APPENDIX 9B

COMPLIANCE WITH

NRC BRANCH TECHNICAL POSITION ASB 9-1

SUSQUEHANNA STEAM ELECTRIC STATION

UNIT 1 REACTOR BUILDING CRANE

The attached table compares the design of the Unit 1 crane with Branch Technical Position ASB 9-1.

Compliance with each regulatory position in the BTP is classified into one of the following categories:

a) comply

b) complied with based on our interpretation of the intent of regulatory position

c) complied with by use of alternate means or methods

d) do not comply

Justification is provided for each item of noncompliance.

TABLE 9B-1

COMPARISON OF UNIT 1 REACTOR BUILDING CRANE DESIGN WITH BTP ASB 9-1

Regulatory Position	Compliance	Compliance based on our interpretation of regulatory position	Use of alternative method to meet the intent of regulatory position	Non-compliance	Remarks
B.1.a Separate Performance Specification		X			Item #1
b Environmental Operational Conditions Structural Movement Selection	X				
c Seismic Category I	X				
d NDE – Lamellar Tearing		X			Item #2
e Fatigue Analysis		X			Item #3
f Preheat-Postheat-Welding		X			Item #4
B.2.a Controls-Devices-Safe Holding Position	X				
b Auxiliary System, Dual Component Immobile Position	X				
c Means for Repairing		X			Item #5
B.3.a Dual Load Attachment Points	X				
b Lifting Devices- Redundant Design	X				
c Dual Hoisting Equipment 5 fpm limit	X				

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d Head Load Block Balance	X				
e Dual Reeving System Rope Standard	X				
f Fleet Angles					Item #6
g 200-Static Design Test				X	Item #7
h Sensor Over-Speed Over-Loading, etc.	X				
i Control System Motors-Torque		X			Item #8
j Two-blocking-Precautions, etc.		X			Item #9
k Drum Protection	X				
l Excessive Breakdown Torque		X			Item #10
m Hoisting Brakes Holding Brakes		X			Item #11
Dynamic-Static Alignment	X				
o Increment Drives	X				

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p Trolley + Bridge i. Motors ii. Speeds		X		X	Item #12
q Cab Located Controls	X				
r Safety Devices, Limit Devices	X				
s Operating Manuals – MWL	X				Item #13
t Change from Construction to Operating	X				
u Installation Instructions	X				
B.4.a Mechanical Check	X				
b 125% Static Test (2 – block) i. 125% static test ii. 2-block	X X			X	Item #14
c Preventive Maintenance Program	X				Item #15

NOTES:

Item #1

The load lifts during construction are not greater than those for plant operation, therefore no separate specifications have been prepared.

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Item #2

We consider that the Regulatory Positions is complied with to the extent that all major structural load carrying welds are 100% magnetic particle (MT) tested. Volumetric examination, in our opinion (RT or UT) of the welds used in the assembly of the crane will not produce meaningful results because of the joint geometrics, therefore, they are not performed.

Item #3

The crane is specified and has been designated as Service Class C, per CMAA-70. This standard determines allowable stresses for the crane structural and mechanical components as a function of the specified crane service class. Service Class C allows for 100,000 to 500,000 loading cycles, which by far exceeds our conservatively estimated 4,000 cycle life. Therefore, no additional fatigue analyses have been performed.

Item #4

This regulatory position is complied with to the extent that the preheat and postheat treatment of the welds is in accordance with AWS D1.1

Item #5

Provisions are made for manual operation of the main hoist holding brakes for lowering the load (Item #11). No special provisions are made for manually moving the immobilized bridge or trolley. However, there are options for moving the bridge or trolley if the electric power cannot be restored.

Item #6

The fleet angle from drum to lead sheave and between sheaves does not exceed 3-1/2 degrees (3'7" actual design). The NRC position recommends limiting the fleet angles between individual sheaves to 1-1/2 degrees. The use of the 3-1/2 degrees limit is justified because:

1. The 3-1/2 degree limitation has been proven to be a reliable parameter for rope leads off of drums which are more critical than rope leads from sheaves; the latter being more deeply grooved.
2. With redundant reeving, sheave spacings are double the normal spacings. Thus to maintain 1-1/2 degree fleet angle, the distance form the hook to the top of the crane would have to be needlessly and excessively increased to such a degree that it would be inconsistent with a good crane design. This would have necessitated, at least, eight to nine feet increase in the building height.

   The design ratio of running sheaves pitch diameters to the rope diameter is 24:1 instead of the 30:1 or 26:1 recommended by the NRC. The 24:1 ratio is justified because: Due to the large diameter of the wire rope used, 30:1 and 26:1 diameter ratio sheave blanks are not readily available. Also 24:1 ratio is recommended by ASME Standard Committee on the Design of Overhead and Gantry Handling Systems for Critical Loads at Nuclear Power Plants, in their comments to the NRC on RG 1.04 dated March 18, 1976, and is consistent with the recommendations of CMAA Specification #70.

