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IES UTILITIES

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Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
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Subject: Duane Arnold Energy Center
Docket No: 50-331
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Additional Information Regarding Request for Technical Specification Change (RTS-269): Revision to Technical Specification Section 3.7, "Plant Containment Systems"

Reference: NG-95-2985 from J. Franz (IES) to William T. Russell (NRC) dated December 22, 1995; Request for Technical Specification Change (RTS-269): Revision to Technical Specification Section 3.7, "Plant Containment Systems"

File: A-117, T-23

Dear Sirs:

In the referenced letter, IES Utilities Inc. requested a revision to the Technical Specifications (TS) for the Duane Arnold Energy Center (DAEC). This revision incorporates changes to the DAEC TS to allow the implementation of a performance based containment leakage testing program in accordance with 10 CFR Part 50, Appendix J, Option B. This TS revision also relocates a requirement to replace the T-ring inflatable seals for the containment purge isolation valves.

The NRC is currently reviewing this submittal. Conversations with the Staff indicated that supplemental information concerning the relocation of the seal replacement requirement would be useful for this review.

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The seal replacement requirement was added to the DAEC TS in 1984 in response to NRC generic concerns pertaining to venting and purging operations. This requirement is contained in Section 6.2.5 of the DAEC Updated Final Safety Analysis Report (UFSAR). Relocating this requirement from TS while keeping it in the UFSAR will allow the DAEC to reevaluate and modify the replacement frequency, as appropriate, while ensuring that any revisions to the requirement are in accordance with the provisions of 10 CFR 50.59.

Relocation of the seal replacement requirement from the DAEC TS is appropriate because:

- Effective surveillances to demonstrate operability of the function are retained in the TS. In addition to the local leak rate tests required by Appendix J, the DAEC TS contain a surveillance requirement to perform purge system isolation valve leakage integrity testing at least once every three months in order to detect excessive leakage of the resilient seats.

- Performance of the components is good and the expected service life is greater than that provided in the TS.

Supplemental information to support the relocation of this requirement from the DAEC TS is provided in the attachment.

The DAEC plans to implement this TS during Refueling Outage (RFO) 14, currently scheduled to begin on October 11, 1996. Approval is therefore requested as soon as possible.

Should you have any questions concerning this submittal, please contact this office.

Kenneth S Putnam for

Kenneth E. Peveler
Manager, Nuclear Licensing and Emergency Planning

Attachment
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Additional Information Regarding RTS-269

Description

Purging and venting operations at the Duane Arnold Energy Center (DAEC) are performed through redundant 18-inch butterfly-type isolation valves in both supply and exhaust headers of the drywell and suppression pool. These valves are identified at the DAEC as CV-4300, CV-4301, CV-4302, CV-4303, CV-4306, CV-4307 and CV-4308.

The purge and vent valves have inflatable T-ring seals of Dupont Nordel-Ethylene Propylene Elastomer. The seal systems are pressurized from the Control Building HVAC instrument air system and provide leak tight seating for the valve discs. A pressure indicator is installed on each of the valves and can be used to locate seal leakage. In the event of leakage, operators will have sufficient time to detect leakage, identify the source and correct the problem before containment oxygen concentration reaches 5%.

Technical Specifications

A Staff position letter (dated November 28, 1978) requested licensees to cease purging (or venting) of containment or limit purging (or venting) to an absolute minimum. Licensees who elected to purge (or vent) the containment were requested to demonstrate that the containment purge (or vent) system design met the criteria outlined in the Standard Review Plan (SRP) Section 6.2.4, Revision 1, and the associated staff Technical Position (BTP) CSB 6-4, Revision 1.

By letter dated June 10, 1982, the DAEC submitted a request for Technical Specification (TS) changes arising out of the resolution of issues related to staff Technical Position CSB 6-4. That TS revision proposed changes to the DAEC TS which included purge/vent system leakage integrity tests on a frequency of once every three months and purge/vent isolation valve seal replacement at intervals not to exceed four years. That TS revision was approved by the NRC as Amendment No. 100.

