

Commonwealth Edison Company
LaSalle Generating Station
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October 28, 1996

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Licensee Event Report #96-011-00, Docket #050-373 is being submitted to your office in accordance with 10 CFR 50.73(a)(2)(ii).

Respectfully,

A handwritten signature in dark ink, appearing to read "D. J. Ray". The signature is fluid and cursive.

D. J. Ray
Station Manager
LaSalle County Station

Enclosure

cc: A. B. Beach, NRC Region III Administrator
M. P. Huber, NRC Senior Resident Inspector - LaSalle
C. H. Mathews, IDNS Resident Inspector - LaSalle
F. Niziolek, IDNS Senior Reactor Analyst
INPO - Records Center

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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503

FACILITY NAME (1): LaSalle County Station Unit One	DOCKET NUMBER (2): 05000373	PAGE (3): 1 of 6
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TITLE (4)
Pneumatic valves with less-than-designed effective diaphragm area results in inadequate valve closing forces which may affect containment isolation.

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	28	96	96	011	00	10	28	96	LaSalle County Station Unit Two	05000374
									FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9): 4
POWER LEVEL (10): 000
THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 73.71(b)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2003(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(c)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 20.2003(a)(4)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> OTHER
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)	<input type="checkbox"/> 50.73(a)(2)(vii)	(Specify in Abstract below and in Text, NRC Form 366A)
<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
<input type="checkbox"/> 20.2003(a)(2)(v)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME Mark Smith, Component Engineer	TELEPHONE NUMBER (Include Area Code) (815) 357-6761 Extension 2323
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)	<input type="checkbox"/> NO	EXPECTED SUBMISSION DATE (15)	MONTH 12	DAY 02	YEAR 96
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines 16)

While developing an Air Operated Valves (AOV) preventative maintenance program, inconsistent testing data were obtained for valves with WKM 70-13-1 pneumatic actuators. The inconsistent results appeared to be related to incorrect effective diaphragm areas (EDA) for the AOV actuators. This occurred in the February-April 1996 time frame.

Two problems associated with the EDA of the actuators of the WKM valves were identified. The first was related to the actual versus the manufacturer's published EDA of the actuator. The second problem was stretching of the diaphragm during valve travel resulting in a reduced EDA.

In March 1996, LaSalle Station's AOV Component Engineer contacted Anchor/Darling Valve Company regarding the published versus the actual EDA and the stretching of the diaphragms. The Component Engineer also requested, via letter, that Anchor/Darling Valve Company perform independent testing to address LaSalle Station's concern with the published EDA. On September 20, 1996, after conducting testing, Anchor/Darling Valve Company acknowledged a reduction of the EDA for the WKM 70-13-1 pneumatic operators, confirming LaSalle Station's preliminary testing results.

There are a total of 36 (18 per unit) WKM AOVs addressed in this LER, and they are listed in Table 1. Thirteen valves per unit are installed in systems which are part of the Primary Containment Isolation System (PCIS) and five valves per unit are in the Reactor Core Isolation Cooling System (RCIC).

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PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

A. CONDITION PRIOR TO EVENT

Unit(s): 1/2

Reactor Mode(s): 4/5

Event Date: 09/28/96

Mode(s) Name: Cold
Shutdown/Refuel

Event Time: 1650 Hours

Power Level(s): 0%/0%

B. DESCRIPTION OF EVENT

During the Unit 1 refueling outage (February-April 1996), the station performed actuator and valve testing on five WKM AOVs in the RCIC (Reactor Core Isolation Cooling) system and one AOV in the RF (Reactor Building Floor Drain) system. The RCIC valves were selected for testing as part of the development of the AOV Preventative Maintenance Program, and the RF valve was tested following corrective maintenance due to a packing leak. The RCIC valves that were tested do not perform a containment isolation function during a Design Basis Accident, but the single RF valve that was tested is one of the primary containment isolation valves.

