FINAL REPORT

REACTOR CONTAINMENT

LOCAL LEAKAGE RATE TEST

SPRING 1983 REFUELING OUTAGE

DUANE ARNOLD ENERGY CENTER

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IOWA ELECTRIC LIGHT AND POWER COMPANY

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REACTOR CONTAINMENT
LOCAL LEAKAGE RATE TEST
SPRING 1983 REFUELING OUTAGE

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1.0 SUMMARY

1.1 TEST SCOPE/RESULTS

As required by Section TS 4.7, Plant Containment Systems, of the Duane Arnold Energy Center (DAEC) technical specifications, local leakage rate testing (LLRT) of primary containment penetrations was conducted. The testing was performed during the Cycle 6/7 refueling outage from February 11 to May 5, 1983. A summary of the LLRT results is provided in Table 1.

The final combined leakage rate for all penetrations and valves subject to Type B and C testing totaled 106,022 sccm.

The acceptance criteria for the Type B and C tests require that the combined leakage rate be less than 0.60 L_a. For the DAEC, this limit corresponds to 220,532 sccm. The final combined leakage rate was well below this limit.

The test results are described in detail in Sections 6.1 and 6.2 of this report.

1.2 TEST METHODS

With the exception of the inboard main steam isolation valves (MSIVs), all containment isolation valve testing used the pressurized flowmeter test method by which the flow of makeup air required to maintain a given pressure is measured. The testing of inboard MSIVs was performed by measuring the actual leakage from the reactor vessel past each inboard valve. Testing of valves subject to the Type C test was conducted in accordance with DAEC Surveillance Test Procedure (STP) 47A005.

The drywell personnel airlock was leak-tested by measuring pressure decay rate. This testing was conducted in accordance with STP 47A004.

All other containment penetrations subject to Type B testing (e.g., testable gaskets, electrical canisters, expansion bellows, and flange O-rings) were tested using the pressurized flowmeter test method in accordance with STP 47A003.

The DAEC obtains the combined leakage rates from the LLRT results in a manner consistent with ANSI/ANS 56.8-1981 (Containment System Leakage Testing Requirements). These criteria are as follows.

a. For containment isolation valves in series, tested individually, the leakage for that penetration is equal to the measured local leakage of the isolation valve with the higher leak rate.

b. For containment isolation valves in series, tested simultaneously (pressurizing between valves), the maximum leakage for that penetration is equal to the total leakage measured.

c. Containment isolation valves tested individually and which are parallel, the local leakage reported for that penetration is the sum of the individually measured leakages.

The results obtained in this manner are considered conservative for the following reasons.

a. The ANSI criteria assumes that only one of two isolation valves in series will shut during an accident and that the functional valve has the highest leak rate. More realistically, most if not all isolation valves would shut during an accident; consequently, the leakage rate past series valves would be controlled by the valve with the lowest leakage rate.

b. The ANSI criteria considers that for containment isolation valves tested simultaneously (pressurizing between valves), the maximum leakage for that penetration is the total leakage measured. A realistic leakage would be one-half of this value. This is justifiable because if one valve was leaking at more than one-half the total leakage measured, the leakage for that penetration would be controlled by the other valve which would leak at a rate less than one-half the total measured.

By applying the above considerations, the realistic as-found combined leak rate would be less than L_a.

1.3 OTHER TESTING

1.3.1 Inservice Inspection Testing (RTS-112/ASME)

These tests were performed to determine the leakage through valves in accordance with RTS-112 and as required by ASME Code Article IWV-3000 covering inservice inspection. The results of this testing are summarized in Section 6.2.2.

1.3.2 Nitrogen Accumulator Check Valves

Nitrogen accumulator check valves of MSIVs, automatic depressurization system (ADS), and reactor building torus vacuum breakers were tested to determine proper cycling. In addition, the ADS accumulator check valves were leak-tested. This testing was conducted in accordance with STP 47A005. The test results are discussed in Section 6.2.3 of this report.