Basis For 4 Year Replacement Interval

The four year replacement interval is based on very conservative assumptions. The environmental conditions (worst case) for these seals are conservatively assumed to be the same as drywell service conditions: 150°F continuous normal ambient temperature and 6.7×10^6 rads radiation (4-year normal plus 30-day accident dose in the drywell). Actual radiation doses are lower because these valves are located outside the drywell. Additionally, Dupont data shows that the seal material has a maximum continuous service temperature of 293°F.

ASCO qualification test reports documented testing of solenoid valves with Ethylene Propylene Elastomer seals. The ASCO data confirmed that the seals are qualified for at

least 4.5 years when exposed continuously to a maximum normal temperature of 150°F followed by 30 days of Loss of Coolant Accident (LOCA) conditions (maximum temperature and external pressure of 448°F and 110 psig, respectively). The total integrated radiation dose for these tests was 2×10^8 rads.

Design Evaluation

In 1982, when the TS was proposed to replace the T-seal every 4 years, the estimated service life was based on a comparison with similar solenoid valve seals, as discussed above. In 1990, an evaluation was done by a consultant to determine the service life specifically for the seals in the vent and purge valves. This assessment was performed on the seals removed from two valves (CV-4306 and CV-4308). The evaluation was performed on the o-rings in the valves and included the evaluation of the following parameters:

1) original seal thickness,
2) recovered seal thickness,
3) compressed thickness,
4) squeeze,
5) compression set,
6) recovery,
7) gland surface roughness, and
8) seal hardness.

Using the information from these parameters, the compression set was extrapolated to the compression set limit and the estimated service life to achieve this limit was determined. The limiting projected service life was determined to be 9 years.

The service life of the T-seal was not directly determined as the T-seal is mechanically energized using plant instrument air and the parameters of squeeze, recovery, and compression set are therefore meaningless. Hardness testing and optical comparisons were performed on the seals. After 3 years, the T-seal had not changed in hardness and had inconsequential changes in shape. The engineering evaluation established the seal life for all seals (including the T-seal) at 9 years.

As stated above, the seals evaluated were from CV-4306 and CV-4308. These valves have no failure history and will not have the worst service conditions. The valves with failure history and the worst service conditions are CV-4302 and CV-4303. However, there have been no service related failures (with the exception of a material problem that has been corrected) since 1985 for all valves. Additionally, the engineering evaluation indicates that the variations in temperature and radiation from one valve to the next are expected to have a negligible influence on seal degradation rate. However, to account for the possibility that other valves may have a higher failure rate, we currently plan to replace the seals at an interval of 7.5 years rather than 9 years.

The engineering evaluation indicated that the projected service life may be extended by future evaluation of valves with additional service life. It is recognized that the longest service life for a T-seal since 1983 has only been 3 years. We intend to "stagger" the T-seals selected for replacement over the replacement interval to increase the likelihood that common-mode failure mechanisms will be identified in a timely manner. We intend to perform evaluations of the as-found conditions of the T-seals when they are replaced to determine the potential for further service life extension and to provide assurance that the interval selected is appropriate.

Additional Purge System Isolation Valve Leakage Integrity Testing

As discussed previously, Amendment No. 100 added purge/vent system leakage integrity tests in addition to the seal replacement requirement. CTS 4.7.A.1.d.4 states "Additional purge system isolation valve leakage integrity testing shall be performed at least once every three months in order to detect excessive leakage of the purge isolation valve resilient seats. The purge system isolation valves will be tested in three groups, by penetration: drywell purge exhaust group (CV-4302 and CV-4303), torus purge exhaust group (CV-4300 and CV-4301), and drywell/torus purge supply group (CV-4307, CV-4308 and CV-4306)."

