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SUBJECT: Forwards response to 830511 request for addl info re NUREG-0737,Item II.K.3.28, "Qualification of Automatic Depressurization Sys (ADS) Accumulators." Current sys provides sufficient capacity to meet FSAR requirements.

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Iowa Electric Light and Power Company

June 30, 1983
NG-83-2223

Mr. Harold Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Response to Request for Additional Information:
NUREG-0737, Item II.K.3.28, Qualification of ADS
Accumulators

Dear Mr. Denton:

This letter is submitted in response to Mr. Vassallo's letter dated May 11, 1983, which requested additional information regarding our response to NUREG-0737, Item II.K.3.28, on Qualification of the Automatic Depressurization System (ADS) Accumulators.

Attachment 1 to this letter provides a response to each of the nine items for which additional information was requested. For convenience, the information is provided in a question and answer format in which the item is repeated, followed by our response.

As discussed in Section 9 of the attachment, our evaluation demonstrates that the current ADS accumulator system provides sufficient capacity to meet the requirements discussed in the Updated Final Safety Analysis Report. However, the results of leak rate testing of the accumulator inlet check valves indicate that modifications are necessary to meet the NUREG-0737 criterion for ADS actuation at 100 days post-accident. Therefore, it is our intent to replace the current ADS accumulator check valves with valves possessing improved leakage characteristics.

Current projections indicate that this modification can be completed prior to startup from the Cycle 8 refueling outage. This modification will be incorporated in Schedule B of the Iowa Electric "Plan

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for the Integrated Scheduling of Plant Modifications for the Duane Arnold Energy Center" ("The Plan", Amendment 91 to DPR-49). The final schedule for implementing this modification will be included with our next semi-annual update of "The Plan".

If we can be of further assistance, please advise.

Very truly yours,

Richard W. McGaughy
Manager, Nuclear Division

RWM/RAB/dmh*
Attachment: Response to Request for Additional Information Regarding Qualification of ADS Accumulators

cc: R. Browning
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DUANE ARNOLD ENERGY CENTER
RESPONSE TO THE REQUEST FOR ADDITIONAL INFORMATION
QUALIFICATION OF ADS ACCUMULATOR SYSTEMS

1.0 NRC QUESTION

Describe the ADS accumulator system design and operation (e.g., trains, air supply, capacity, alarms and instrumentation and their location, etc).

1.1 IELP RESPONSE

1.1.1 Introduction

The Duane Arnold Energy Center (DAEC) pressure relief system is equipped with six safety relief valves (SRVs). The DAEC automatic depressurization system (ADS), which serves as a backup to the high-pressure coolant injection system to reduce pressure under loss-of-coolant accident (LOCA) conditions, utilizes four of the six SRVs. The ADS is normally provided with a pneumatic supply from the drywell nitrogen supply system. This nitrogen supply is part of the containment atmosphere control system. The containment atmosphere control system also maintains the nitrogen inerted atmosphere in the DAEC drywell. A nonsafety drywell nitrogen system accumulator (IT-128), which is located outside the drywell, supplies nitrogen to the ADS SRV accumulators. Pressure is maintained in the drywell nitrogen system accumulator by a nonsafety nitrogen compressor and by a nonsafety backup nitrogen supply system.

1.1.2 ADS Accumulator System Design and Operation

Each of the four ADS SRVs (SRV-4400, 4402, 4405, and 4406) is equipped with a dedicated Seismic Category I accumulator (IR-003A,B,C,D). Each ADS accumulator system is provided with an inlet check valve at the boundary between the safety grade accumulator system and the nonsafety drywell nitrogen supply system (see Section 1.1.4). The inlet check valves serve to minimize the loss of nitrogen from the ADS accumulator systems in the event that the normal drywell nitrogen supply system should fail.

1.1.3 Trains

Because each ADS SRV is provided with a dedicated accumulator (except as discussed in Section 1.1.7), and because of the large volume of each accumulator (200 gallons), a safety grade backup ADS nitrogen supply is not provided. The cryogenic nitrogen supply and tank truck hookup act as a single-train, nonsafety-grade backup system which taps into the main supply line upstream of the drywell nitrogen system accumulator.

