	-	9.37
Anchor Shackles	3.54*	-	21.20
2 1/2" Turnbuckles	2.37*	-	11.90
2-3/4" Turnbuckles	2.41*	-	12.10
Lifting Lugs (Tension)	8.30	13.50	(large)
Hook Pin (Bending)	12.70	21.20	(large)

*Denotes F.S. with respect to Mfr's Safety Working Load.

2. Dryer Separator Sling - The dryer and separator sling was also found to exceed minimum AISC factors of safety in all areas as shown in Table 2.

Table 2: Dryer & Separator Sling - Factors of Safety

Item	AISC F.S.	ANSI Yield F.S.	ANSI Ultimate F.S.
Minimum Requirement	1.00	3.00	5.00
Socket Pin (Bending)	2.71	3.61	5.76
Bell Housing (Bending in 3/8" Plate)	2.33	3.81	5.72
Bell Housing (Bending in 1" Plate over W6x15)	2.39	3.90	5.86
Cross Beam W5x16 (Axial Compression)	10.40	(large)	(large)
Cross Beam W5x16 (Bending)	3.90	6.38	7.19
Lifting Lugs (Bending Extensions)	5.59	9.10	(large)
2 1/2" Turnbuckles	2.99*	-	14.90
1 1/2" Wire Rope	-	-	8.20
Hook Box (Bending in Cross Plates)	6.94	11.36	(large)
Hook Box (Tension)	9.82	16.10	(large)
Hook Pin (Bending)	10.40	17.30	(large)

2a. Wire Rope - It should be noted that the exact wire rope used was not specified on the drawings. G.E. Drawing No. 730E763 calls for 1 1/2" Diameter, 6/19 wire rope, non-lubricated, corrosion resistant steel by J.A. Roebling Corp. or equal. Since then, Roebling has been acquired by Bethlehem Steel and it was not possible to obtain original data from Roebling. However, "Riggers Bible" (R.P. Leach, Master Printers, 1976) lists for following breaking strengths for Roebling 1 1/2" diameter, 6x19 wire rope:

a.	Bright, I.W.R.C.	98.9 Tons
b.	Bright, Fiber Core	92.0 Tons
c.	Galvanized, Fiber Core	82.8 Tons

We were informed by Bethlehem Steel that their catalog contains no 1 1/2" diameter, 6x19 wire rope, but does contain 1 1/2" diameter, 6x25 wire rope which has the following breaking strength:

a.	Bright, Wire Center	98.9 Tons
b.	Bright, Fiber Core	92.0 Tons
c.	Galvanized, Wire Center	89.0 Tons
d.	Galvanized, Fiber Core	82.8 Tons

It appears that only the designation has changed (from 6x19 to 6x25; it should be noted that the old "6x19" designation allowed anywhere from 16 to 25 wires to the strand), so it was conservatively assumed that galvanized wire rope with a fiber core was used on the Vermont Yankee dryer/separator sling in determining wire rope safety factors in Table 2.

2b. Location of Load on Socket Pin - The drawings do not show the exact location of the loads from the dryer or separator as they are applied to the socket pins. The socket pin spans in the bell housing, a clear distance of 7-3/8", and has a 3/8" support plate in the middle. In determining socket pin safety factors in Table 2, it was assumed that the load is applied on the socket pin midway between 3/8" plate and the outer bell housing plate.

Based on factors of safety shown in Tables 1 and 2 for the head strongback and the dryer/separator sling assembly, it is judged that these devices satisfy the intent of ANSI N14.6-1978.

II. Clarification of Item 3d, first paragraph, page 19 of Reference (g):

"Other special and general purpose slings are covered by criteria added to load handling procedures that meet the intent of ANSI B30.9 for sling selection and use as well as inspection and maintenance."

The commonly used document that governs the manner in which wire rope slings are utilized at Vermont Yankee is the Rigger's Handbook, One Hundredth Anniversary Issue, supplied by Broderick and Bascom Rope Company. This document is based on and comparable to ANSI B30.9, therefore Vermont Yankee considers this document one and the same as ANSI B30.9. It is Vermont Yankee's intent to continue utilizing the Rigger's Handbook since it is a handy tool which our plant mechanics can easily keep in their tool storage areas.

In August of 1981, a 32 man-hour training program was completed by most of Vermont Yankee's shop personnel. This program, presented by New England Power Service Company, included hoisting, rigging, and operator training. During the Overhead Crane Portion of the program shock and dynamic loading was discussed in detail.

Vermont Yankee is confident that present sling selection practices are comparable with ANSI B30.9. However, a reference to ANSI B30.9 has already been added to OP 1200 and OP 1201, the disassembly and assembly procedures for the Reactor Vessel.

III. Statement in regard to Interim Action(5):

Upon receipt of the NRC Generic Letter 81-07, special attention was given to procedures, equipment, and personnel for the handling of heavy loads over the core. Deficiencies noted at the time were mainly in the Operator

Qualification area. These deficiencies were corrected prior to May 15, 1981 via a training session. The training session consisted of pertinent sections of ANSI B30.2 and a presentation of the consequences of a load drop per NUREG 0612.

IV. Status of actions that are the results of Vermont Yankee's review of NUREG 0612:

Several procedures are now revised along with the development of two new procedures. All subject procedures are currently in the review cycle and will be implemented by March 31, 1982 or shortly thereafter. Derating on the Refueling Floor Jib Cranes and the Refueling Platform Hoist will also be accomplished within the above timeframe.

Vermont Yankee concludes that the actions described in this letter adequately address the topics agreed upon during Reference (i); however, should you have further questions, please contact us.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Earl W. Jackson
Manager of Operations

EWJ/dm