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SUBJECT: Requests exemption from NRC Branch Technical Position ETSB.11.1,Section IV re hydrostatic testing of D-augmented piping in offgas sys.

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APR 18 1991

Director of Nuclear Reactor Regulation
Attention: Dr. W. R. Butler, Project Director
Project Directorate I-2
Division of Reactor Projects
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
REQUEST FOR EXEMPTION FROM NRC BRANCH
TECHNICAL POSITION ETSB.11-1,
SECTION IV, HYDROSTATIC TESTING OF
D-AUGMENTED PIPING IN THE
OFFGAS SYSTEM
PLA-3546 FILES R41-2

Docket Nos. 50-387
and 50-388

Dear Dr. Butler:

During a review of the offgas system piping documentation in 1983, it was discovered that certain piping had not received the hydrostatic testing which was required by Branch Technical Position ETSB 11-1 for D-augmented piping. A nonconformance report (NCR) was written to address this problem. The disposition of the NCR was to 'use as is' since the affected welds have received a liquid penetrant test or a radiographic examination in lieu of a hydrostatic test. In order to accept a radiographic examination or a liquid penetrant test in lieu of a hydrostatic test, an exemption from the hydrostatic testing requirements for those welds must be taken. Therefore, this letter requests an exemption from the hydrostatic testing requirements for those welds. The justification for the exemption follows:

BACKGROUND

The Offgas System piping identified in the Nonconformance Report (NCR) consists of a total of ten (10) field welds, on two sections of 2" GBD-156 (SP-GBD-156-1), each of which is approximately two feet in length. According to the NCR no evidence could be found to show that field welds 1, 4, 5 and 8 thru 14 were ever hydrostatically tested. Hydrotest records found by PP&L subsequent to the issuance of the NCR indicated that the piping in question was hydrotested to 1050 psig (Design Pressure 700 psig) under Release No. 2444D in September of 1980. Subsequent to this test, Valves 171026 and 171027 were changed from ball valves to plug valves. This modification created new field welds 9 thru 14 but did not affect field welds 1, 4, 5 and 8. A review of the latest revision of SP-GBD-156-1 indicates that welds 9 thru 12 received a Liquid Penetrant Test in lieu of a

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hydro test and welds 13 and 14 received a Radiographic Examination in lieu of a hydro test. Therefore, the original hydrotest is still in effect for welds 1, 4, 5 and 8 and these welds were eliminated from the NCR. For welds 9 thru 14, the Branch Technical Position ESTB-11-1 requires a hydrotest to be performed without exception, so that the PTs and RTs performed, while qualified acceptable forms of NDE, are not acceptable for satisfying the requirements of ESTB 11-1. The Branch Technical Position requires that the offgas system be hydrotested to 1.5 times the system design pressure, but in no case shall the pressure be less than 75 psig.

The system design pressure chosen for the offgas system ranges from 300 psig to 700 psig, while the normal operating pressures are either slightly below or above atmospheric pressure, depending on location within the system. The basis for the high design pressures is in the possibility of a hydrogen detonation. ANSI/ANS 55.4-1979, "American National Standard for Gaseous Radioactive Waste Processing Systems for Light Water Reactor Plants" establishes the minimum design, construction and performance requirements for offgas systems for both normal operation and system design basis occurrences. Paragraph 5.3.6 of this standard establishes the design requirement for explosive conditions as follows, "If the potential for an explosive mixture of hydrogen and oxygen exists, the gaseous waste handling and treatment system shall either be designed to withstand the effects of a hydrogen explosion, or be provided with dual gas analyzers with automatic control functions to detect the formation or buildup of explosive mixtures and shall annunciate both locally and in the main control room." Susquehanna has utilized both forms of protection in the design of the offgas system; however, Technical Specification 3.11.2.6 for explosive mixture is based on a system that is detonation proof and therefore does not provide as much margin in the permissible hydrogen concentration as the Technical Specifications used for plants that do not have detonation proof piping. The action limit for the Susquehanna Technical Specification is 4% hydrogen, which is sufficiently low to prevent a detonation; however, the offgas recombiner inlet isolates when the hydrogen concentration reaches 2%, which is consistent with the Technical Specifications for non-detonation proof piping. Therefore, the Susquehanna Offgas System is designed with both isolation on high hydrogen concentration (well below the detonation point) and detonation proof piping rather than only one of these requirements as specified by ANSI/ANS-55.4-1979.

The piping design pressure selected for detonation proof piping is determined by using the guidance provided in Appendix C of ANSI/ANS-55.4-1979. This Appendix established that the detonation pressure would be the result of the peak pressure experienced as a result of the reflection of a detonation shock wave, the attenuation of the reflected wave, and changes in internal pipe geometry or direction. Since the peak pressure from a detonation occurs only a very short time, it has a very short rise time and the pulse duration drops rapidly with time to a residual value that is less than 10 times the initial value. The Appendix then goes on to provide formulas to calculate the peak detonation pressure for various piping configurations and establishes the basis for having different detonation pressures in adjoining unisolated piping segments due to the specific piping configuration. Therefore, it is possible and appropriate to have this range of pressure.