The six valves discussed above were all originally designed by WKM. The design is currently manufactured by Anchor/Darling Valve Company. Actuator testing prior to returning the valves to service revealed that inconsistencies existed between the manufacturer's published bench set data and the data recorded by the mechanics. After further in-house testing and verification that the other actuator components were functioning as designed (e.g., spring rate design versus actual), it was determined that the published EDA for the WKM AOV actuators was incorrect.

All AOVs operate in much the same manner. The diaphragm, which is a flexible, nylon-reinforced rubber material, is sandwiched at its outer diameter between the upper and lower diaphragm casings. A stem is mounted to the center of the diaphragm via a diaphragm plate, and this stem protrudes from the center of the lower casing. The diaphragm plate moves inside the casing much like a piston, with the diaphragm providing an air-tight seal between the top and bottom of the casing halves. When air pressure is applied through an opening in the casing to [either side of] the diaphragm, the flexible diaphragm/plate/stem assembly moves away from the applied air, resulting in linear travel of the protruding stem. For most AOV applications, the diaphragm/plate/stem assembly is spring-mounted within the actuator, and the force of compressing this spring works in the opposite direction of the force due to the applied air to the diaphragm. In application, the stem that protrudes from the diaphragm casing is coupled to a valve stem, such that the valve is opened and/or closed based upon a combination of air pressure and spring force.

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For installation, AOVs are bench set. Bench setting consists of applying air pressure to the actuator in accordance with manufacturer's published values, and adjusting the actuator's spring [compressive force] to achieve a relationship between air pressure and valve stem travel. The lower bench set values and the upper bench set values should correlate to the valve being stroked through its full range of travel (closed to open or vice-versa). With no air on the actuator's diaphragm, the force remaining in the actuator's spring, and hence the valve to which it is attached, is enough to keep the valve in its designed position (either open or closed). The force of the spring is adjusted to be the product of the actual EDA and the lower bench set air pressure value. If the actual EDA is less than what the manufacturer publishes, then the closing (or opening) forces installed in the valve (via spring/spring adjustment) will be less than required. This is the problem with WKM AOVs at LaSalle.

During bench set testing of the WKM 70-13-1 actuator/valve assemblies (using diagnostics), the controlled air test pressures did not correlate to the designed valve stem travel. Similar testing at the LaSalle Station on other (i.e., not manufactured by Anchor/Darling Valve Company) AOVs yielded predictable results regarding the accuracy of the manufacturer's recommended bench-set air pressures and valve stem travel. However, when bench-set testing was performed on the WKM AOVs, it was identified that the valves did not complete their predicted travel within the bench set pressure span. Typically, this is indicative of a stiffer-than-expected spring force. However, additional testing with a known (measured) spring force, supply air pressure, and output load, identified concerns related to the manufacturer's published actuator EDA. Also, the WRM 70-13-1 actuator's diaphragm height was found to be incorrect in relationship to the upper internal actuator casing dimensions. The as-delivered upper-half of the diaphragm casing was deeper than the lower half. During valve operation, as the diaphragm moved into the upper (i.e., deep) casing, the diaphragm material would begin to stretch prior to contacting the upper stop within the casing, thereby reducing the EDA. Therefore, LaSalle personnel concluded that two problems existed with the WKM AOVs: 1) Incorrect published EDA66; and 2) A changing EDA as the diaphragm stretched within its casing.

After consultation with Anchor/Darling Valve Company, design changes were made to account for the effective diaphragm area reduction for the referenced valves. The design changes corrected the problems with the published versus the actual EDA and the stretching of the diaphragm. Upon completion of maintenance work and testing, the RF valve (i.e., the only containment isolation valve in the test group) passed the required local leak rate testing (LLRT) and stroke time testing and it was placed back into service. A review of Unit 1 and Unit 2 10 CFR 50 Appendix J LLRT test results and IST stroke time tests for the PCIS valves with WKM actuators confirmed that all the valves had also successfully passed these tests.