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Item #7

The 200% load test is in conflict with current safety standard codes, specifically ANSI B.30.2 which states that the entire crane is to be load-tested in the field at 125% of the rated load. If this requirement for the load test of 200% of the rated load is to meet the safety requirements and be within the allowable stress values for the crane design, it would require a large crane. Also, the test may not proof the wire rope at 200% load as permanent deformation can result, and the rope will have to be discarded after the test. We do not recommend testing any portion of the crane at 200% load, except each redundant hook, which is specified to be tested at twice the rated load. However, the hoisting system components are all designed to support a static load of 200% of the design rated load.

Item #8

The electric controls are set to limit the motor torque to 150% of rated motor torque, and are field adjustable between 125% to 200% of that torque. Note that the “rated”, not “required” torque is limited. The “required” rating of the motor is not clearly defined and opens the possibility for its misapplication. Ratios of motor horsepower are given in Items 10 and 12.

Item #9

The mechanical and structural components of the hoisting system should be protected against the possibility of two blocking or load hangup occurrence during hoisting. This protection is provided by a system of limit switches such that a second blocking could not occur after a first order failure. First order protection for raising and lowering is provided by a geared limit switch coupled to a shaft on the drive gear case and wired to stop the hoist motion and set a hoist brake by opening a reversing switch control circuit. The second order protection in the raising direction is provided by a power circuit limit switch wired to positively interrupt motor raising and lowering circuits and set brakes. The interruption by the power circuit limit switch will require manual release of the hoist holding brakes to lower the upper block and reset the switch. With this arrangement the operator will be alerted to the fact that the geared type lower upper limit switch has failed. The second order protection in the lowering direction is provided by a second geared limit switch coupled directly to drum shaft and wired so as to open the control circuit of the line contractor.

The first order protection against load hangup is an overload device in the hoisting train that senses the overload and interrupts motor raising circuit and set brakes. The overload device can be set as low as 110% of the rated load. The second order of protection is provided with “over current” and “current rate of rise” set at higher torque (load) level, than the overload device. This is necessary to allow for an additional torque required to accelerate the load and the hoist mechanisms from a standstill position.

Item #10

The hoist motor rating is limited to 105% of the combined calculated running and accelerating horsepower required to accelerate the rated load to the maximum design hoist speed. This regulatory position does not directly address the accelerating portion of the calculated design horsepower; however, the paragraph entitled,” Drivers and Controls” on pages 1.104-3&4 of Regulatory Guide 104, dated February 1976 calls for its consideration. Based on the above interpretation, this regulatory position is considered implemented.

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Item #11 The crane design meets the requirements of this Regulatory Position except that holding brake heat dissipation will be accomplished by alternating the lowering and holding to provide time for cooling the braking mechanism. Also administrative controls (had held tachometer) will be used to limit the lowering speed to less than 3.5 fpm.					
Item #12 The ratios of motor horsepower ratings to the combined calculated running and accelerating horsepowers required to accelerate the load to the maximum design speed are as follows:					
trolley – 101% bridge – 104%					
Refer to Item 9 for a discussion of the inclusion of the accelerating horsepower to the motor horsepowers.					
No special provisions are made for manual operation of the bridge and trolley holding brakes. If necessary, they can be released by using various methods not excluding brake partial disassembly.					
The requirement that “opposite wheels on bridge and trolley have identical diameters”, is not practical, since it has no tolerance allowance. Our specification calls for wheels ground true to .001 inch per inch of diameter. Trolley speed, with a critical load attached is a maximum of 30 fpm as recommended by NRC. However, the trolley speed, with a non-critical load attached is 50 fpm, therefore administrative controls must be maintained to prevent inadvertent running of the trolley with a critical load attached at the higher (50 fpm) speed.					
The bridge speed (50 fpm) exceeds slightly the NRC recommended speed of 40 fpm. The substantial runway length (323 ft.) stepless type bridge speed control, and minor (10 fpm) difference between the NRC recommended and the specified speeds to not justify the reduction of the bridge speed from 50 fpm to 40 fpm.					
Item #13 The unit 1 and 2 crane main hoist rated loads and design loads are the same and equal 125 tons.					

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Item #14 As stated in Item 9, protective means are provided to prevent the occurrence of two-blocking or load hang-ups. Therefore, there is no need to run the recommended tests. In addition, the recommended tests present a potential for injuring personnel and for causing an undetectable damage to the hoist components. These conditions will exist whether the tests are performed in the vendor shop or at the site. Also, it would be difficult, after the tests, to assess any potential damages that might have resulted from those tests. Verification testing of the upper limit switches and the overloads will be performed to assure their proper functioning.					
Item #15 The Unit 1 and 2 cranes will be maintained at their rated capacities, i.e., 125 tons main hoists and 5 tons auxiliary hoists.					