2.0 REFERENCES

2.1 Title 10 CFR 50, Appendix J

2.2 Duane Arnold Technical Specification, Section TS 4.7, Plant Containment Systems

2.3 DAEC STP 47A003, Leak Rate Test Type B Penetration Test

2.4 DAEC STP 47A004, Airlock Local Leak Rate Test

2.5 DAEC STP 47A005, Containment Isolation Valve Leak Tightness Type C Penetration

2.6 Manufacturer's Standardization Society, Standard Practice, Edition 1961 (MSS-SP-61)

3.0 DEFINITIONS

3.1 CLR (sccm): The combined leakage rate for all components subject to Type B and C penetration tests.

3.2 L_a (percent/24 hour): The design basis accident leakage rate at the calculated peak containment internal pressure defined in the technical specifications (for DAEC, L_a equals 2% per day at 54 psig or 367,553 sccm).

3.3 sccm: Cubic centimeters of air or nitrogen at standard temperature and pressure per minute.

3.4 scfh: Cubic feet of air or nitrogen at standard temperature and pressure per hour.

4.0 ACCEPTANCE CRITERIA

4.1 The combined leakage rate for all penetrations and valves subject to Type B and C test shall be less than 0.60 L_a. For DAEC Unit 1, 0.60 L_a equals 220,532 sccm.

4.2 The absolute maximum leakage rate for any single penetration will be 5% of L_a (18,378 sccm) in accordance with STP 47A005.

4.3 The leakage from any one MSIV shall not exceed 11.5 scfh (5,427 sccm) at an initial test pressure of 24 psig.

4.4 The containment isolation valves were procured in accordance with MSS-SP-61, which specifies a maximum permissible leakage rate of less than 0.1 scfh (50 sccm) per inch of nominal diameter as manufactured. Therefore, this specification was used as the basis for calculating the desired leakage rate for each containment isolation valve.

5.0 <u>EQUIPMENT</u>

5.1 LOCAL LEAKAGE RATE TESTING UNITS

5.1.1 Most of the leakage rate testing employed one of four LLRT units (Figure 1). These portable units are constructed of 3/8-inch stainless steel tubing fitted with a pressure regulator, pressure gage, four flow instruments, a bubbler, and various isolation valves. The unit was supplied with either air or nitrogen and connected via a length of plastic tubing to the volume to be tested. Leakage rates were determined by measuring the amount of makeup air required to maintain the test pressure. Millimeter scale readings from the flowmeters were converted to sccm by using the calibration curve for the flowmeter.

5.1.2 As-found leakage from the inboard MSIVs was measured by pressurizing the reactor vessel to 24 psig and measuring the outflow of air which leaked through the seat. For this measurement, the flowmeters were connected directly to the test vent connection with no additional equipment required. A water head was established on the outboard side of the outboard MSIVs to seal these valves so all leakage from the inboard MSIVs was directed to the test rig for an accurate measurement. A special test connection (Figure 1) that bypassed the air supply pressure regulator was used for this measurement. The final leakage of the inboard and outboard B MSIVs was determined by pressurizing the test volume between them [in accordance with design change form (DCF) 5222] and recording a combined leak rate.

5.1.3 Where specified in accordance with the test procedure(s), water tests (designated Type H) were performed using a pressure tank (Figure 2). The tank was pressurized with air or nitrogen at the top. Water was delivered to the test volume from the bottom. Water leakage rate was determined by measuring tank input air required to maintain the test pressure in the tank. Test pressures at the LLRT test units were adjusted for liquid static head due to any difference in elevation between the test tank water level and the test volume so the differential pressure across the isolation valve was maintained at the desired test pressure (54 psig).

5.2 INSTRUMENT CALIBRATION AND ACCURACY

The LLRT units are designed to provide measurement of test volume leakage at a high level of accuracy. Instruments were calibrated prior to the commencement of the tests. Some instruments were new and were supplied with factory calibration data. Other instruments were calibrated by an outside firm. A number of flowmeters were rebuilt and calibrated at the DAEC instrument shop.