In early May 1996, LaSalle's 10 CFR Part 21 Coordinator was notified regarding the test results indicating the reduced EDA for WKM actuators. An action item was issued to track and resolve the WKM EDA concerns. Due to the lack of official Anchor/Darling Valve Company correspondence regarding the actual versus the published EDA, it was considered that there was insufficient data available at the time to determine potential Part 21 applicability. Anchor/Darling Valve Company was notified regarding their need to address Part 21 issues related to WKM 70-13-1 valves.

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In an effort to communicate the WKM EDA concerns, the Component Engineer discussed the AOV EDA issues at INPO during an AOV working meeting (May 7 and 8, 1996). Additionally, the Component Engineer discussed the WKM concerns with the other five ComEd Nuclear Facility peers at their Quarterly Peer Group Meeting (May 26, 1996).

In June 1996, Anchor/Darling Valve Company formally acknowledged their responsibility to review the EDA concern for 10 CFR Part 21 applicability. The LaSalle Component Engineer prepared and issued a letter to Anchor/Darling Valve Company detailing all of the concerns that LaSalle Station had identified with the WKM AOVs. Specifically, there were four items submitted to Anchor/Darling Valve Company due to concerns regarding the WKM actuators:

Evaluate the actual EDA versus the original design values.

Calculate the new bench range values for the LaSalle population based on original design specifications.

Evaluate the actuator casing inner dimensions with regard to the diaphragm molded heights for all actuator sizes.

Evaluate the current spring guide (plate) design to ensure proper spring alignment and provide appropriate part numbers, and material.

On August 16, 1996, Anchor/Darling Valve Company provided preliminary test results for the WKM 70-13-1 actuator. This was followed up with a trip by the AOV Component Engineer to the Anchor/Darling Valve Company facilities to review the test results, methodology and to discuss corrective actions. On September 20, 1996, Anchor/Darling Valve Company acknowledged the EDA reduction and provided their recommended corrective actions.

Due to the required valve changes and safety significance of the systems affected, LaSalle Station began gathering data to review operability. On September 28, it was determined that without implementation of design changes incorporating the Anchor/Darling Valve Company recommended corrective actions, the PCIS valve assemblies listed in Table 1 may not isolate as designed. Specifically, for the AOVs that close to perform their PCIS function, the spring may not be adjusted with enough force to close the valve under design conditions. Based on this condition, a four hour notification in accordance with 10 CFR 50.72(b)(2)(i) was made to the NRC on September 28, 1996 at 2035. On October 4, 1996, LaSalle personnel issued a 10 CFR Part 21 notification regarding the EDA concerns related to the WKM Model 70-13-1 Pneumatic Actuators currently manufactured by the Anchor/Darling Valve Company.

C. CAUSE OF EVENT

The root cause of this event is the use of incorrect EDA (effective diaphragm area) by the Original Equipment Manufacturer (OEM) for actuator setup. The OEM at the time was WKM.

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D. ASSESSMENT OF SAFETY CONSEQUENCES

All the PCIS valves would close at the designed basis accident primary containment pressure of 40 psig; however, most are designed to operate at a higher system pressure. The reduced EDA impacts the ability of the valves in Table 1 to perform at a higher system pressure. As found testing is in progress to obtain the available seating force for all the valves. This data will be analyzed to determine if these valves would have performed their function at design conditions. A supplemental report addressing any further safety significance will be issued by December 2, 1996. Both units will remain in a condition that doesn't require valve design operation until the problem is corrected.

E. CORRECTIVE ACTIONS

1. Engineering is preparing design change packages (DCP) to compensate for the reduced EDA and restore the valves design specifications. These DCPs will be implemented prior to Unit 1 and Unit 2 startup from the current outages.
2. 10 CFR Part 21 notification on the deficiency of WKM 70-13-1 Pneumatic Actuators currently manufactured by the Anchor/Darling Valve Company was issued on October 4, 1996.

F. PREVIOUS OCCURRENCES

LER NUMBER	TITLE
None	

G. COMPONENT FAILURE DATA

BS&B manufactured the original design of these air operators. Subsequently, other valve manufacturers have owned the design and have manufactured them. Chronologically, the affected designs have been manufactured by:

- BS&B (Black, Sivalls and Bryson)
- WKM Valve Division, ACF Industries
- Muesco
- A/DV (Anchor/Darling Valve Company)

The actuator model is 70-13-1.