Another important factor discussed in Appendix C is the philosophy used by the designer selecting the detonation event frequency. In determining the design pressure, it is necessary to determine if one is going to select it based on ultimate strength or yield strength; the difference being that ultimate is used if a one time event is considered and yield is used if multiple events are postulated to occur. For Susquehanna, a comparison of the design values to the values determined by the formulas in Appendix C indicates that a one time event was used. Also, while the ultimate strength was used to determine the design pressure, the yield allowables were used in conjunction with the design pressure to establish the appropriate wall thickness to ensure the pipe or component would not rupture. The importance of this discussion on selecting design pressure is that it establishes that a one-time event approach to detonation pressure is appropriate and is the basis for Susquehanna Offgas System. This then leads into a discussion of whether or not it is appropriate to use the detonation pressure as the "design" pressure or as a "maximum" pressure which must be considered in the design of the component, but is done so more as an emergency or faulted condition. Both ANSI B31.1 and ASME Section III make allowances for such conditions to exist in determining the appropriate design pressures and subsequent hydrotest pressure. Under these codes, the hydrotest would be conducted based on those pressures that are expected to occur during the normal operations of the system with consideration to pressure surges that would be expected to occur on a regular basis. Since a detonation is postulated as a one-time event at Susquehanna, it is unreasonable to include this pressure in the design pressure that is subsequently used in determining the hydrotest pressure. For these reasons, it is recommended that the design pressure be changed to reflect the maximum pressure expected during normal operation, and the maximum pressure remain as the detonation pressure. However, certain portions of the offgas system shall continue to be hydrotested to the maximum pressure due to the close proximity of these portions to the hydrogen source in the unlikely event of a detonation. A detailed discussion on which portions could be exempted follows.

SPECIFIC EVALUATION OF SP-GBD-156-1

The portion of piping involved in the NCR is between the inlet HEPA Filters and the Offgas Recombiner Skid. The piping size is 2 inch and each segment is 24 inches long. When the system is in normal operation, only one of the segments is subjected to process flow. This portion of the system is also downstream of the hydrogen analyzers that provide for system isolation.

The portion of piping in question is in a highly unlikely area for detonation to occur since the hydrogen analyzers would isolate offgas flow, and if the analyzers were to fail, the delay pipe would tend to concentrate the hydrogen and cause the detonation to occur prior to reaching SP-GBD-156-1. Also, the welds in question did receive NDE providing reasonable assurance that the welds have sufficient integrity. The level of confidence in the welds would certainly be commensurate to the level of confidence provided by the 75 psig minimum pressure required by the Branch Technical Position, especially if one considers that the weld is sized to withstand 700 psig.

In addition, the following are a listing of practical problems associated with performing the hydrostatic testing or alternative testing:

- The pressure boundary involved in the testing covers about 1000 linear feet of piping. The actual field welds to be examined are on two (2) two (2) feet lengths of pipe.

- A hydrostatic pressure test is undesirable for several reasons. The piping involved is gas piping. The moisture left within the offgas piping on completion of the testing is undesirable because of the charcoal filters within the system. The water (approximately 2400 gallons) would have to be processed as liquid radwaste after being drained from the system.

- An air or nitrogen gas test would be an alternative to hydrotesting. Most of the piping to be pressurized is eight (8) inch (about 700 ft), so a considerable volume is involved. About 325 cubic feet volume is involved, which would require about 23,000 standard cubic feet of gas for pressurization to 1050 psig (design pressure 700 psig). The gas requirements could be considerably more given the leakage at the valve boundaries for the pressure test.

- Any gas test at high pressure is considered a safety concern. Unlike a water pressure boundary that would rapidly depressurize given a system leak, a gas pressure boundary depressurizes much more slowly and the leak is not as visible. If a nitrogen test were used, a considerable leak could cause an oxygen deficient atmosphere in a confined space. After completion of the pressure test, the boundary must be depressurized. For the nitrogen test, the boundary would have to be purged. Depressurizing and purging involve the same safety concerns. Since this test involves a considerable length of pipe and volume of gas, the safety concern is greater than for a smaller pressure boundary.

- An air test would be undesirable if air quality is not maintained. Moisture and dirt could be introduced into the offgas system. This issue would have to be weighed against the increased safety concerns associated with the nitrogen test.

- Numerous pipes and components are not isolable from the field welds on GBD-156 that must be hydrotested. The pressurized piping for the testing is in several areas in the radwaste and turbine buildings. The piping passes through the Unit 1 HEPA filter room, the radwaste building pipe tunnel, the Unit 1 turbine building pipe tunnel and the Unit 1 Recombiner

Room. The Unit 1 areas will be accessible with respect to radiation levels with the Unit 1 offgas recombiner and treatment system out of service. For a gas test, these areas would have to be controlled because of the safety concerns as already discussed. The radwaste building pipe tunnel contains the Unit 2 offgas system piping, therefore would not be accessible due to high radiation levels. If a leak or other problem developed during testing in that area, it would not be accessible without shutting down both Unit 1 and 2 reactors.

Lastly, even if one of the welds in question were to catastrophically fail and the pipe were breached due to a detonation, the consequences would be no worse than those evaluated in FSAR Section 15.7. The radiological consequences, even for the theoretical event, are a very small fraction of 10CFR 100 limits. Therefore, based on the above discussion it is justified to exempt SP-GBD-156-1 from hydrotesting for the welds in question.

We request that the exemption to use other NDE in lieu of hydrostatic testing be approved by December 1, 1991. If you have any questions, please contact Mr. C.T. Coddington at (215) 774-7915.

Very truly yours,

H. W. Keiser

cc: Document Control Desk (original)
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