5.2.1 Pressure Gages

Instrument numbers	P-251, P-254, P-255, P-256 (gage P-253 used on nitrogen pressurization apparatus)
Manufacturer	Perma-Cal
Model	Test gage
Range, psig	0 to 100
Accuracy, %	± 0.1 of full scale
Calibration date	January 14, 1983, by Iowa Electric instrument technicians

5.2.2 Flow Indicators

Range and calibration data for the flowmeters are provided in Table 2. The accuracy of the flowmeters is ± 1% of full scale over the range of 100 to 10% of full scale.

5.3 TEST MEDIUM

5.3.1 Type B testing of testable gaskets and flange O-rings was performed using plant service air. Testing of electrical penetration canisters and piping expansion bellows was performed using bottled nitrogen.

5.3.2 Type C testing was performed using plant service air or bottled nitrogen. Type H water tests were performed using demineralized or well water to fill the test volume consistent with system service.

6.0 RESULTS DESCRIPTION

The results of the Type B LLRT are provided in Appendix A. The results of the Type C LLRT are provided in Appendix B. The results of the Type C non-technical specification inservice inspection testing (RTS-112/ASME) are summarized in Appendix C.

6.1 TYPE B TESTING

Type B testing began on February 17, 1983, with testing of the stabilizer access ports. Testing was performed in accordance with DAEC STP 47A003. Testing of the drywell personnel airlock (penetration X-1) was completed on May 5, 1983, in accordance with STP 47A004.

The Type B penetrations are divided into five categories. The categories and the final leakage results for each are as follows.

	As-Found (sccm)	After Repair (sccm)
Personnel airlock (5/5/83)	8,287	8,287
Testable gaskets	3,155	1,835
Electrical canisters	306	306
Flange O-rings	185	80
Expansion bellows	1,183	1,183
TOTAL	13,116	11,691

Significant leakage was found on only six penetrations. One stabilizer access port (testable gasket, penetration 58A) had a leakage of 1,300 sccm. Two vent line expansion bellows (penetrations 201A and 201H) had leakages of 510 and 163 sccm and the residual heat removal (RHR) pump discharge expansion bellows had a leakage of 180 sccm. No maintenance action was performed on these penetrations. The drywell head access port also had significant (240 sccm) initial leakage. Because of its accessibility, this hatch was repaired and retested later at 0 sccm leakage. The access hatch (testable gasket, penetration 200B) had an initial leakage of 1,100 sccm. After gasket replacement, this leakage was reduced to less than 20 sccm.

The flange O-rings on valves CV-4300, CV-4302, CV-4304, CV-4305, CV-4307, and CV-4308 were retested after replacement of the valve T-rings. The T-rings were replaced in accordance with DAEC commitments to the NRC.

6.2 VALVE TESTING

6.2.1 Containment Isolation Valve Testing (Type C)

Testing of valves required to be Type C-tested began on February 11, 1983, with testing of the MSIVs and ended on April 26, 1983. Testing was performed in accordance with DAEC STP 47A005. The tests in this category may be subdivided into tests done with water and tests done with air. Valves were tested with water if the valves would be submerged under accident conditions. The final leakage results for each are as follows.

Air-tested valves, sccm	68,752
Water-tested valves, sccm	25,579
TOTAL	94,331

Six of the eight MSIVs exhibited acceptable leakage rates in the as-found condition. The two MSIVs (inboard and outboard) on the B steam line exhibiting high as-found leakage rates were repaired by grinding the seats and valve disks using a newly acquired Rockwell tool for the first time. The B inboard and outboard MSIVs were successfully retested on March 24, 1983. In addition, all outboard MSIV actuators were rebuilt and the air control assemblies reworked on all eight valves. A detailed discussion of the MSIV repairs is provided in Appendix D.