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Table 1
Affected AOVs
Manufacturer/Supplier - W-K-M Controls

Tag/EPN	Valve Model	Actuator Size	Fail Mode	Valve Noun Name
1B33F019*	70-18-9DRT	70	Close	RR Inboard Process Sample Stop
1B33F020*	70-18-9DRT	70	Close	RR Inboard Process Sample Stop
1E51F004	70-29-1DRT	70	Close	RCIC Baro Condenser Cond Pump
1E51F005	70-29-1DRT	70	Close	RCIC Baro Condenser Cond Pump
1E51F025	70-18-9DRT	70	Close	RCIC Steam Supply Drain Pot Outlet Upstream Stop
1E51F026	70-18-9DRT	70	Close	RCIC Steam Supply Drain Pot Outlet Downstream Stop
1E51F054	70-18-9DRT	70	Close	RCIC Steam Supply Drain Pot Outlet Trap
1IN001A*	70-29-1DRTS	70	Close	Drywell Suction Upstream Isolation
1IN001B*	70-29-1DRTS	70	Close	Drywell Suction Downstream Isolation
1IN017*	70-29-1DRTS	35	Close	Drywell Pneumatic to Drywell
1IN074*	70-29-1DRTS	35	Close	DW Pneumatic Dryer Downstream Purge Outlet
1IN075*	70-29-1DRTS	35	Close	DW Pneumatic Dryer Upstream Purge Outlet
1RE024*	70-29-1DRTS	70	Close	DW Equipment Drain Inboard Isolation
1RE025*	70-29-1DRTS	70	Close	DW Equipment Drain Outboard Isolation
1RE026*	70-29-1DRTS	35	Close	DW Equipment Drain Sump Recirc Valve
1RE029*	70-29-1DRTS	35	Close	DW Equipment Drain Sump Discharge Valve
1RF012*	70-29-1DRTS	70	Close	DW Floor Drain Inboard Isolation
1RF013*	70-29-1DRTS	70	Close	DW Floor Drain Outboard Isolation
2B33F019*	70-18-9DRT	70	Close	RR Inboard Process Sample Stop
2B33F020*	70-18-9DRT	70	Close	RR Inboard Process Sample Stop
2E51F004	70-29-1DRT	70	Close	RCIC Baro Condenser Cond Pump
2E51F005	70-29-1DRT	70	Close	RCIC Baro Condenser Cond Pump
2E51F025	70-18-9DRT	70	Close	RCIC Steam Supply Drain Pot Outlet Upstream Stop
2E51F026	70-18-9DRT	70	Close	RCIC Steam Supply Drain Pot Outlet Downstream Stop
2E51F054	70-18-9DRT	70	Close	RCIC Steam Supply Drain Pot Outlet Trap
2IN001A*	70-29-1DRTS	70	Close	Drywell Suction Upstream Isolation
2IN001B*	70-29-1DRTS	70	Close	Drywell Suction Downstream Isolation
2IN017*	70-29-1DRTS	35	Close	Drywell Pneumatic to Drywell
2IN074*	70-29-1DRTS	35	Close	DW Pneumatic Dryer Downstream Purge Outlet
2IN075*	70-29-1DRTS	35	Close	DW Pneumatic Dryer Upstream Purge Outlet
2RE024*	70-29-1DRTS	70	Close	DW Equipment Drain Inboard Isolation
2RE025*	70-29-1DRTS	70	Close	DW Equipment Drain Outboard Isolation
2RE026*	70-29-1DRTS	35	Close	DW Equipment Drain Sump Recirc Valve
2RE029*	70-29-1DRTS	35	Close	DW Equipment Drain Sump Discharge Valve
2RF012*	70-29-1DRTS	70	Close	DW Floor Drain Inboard Isolation
2RF013*	70-29-1DRTS	70	Close	DW Floor Drain Outboard Isolation

* PCIS Valve