1.1.4 Air (Nitrogen) Supply

The ADS SRVs receive normal pneumatic supply from the drywell nitrogen supply system. The drywell nitrogen supply is a recirculation system maintained through a pneumatic supply system compressor (1K-14) which takes suction from the drywell. The drywell nitrogen supply system also maintains pressure in the ADS SRV accumulators.

When the drywell nitrogen system accumulator pressure drops to the setpoint, the compressor is started and nitrogen is supplied to the drywell nitrogen system accumulator. In the automatic operating mode, the compressor starts at a drywell nitrogen system accumulator pressure of 90 psig and stops when the system accumulator reaches 100 psig. The compressor can also be manually operated.

The nitrogen compressor is capable of being powered from onsite. In the event of loss of offsite power, manual switchover provides the nitrogen compressor with onsite emergency diesel power.

1.1.5 Capacity

Each ADS SRV accumulator has a volume of 200 gallons and is equipped with an inlet check valve to minimize leakage in the event that the drywell nitrogen supply system fails. When fully charged (90 psig), each ADS SRV accumulator contains approximately 12 pounds-mass of nitrogen. The minimum differential pressure required to actuate an ADS SRV is 20 psid (accumulator-drywell). The volume of nitrogen required to actuate an ADS SRV five times is negligible compared to the volume of the accumulator.

1.1.6 Alarms and Instrumentation and Their Location

A nitrogen compressor panel 1C-189 trouble alarm is located on panel 1C-35 in the control room. In addition, a pressure transmitter/indicator instrument loop has been installed to monitor nitrogen header pressure with pressure indicator PI-4390 and a low/high pressure nitrogen header alarm on panel 1C-35. This pressure indication loop can be utilized to periodically monitor nitrogen supply header pressure inside containment.

The drywell nitrogen system accumulator is provided with a local pressure indicator (PI-4372) and a local pressure switch (PS-4374A) set at 80 psig. If the drywell nitrogen system accumulator pressure drops below this value, local emergency nitrogen supply valve CV-4377 opens (activated by PS-4374C) and introduces makeup nitrogen at 100 psig. A low-pressure alarm is also activated on panel 1C-07 in the control room through local pressure switch PS-4376. All local instrumentation is located outside drywell in the southeast area of the reactor building at elevation 757'-6".

1.1.7 Recent Modifications of the ADS SRV Accumulator Systems

As part of the Mark I modifications implemented during the Cycle 7 refueling outage, non-ADS SRV-4401 was pneumatically connected to ADS accumulator 1R-003B serving SRV-4400, and non-ADS SRV-4407 was pneumatically connected to ADS accumulator system 1R-003A serving SRV-4406. These modifications do not impact the long-term supply capability of the ADS accumulators (see Section 2.1.6) because the modifications consist of only the installation of tubing and mechanical fittings. The additional volume of nitrogen used to actuate the non-ADS SRVs is negligible compared to the volume of the accumulator as stated in Section 1.1.5.

2.0 NRC QUESTION

Define the basis for the allowable leakage criteria for the ADS SRV accumulator system (e.g., boundary condition environmental and seismic parameters, operator interface, margin, etc).

2.1 IELP RESPONSE

2.1.1 Introduction

The DAEC Updated Final Safety Analysis Report (UFSAR) requires an ADS capability of five actuations after a period of five hours post-LOCA. Additionally, NUREG 0737, Item II.K.3.28 requires a long term (100 days post-LOCA) ADS capability. The DAEC evaluation of the adequacy of the ADS accumulators is based on satisfying the following two criteria:

a. Short-Term ADS SRV Design Criterion

   Cycle the ADS valves five times at drywell design pressure

b. Long-Term ADS Design Criterion

   Cycle the ADS valves five times at 100 days following a design basis LOCA

Short-term is defined as the time required to depressurize the reactor to the residual heat removal (RHR) shutdown cooling pressure permissive setpoint, stabilize the reactor water level, and place the reactor in the shutdown cooling mode.