Although the as-found leakage rates were acceptable, the seat rings (T-rings) were replaced on nine large butterfly valves in accordance with NRC commitments. The valves were satisfactorily retested following seat ring replacement.

A number of control valves were repaired by lapping the valve seats. These include wellwater A, wellwater B, nitrogen compressor discharge, recirculation pump A seal, and recirculation pump B seal.

Steam line drain valves MO-4423 and MO-4424 exhibited high initial leakage rates and were repaired by lapping the valve seats. These valves were tested prior to the integrated leak rate test (ILRT) and were found to have low leakage after the valves were manually tightened. A satisfactory LLRT test was performed on these valves after the ILRT test. The LLRT results were added to the ILRT results.

6.2.2 Inservice Inspection (RTS-112)

Testing of these valves was performed in accordance with DAEC STP 47A005. The tests in this category may be subdivided into tests done with air and tests done with water. The final leakage results for each are as follows.

Air-tested valves, sccm	14,456
Water-tested valves, sccm	15,838
TOTAL	30,294

The check valves in the standby liquid control system exhibited high initial leakage rates. The valve seats were lapped resulting in a reduction of leakage from 61,000 to 7,200 sccm.

6.2.3 Miscellaneous Valve Testing

The nitrogen accumulator check valves of the inboard MSIVs, outboard MSIVs, ADS, and torus vacuum breakers were tested in accordance with STP 47A005. The test results were satisfactory.

In compliance with the DAEC commitments in response to IE Bulletin 80-1, the ADS accumulator check valves were leak-tested in accordance with Special Test Procedure 70. Check valve V-14-9 exhibited high initial leakage rates and was repaired by lapping the valve seats.

6.2.4 Procedure Changes

Many DCFs were issued to the LLRT procedures (STP 47A003, 47A004, and 47A005). Appendix E lists the DCFs.

Deviation reports for STP 47A005 performance were issued for valves with high leak rates. A listing of these reports is provided in Appendix F.

APPENDIX A

TYPE B LOCAL LEAK RATE TEST RESULTS

Penetration	Description	Leakage (sccm)	Comments
1	Personnel lock doors and penetrations	8,287	--
2	Equipment access	<20	Note 1
4	Head access	<20	As-found leakage equals 240 sccm, replaced gasket and reopened, retested April 25, 1983
6	CRD removal hatch	<20	Reopened, retested May 1, 1983 (Note 1)
35A	TIP drives	<20	Note 1
35B	TIP drives	<20	Note 1
35C	TIP drives	<20	Note 1
35D	TIP drives	<20	Note 1
53	Spare	<20	Note 1
--	Drywell head	<20	Note 1
58A	Stabilizer access ports	1,300	--
58B	Stabilizer access ports	<20	Note 1
58C	Stabilizer access ports	215	--
58D	Stabilizer access ports	<20	Note 1
58E	Stabilizer access ports	<20	Note 1
58F	Stabilizer access ports	<20	Note 1
58G	Stabilizer access ports	<20	Note 1
58H	Stabilizer access ports	<20	Note 1
200A	Access hatch	0	As-found leakage <20 sccm, retested April 16, 1983
200B	Access hatch	<20	As-found leakage equals 1,100 sccm, replaced gasket, retested April 28, 1983

Appendix A (continued)