This test provides a means to trend performance of the purge and vent valves during the cycle to detect excessive leakage of the valve resilient seats. This test has been successful in identifying problems with the valves in the past, particularly the T-seal leakage or failures described in the maintenance history. (See page 4 of this attachment.) There have been no failures of the integrity test during this cycle.

As stated in a letter from the NRC to GPU Nuclear Corporation dated July 29, 1994 (TAC M89783), "Seal replacement at 5-year intervals is not a staff position or regulatory requirement, but is a staff-accepted alternative to augmented leakage testing. ... the model Technical Specifications ... stated that the seals should "be replaced at least once per ___ years," leaving blank the time interval. ... It was never intended that test intervals and seal replacement intervals remain fixed, except for the 24-month 10 CFR Part 50, Appendix J limitation on local leak rate test (LLRT) intervals." Thus our current surveillance requirement for integrity testing (which is being retained) is an acceptable alternative to seal replacement.

Surveillance requirement 4.7.A.1.d.4 provides assurance that the requirements of 10 CFR 50.36(c)(3) are met. 10 CFR 50.36(c)(3) states "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met." As discussed above, the integrity testing assures the T-seals have not degraded and are capable of fulfilling their function.

Maintenance History

Since 1977, 41 T-seals have been replaced at the DAEC. (This includes the torus-to-reactor building vacuum breakers, CV-4304 and CV-4305, which also have T-seals.) Of these 41 seals, the majority have been periodically replaced as required by TS with no evidence of T-seal problems. The reason for T-seal replacement is shown in the following table.

Reason	Number of replacements
LLRT Failure*	5
Preventative	34
T-seal leakage	2

*No LLRT failures have occurred since 1985.

In 1988, the volume between CV-4300 and CV-4301 was found pressurized when preparing for the LLRT. It was determined that the T-seal of CV-4300 was leaking. However, the as-found LLRT indicated a penetration leakage of only 420 sccm. This indicates that the seal was performing satisfactorily.

In 1989, the T-seal broke at the splice at CV-4302. The investigation of the event indicated that the T-seal may have been defective. Another T-seal was found split in 1990. Since that time, DAEC has exclusively used continuous molded T-seals to eliminate the potential for glued joint failures.

No inservice failures have occurred in the past 7 years. The performance of the T-seal is good, particularly based on recent history, and the periodic replacement interval can be extended.

LLRT Performance

In 1985, there were 2 LLRT failures. (One of the failures was a torus-to-reactor building vacuum breaker.) Since 1985, there have been no LLRT failures. In approximately 75% of the tests, the leakage has been less than 10% of the allowable leakage. The LLRT data indicates that the valves have had good leakage performance.

Summary

Since 1982, significant information has been gathered concerning the performance of these valves and in particular the T-seal. This information has been gathered through periodic replacement inspections, local leak rate testing, quarterly leakage integrity surveillance testing, and through inservice failures. In addition, engineering evaluations have been performed to determine the service life. Based on this information, IES has evaluated the replacement frequency for the T-seals and found a frequency of 7.5 years (or five 18-month cycles) to be appropriate.

Seal replacement at a preset interval is a Staff-accepted alternative to augmented leakage testing. The DAEC TS contain a surveillance requirement to perform purge system isolation valve leakage integrity testing at least once every three months in order to detect excessive leakage of the purge isolation valve resilient seats. The test history of these valves has been very good, with no degradation in leaktightness and consequently T-ring seal integrity, being observed. Because of the continued demonstration of seal integrity, via the leak rate tests, the possibility of a sudden, catastrophic failure of a T-ring seal is highly unlikely.

The requirement to periodically replace the T-ring inflatable seals will be contained in the DAEC UFSAR and plant procedures. Any changes to the UFSAR must be evaluated in accordance with 10 CFR 50.59. Any change to the frequency of T-seal replacement would therefore require an evaluation in accordance with 10 CFR 50.59.