The primary purpose of the long-term ADS is to keep the reactor pressure low enough so low-pressure emergency core cooling (ECC) systems can be used to keep the core cooled. The maximum allowable leakage criterion resulting from the DAEC evaluation is based on the long-term ADS design criterion.

The results of our evaluation demonstrate that each ADS SRV accumulator system has the capability to accommodate a nitrogen system leakage of 30 scc/min for up to 100 days without makeup (taking no credit for nonsafety systems) and still provide five actuations of the ADS SRVs.

2.1.2 Boundary Conditions

The ADS SRV accumulator system boundaries include the pilot (solenoid) valve, accumulator, manual stop valve, and an inlet check valve connected by tubing and piping.

Environmental boundary conditions are described in Section 2.1.3.

2.1.3 Environmental and Seismic Parameters

Postulated environmental conditions for a design basis LOCA are presented in UFSAR Figures 6.2 -45 and 46. In as much as drywell temperatures remain above 175F for less than 100 seconds, the effect on ADS leakage because of the temperature transient will be minimal; a conservative, continuous, post-accident drywell temperature of 175F (for a 100-day period) was assumed in defining the design leak rate criterion for the ADS. The drywell pressure will not have any effect on leakage through the check valves.

Seismic parameters are defined in General Electric's specifications for the SRVs. Seismic coefficients are 2.0G horizontal and 1.0G vertical.

2.1.4 Operator Interface

During normal operation, the operators are responsible for ensuring that the ADS SRV accumulators are fully charged to the required operating pressure (90 psig). No credit is taken for post-accident operator actions in establishing the allowable leakage criterion in Section 2.1.1.

2.1.5 Margin

The calculated leakage criterion of 30 scc/min includes a margin of the following forms.

a. 100 days post-accident includes margin of at least 70 days because accidents of a nature requiring ADS operation are expected to be terminated or under control within 30 days.

b. Post-accident environmental conditions have been conservatively determined.

Also, an additional margin of 5 scc/min is being established below the required leak rate by specifying an allowable leak rate during periodic testing of 25 scc/min (see Section 9.1).

2.1.6 Assumptions Regarding Potential Sources of Leakage

Five potential sources of leakage exist within the ADS accumulator system.

a. Mechanical fittings

b. Second stage piston (rings)

c. Stem seals on pilot solenoid valves

d. Manual stop valve (backseat)

e. Check valves (disc/seat)

The hard-seated inlet check valves are believed to be the source of leakage from the ADS SRV accumulator system. The remaining potential leakage sources are assumed to be negligible because of their design. The entire system is checked for leakage during the periodic testing procedure described in Section 6.1.

3.0 NRC QUESTION

What margin is in the allowable leakage criteria to account for possible increase in leakage resulting from the effects of a harsh environment and/or a seismic event.

3.1 IELP RESPONSE

3.1.1 Potential sources of leakage from the system are listed in Section 2.1.6. The only potential leakage paths containing organic seals (subject to harsh environment-induced degradation) are the pilot solenoid valve stem seals. The seals for these solenoid valves have been addressed by the solenoid valve's environmental qualification program (see Section 8.1). The margin discussed in Section 2.1.5 accounts for any harsh/seismic-induced leakage effects.

4.0 NRC QUESTION

A statement that test and/or analysis performed verified that a harsh environment and/or seismic event would not increase the leakage rate.

4.1 IELP RESPONSE

Potential leakage sources are identified in Section 2.1.6. Leakage sources subject to degradation from harsh environment effects have been environmentally qualified by a combination of test and analysis.

To minimize the potential for increased leakage after a seismic event, the entire ADS accumulator line from the accumulators to the check valves and SRVs has been designated Seismic Category I. Valves procured for the upcoming check valve replacement (see Section 9.1) will be seismically qualified.

5.0 NRC QUESTION

A statement that verifies that no credit was taken for nonsafety-related equipment and instrumentation when establishing the allowable leakage criteria.

5.1 IELP RESPONSE

No credit was taken for nonsafety-related equipment and instrumentation in establishing the allowable leakage criterion of 30 scc/min.