Penetration	Description	Leakage (sccm)	Comments
100B	Neutron monitoring	<20	Note 1
100C	Neutron monitoring	<20	Note 1
100E	Neutron monitoring	0	Note 2
100F	Neutron monitoring	<20	Note 1
100G	RPV vibration monitoring	<20	Note 1
101A	Recirculating pump power	<20	Note 1
101C	Recirculating pump power	<20	Note 1
103	Thermocouples	0	Note 2
104A	CRD rod position indicator	0	Note 2
104B	CRD rod position indicator	0	Note 2
104C	CRD rod position indicator	<20	Note 1
104D	CRD rod position indicator	<20	Note 1
105B	Power and control	<20	Note 1
105D	Power and control	30	--
106A	Power and control	<20	Note 1
106C	Power and control	56	--
230B	Vacuum breakers electrical cables	<20	Note 1
25	Drywell purge outlet CV-4302	<20	Notes 1 and 4; as-found leakage equals 0 sccm, retested April 11, 1983
26	Drywell and torus purge supply CV-4307	0	Notes 2 and 4; as-found leakage equals 65 sccm, retested March 12, 1983
220	Drywell and torus purge supply CV-4308	0	Notes 2 and 4; as-found leakage equals 80 sccm, retested March 12, 1983
205	Torus purge outlet CV-4300	<20	Notes 1 and 4; as-found leakage equals 0 sccm, retested April 12, 1983
231	Torus vacuum breaker CV-4304	<20	Notes 1 and 4; as-found leakage equals <20 sccm, retested April 12, 1983
231	Torus vacuum breaker CV-4305	<20	Notes 1 and 4; as-found leakage equals <20 sccm, retested April 12, 1983
7A	Steam to turbine	0	Note 2
7B	Steam to turbine	0	Note 2
7C	Steam to turbine	0	Note 2
7D	Steam to turbine	<20	Note 1

Appendix A (continued)

Penetration	Description	Leakage (sccm)	Comments
9A	RPV feedwater	0	Note 2
9B	RPV feedwater	<20	Note 1
10	Steam to RCIC turbine	<20	Note 1
11	Steam to HPCI turbine	<20	Note 1
12	Shutdown pump supply RHR	<20	Note 1
13A	RHR pump discharge	180	--
13B	RHR pump discharge	<20	Note 1
15	RWCU supply	<20	Note 1
16A	Core spray pump discharge	<20	Note 1
16B	Core spray pump discharge	<20	Note 1
17	RPV head spray	<20	Note 1
201A	Vent line	510	--
201B	Vent line	<20	Note 1
201C	Vent line	<20	Note 1
201D	Vent line	<20	Note 1
201E	Vent line	0	Note 2
201F	Vent line	0	Note 2
201G	Vent line	70	--
201H	Vent line	163	--

Notes:

1. Lowest meter mark
2. Bubbler = 0 bubbles per minute
3. Test on inboard flange only of designated valves
4. T- and O-rings were replaced in accordance with NRC commitment.

APPENDIX B

TYPE C LOCAL LEAK RATE TEST RESULTS

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Valve Number/ Leakage (sccm) Outside	Maximum Penetration Leakage (sccm)
7-A	Main steam	C	1,000	CV-4412 0	CV-4413 850	850
7B	Main steam	C	1,000	CV-4415 400	CV-4416 (2)	400
7C	Main steam	C	1,000	CV-4418 0	CV-4419 1,700	1,700
7D	Main steam	C	1,000	CV-4420 0	CV-4421 360	360
8	Steam line drain	C	150	MO-4423 8,250	MO-4424 (2)	8,250
9-A	Feedwater	H	800	V-14-3 V-14-4 9,200(2)	MO-4441 MO-2312 V-14-4 560(2)	9,200
9-B	Feedwater	H	800	V-14-1 V-14-2 12,500(2)	MO-4442 V-14-2 MO-2740 2,420(2)	12,500

Appendix B (continued)

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Outside	Maximum Penetration Leakage (sccm)
10	RCIC condensate return	H	50	None	CV-2410 CV-2411 1,100(2)	1,100
10	RCIC steam	C	200	MO-2400	MO-2401 4,500 (2)	4,500
11	HPCI steam	C	500	MO-2238	MO-2239 0 (2)	0
11	HPCI condensate return	H	50	None	CV-2211 CV-2212 1,800(2)	1,800
12	RHR supply	H	900	MO-1908	MO-1909 130 (2)	130
15	Reactor water cleanup	C	200	MO-2700	MO-2701 160 (2)	160
16-A	Core spray	H	400	None	MO-2117 MO-2115 128 (2)	128
16-B	Core spray	H	400	None	MO-2135 MO-2137 593 (2)	593

Appendix B (continued)

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Outside	Maximum Penetration Leakage (sccm)
19	Drywell drain	C	150	None	CV-3704 CV-3705 110 (2)	110
22 and 229-A	Containment compressor	C	100		CV-4371C 710 CV-4371A 0	
				V-43-214	CV-4371C 1,300 (2)	2,010
23-A	Well water supply	C	200	V-57-62	CV-5718A CV-5719A 1,650 (2)	1,650
23-B	Well water supply	C	200	V-57-61	CV-5718B CV-5719B 11,500 (2)	11,500
24-A	Well water return	C	200	None	CV-5703A CV-5704A 8,500(2)	8,500
24-B	Well water return	C	200	None	CV-5703B CV-5704B 1,800(2)	1,800

Appendix B (continued)

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Valve Number/ Leakage (sccm) Outside	Maximum Penetration Leakage (sccm)
25	Drywell purge	C	900	None	CV-4302 CV-4303 CV-4310 150 (2)	150
26 and 220	Drywell and torus purge	C	900	None	CV-4306 CV-4307 CV-4308 0 (2)	0
26 and 220	Drywell and torus nitrogen makeup	C	900	None	CV-4311 CV-4312 CV-4313 6,000(2)	6,000
32-D	Containment compressor	C	100	None	CV-4378A 140 CV-4378B 60	140
32-E	Recirculating pump A seal	C	50	V-17-84 V-17-96 155 (2)	CV-1804B V-17-84 128 (2)	155
32-F	Recirculating pump B seal	C	50	V-17-80 V-17-83 1,400(2)	CV-1804A V-17-80 85 (2)	1,400
36	CRD return	H	150	V-17-53 128	V-17-52 128	128

Appendix B (continued)

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Outside	Maximum Penetration Leakage (sccm)
40-D	Jet pump coolant	C	50	None	SV-4594A 18 SV-4594B 0	18
41	Recirculation loop sample	C	50	CV-4639	CV-4640	9,200
				9,200 (2)		
46-F	Oxygen analyzer	C	50	None	SV-8105B 0 SV-8106B 0	0
48	Drywell drain discharge	C	150	None	CV-3728 CV-3729 0 (2)	0
50-B	Oxygen analyzer	C	50	None	SV-8101A 20 SV-8102A 0	20
50-D	Oxygen analyzer	C	50	None	SV-8105A 20 SV-8106A 20	20

Appendix B (continued)

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Outside	Maximum Penetration Leakage (sccm)
50-E	Oxygen analyzer	C	50	None	SV-8103A 0 SV-8104A 0	0
54	Closed cooling water return	C	200	V-12-64 V-12-65 V-12-68 19 (2)	MO-4841A	19
55	Closed cooling water supply	C	200	V-12-62 V-12-63 V-12-66 19 (2)	MO-4841B	19
56-C	Oxygen analyzer	C	50	None	SV-8101B 0 SV-8102B 0	0
229-H	PASS sample return	C	50	None	SV-8772A SV-8772B 57 (2)	57
56-D	Oxygen analyzer	C	50	None	SV-8103B 0 SV-8104B 0	0

Appendix B (continued)

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Outside	Maximum Penetration Leakage (sccm)
205	Torus purge out	C	900	None	CV-4300 CV-4301 0 (2) CV-4309 128	128
219	HPCI/RCIC exhaust vacuum breaker	C	100	None	V-22-60 MO-2290A 450 (2) V-22-60 MO-2290B 400 (2)	450
229-B	Oxygen analyzer	C	50	None	SV-8107A 128 SV-8108A 0	128
229-C	Oxygen analyzer	C	50	None	SV-8109A 110 SV-8110A 120	120
229-4	Oxygen analyzer	C	50	None	SV-8109B 0 SV-8110B 19	19