6.0 NRC QUESTION

Define the periodic leakage testing of the ADS accumulator system (i.e., the time interval between these leak tests, along with a concise description of the test procedure employed).

6.1 IELP RESPONSE

Periodic leak tests, using Special Test Procedure-70 (SpTP-70), have been performed during refueling outages in accordance with IE Bulletin 80-01. Three leak tests have been performed since March 1980.

The purpose of the test is to determine ADS accumulator system leakage via the accumulator inlet check valves. The procedure simulates the loss of normal nitrogen supply by depressurizing the nitrogen supply header. A test rig is connected to tubing normally attached to the SRV pilot (solenoid) valve. The test rig monitors the leak rate by measuring the nitrogen supplied to maintain a pressure of 95 psia in the ADS accumulator system.

Calibration curves have been generated for the particular test rig to determine the actual leak rate in standard cubic centimeters per minute (scc/min).

7.0 NRC QUESTION

A concise description of the surveillance performed, and how frequent, on alarms and instrumentation associated with the ADS accumulator system.

7.1 IELP RESPONSE

Safety-related portions of the ADS SRV accumulator system have no alarms or instrumentation. The only surveillance necessary is the inspection and the replacement of component parts for the pilot (solenoid) valve and the check valve leak rate tests during refueling outages. The alarms and instrumentation associated with the pneumatic supply system are nonsafety-related and located in a mild environment. Although these items provide an essential function during normal operation, no credit has been taken for these items during and/or following an accident.

8.0 NRC QUESTION

A statement that confirms that the electrical and mechanical components in the ADS accumulator system and associated equipment and control circuitry are environmentally qualified for conditions associated with normal operation, maintenance, testing, and postulated accidents.

8.1 IELP RESPONSE

The only electrical system components in safety-related portions of the ADS accumulator systems are six Automatic Valve Company manufactured pilot solenoid valves. These valves are environmentally qualified as described in the second Semiannual DAEC Environmental Qualification Report transmitted to the NRC by LDR-82-191, dated July 15, 1982, as clarified by Attachment 3 to the Iowa Electric response to 10 CFR 50.49, transmitted by NG-83-1809, dated May 20, 1983.

The present design of the safety-related portions of the ADS accumulator system contains no seals, gaskets, or other organic material within the scope of mechanical equipment qualification. Valves procured for the upcoming check valve replacement (see Section 9.1) will be appropriately environmentally qualified.

9.0 NRC QUESTION

A statement verifying that the ADS valves, accumulators, associated equipment, and instrumentation are capable of performing their function during and following an accident situation while taking no credit for nonsafety-related equipment and instrumentation.

9.1 IELP RESPONSE

The ADS accumulator systems are capable of performing the safety function required by the UFSAR during and following an accident while taking no credit for nonsafety-related equipment and instrumentation. As indicated in Section 8.0, there is no control circuitry or instrumentation associated with the performance of the ADS accumulator's safety function.

The present check valves are capable of performing their safety function during and following an accident and their leak rate will not exceed the UFSAR Section 6.3.2.2.2 limit of 200 scc/min. As discussed in Section 2.1, the long-term (100 day) allowable leakage criterion for the ADS check valves is 30 scc/min (including margins). As described in Attachment 4 to Iowa Electric Letter LDR-81-348 to the NRC, dated December 23, 1981, leakage tests conducted on the hard-seated check valves resulted in leak rates less than 20 scc/min. However, these tests were conducted on new valves. More recent tests have resulted in leak rates of up to 190 scc/min (which is below the UFSAR limit of 200 scc/min and allows achievement of the short-term ADS design criterion). To reduce the leak rate below the Section 2.1.1 limit of 30 scc/min and thereby meet the long-term criterion (100 days), the present hard-seated check valves will be replaced with appropriately qualified (see Section 8.1) soft-seated check valves. Additionally, with the replacement of these check valves, the leakage acceptance criterion of SpTP-70 (see Section 6.1) will be revised to 25 scc/min to provide an additional margin of 5 scc/min below that required to meet the long-term criterion.