Appendix B (continued)

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Outside	Maximum Penetration Leakage (sccm)
229-G	Oxygen analyzer	C	50	None	SV-8107B 19 SV-8108B 19	19
231	Vacuum breaker	C	1,000	None	CV-4304 V-43-169 7,000(2)	7,000
231	Vacuum breaker	C	1,000	None	CV-4305 V-43-168 1,900(2)	1,900

Notes:

(1)Type C = lines are drained
Type H = lines are water-filled (hydrotested)
(2)Above valves were tested together

APPENDIX C

TYPE C NON-TECHNICAL SPECIFICATION/ISI TEST RESULTS
(RTS-112/ASME)

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Valve Number/ Leakage (sccm) Outside	Maximum Penetration Leakage (sccm)
39A	CAD supply	C	100	None	SV-4332A 0 SV-4332B 0	0
39B	CAD supply	C	100	None	SV-4331A 49 SV-4331B 52	52
211A	CAD supply	C	100	None	SV-4333A 1,400 SV-4333B 1,400	1,400
211B	CAD supply	C	100	None	SV-4334A 5,400 SV-4334B 5,400	5,400
20	Demineralizer water	C	50	V-09-111	V-09-65 20 (2)	20
X-21	Service air	C	50	Blind flange	V-30-287 128	128

Appendix C (continued)

Penetration	Description	(1) Type	Desired	Valve Number/ Leakage (sccm) Inside	Valve Number/ Leakage (sccm) Outside	Maximum Penetration Leakage (sccm)
212	RCIC turbine exhaust	H	500	None	V-24-23 V-24-8 210 (2)	210
214	HPCI turbine exhaust	H	800	None	V-22-16 V-22-17 15,500(2)	15,500
222	HPCI condensate	H	100	None	V-22-21 V-22-22 128 (2)	128
35	TIP valves	C	200	None	(four) 128	128
42	Standby liquid control	C	75	V-26-9 2,530	V-26-8 7,200	7,200
X-17	RHR	C	200	MO-1900 128 (2)	MO-1901	128

Notes:

(1)Type C = lines are drained
Type H = lines are water-filled (hydrotested)
(2)Above valves were tested together

0156E

DAEC MSIV ACTIVITIES, 1983 REFUELING OUTAGE

BACKGROUND

Two of the eight main steam isolation valves (MSIVs) exhibited high leakage rates in the as-found condition at the start of the LLRT conducted during the 1983 refueling outage. These two valves were repaired and successfully retested.

VALVE SEAT REPAIR

Rework of the valves included remachining the main valve disks on the lathe, lapping the stem disk to stem disk seat, and machining the main valve body seat using the new Rockwell FM4-89 portable field machine. The lather tool for this machine was used to reduce the valve seat width and the air grinder was used to grind the valve seating surface.

The valve bores were measured using inside micrometers and runout measurements on the seat and guide ribs were made using a tool bar with a dial indicator. Runout on the valve seat was also measured using a dial indicator on the FM4-89 machine. The two valves were compared and used to verify alignment. Runout for the main disk and the main seat were within 0.003 TIR.

VALVE OPERATOR REWORK

In addition to the valve seat repair, four of the valve operators were refurbished, including the change of hydraulic oil to GE SF-1147 fluid. The Shell iris oil that was removed had separated, but the seals and other internal components were still adequately lubricated. Some units did show oxidation in the accumulator area.

The air control assemblies on all eight MSIVs were disassembled and refurbished during this outage. The ASCo air solenoids were not disassembled because they had been changed out within the last 3 years for environmental qualification reasons.

SUMMARY

The MSIV work accomplished during this outage completes the valve refurbishment that was planned 18 months ago. DAEC will now follow the preventive maintenance program that was recommended and rework two to three valves each refueling outage (all eight valves to be redone every 5 years).

DOCUMENT CHANGE FORMS
STP 47A005

DCF	Penetration	Pages
*4707	X-40D	11, 16, 148a through 148e
4872	X-7A, X-7B, X-7C, X-7D	21 through 40
4873	N-229H	13, 18d, 353 through 360
4927	X-21	331 through 333
4928	X-7A, X-7B, X-7C, X-7D	21 through 40
4997	X-10	61 through 64
5001	N219	343 through 345
5033	X-22/N-229A	278 through 281
5036	X-26	125 through 128
5037	X-24A	109 through 112
5038	X-48	161 through 164
5040	Appendix I	--
5041	X-24A	109 through 112
5052	Special Test Procedure 71	--
5074	Appendix I	--
*5075	Appendix II (MSIV)	--
5088	Special Test Procedure 70	--
5089	Appendix II (MSRV)	--
5109	X-12	77 through 80
5121	Appendix III	--
5122	Appendix III	--
*5156	Appendix II (MSIV)	--
5200	X-15	81 through 84
*5205	X-17	349 through 352
5209	X-25	117 through 120
*5213	X-25	117 through 120
*5221	X-24B	113 through 116
5222	X-7B	26 through 30
5224	X-25	117 through 120
5235	X-10	65 through 68
5238	X-10	65 through 68
5344	X-15	81 through 84
5345	X-32F	137 through 140
5358	Appendix II (MSRV)	--
5359	Appendix II	Same DCF as 5358

DCFs (continued)

DCF	Penetration	Pages
*5472	Special Test Procedure 71	--
5604	--	348a through 348d
**4979	All	--
**4988	All	--
***5543	X-1	--
***5391	X-1	--

*These DCFs can be found with the actual test procedures.
**These DCFs were written for STP 47A003.
***These DCFs were written for STP 47A004.

DEVIATON REPORTS
STP 47A005*

Deviation Report	Description
83-110	Penetration X-7B (MSIV) CV-4415 and CV-4416
83-111	Penetration 42 (standby liquid control) V-26-9
83-112	Penetration X-10 (RCIC steam supply) MO-2400 and MO-2401
83-113	Penetration X-8 (steam line drain) MO-4423 and MO-4424
83-114	Penetration X-23B (drywell water cooling supply) CV-5718B, CV-5719B, and V-57-61
83-115	Penetration X-26, N-220 (drywell and torus nitrogen makeup) CV-4311
83-116	Penetration X-23A (drywell water cooling supply) CV-5718A, CV-5719A, and V-57-62

*No deviation reports were written for STP 47A003 or STP 47A004.

TABLE 1

COMBINED LEAKAGE RATE SUMMARY

	As-Found (sccm)	After Repair (sccm)
MSIVs (four penetrations)	121,910	3,310
Other Type C	366,109	91,021
Total Type C	488,019	94,331
Personnel airlock (5/5/83)	8,287	8,287
Other Type B	4,829	3,404
Total Type B	13,116	11,691
Combined Leakage Rate	501,135	106,022
Acceptance Criteria (0.60 L_a)	220,532	220,532

TABLE 2

FLOWMETER CALIBRATION DATA

Instrument	Manufacturer	Meter Calibrated Range (sccm) 14.7 psia/70F	24 psig/70F	54 psig/70F	Calibrated By	Calibration Date
P-146	Brooks	393-5046	798-9140 (Note 1)	--	Homer R. Dulin Co	3-24-83
P-147	Brooks	46-821	114-1625 (Notes 1,2)	200-2200	Homer R. Dulin Co	3-24-83
P-148	Brooks	7.6-64.7	15-79	26-234	Iowa Electric (IE) instrument technicians	2-4-83
P-231	Brooks	52-332	82-557	128-844	IE instrument technicians	1-28-83
P-232	Brooks	8-263	14.2-527	18.3-805	IE instrument technicians	2-1-83
P-233	Brooks	5-52	14-122	Note 2	IE instrument technicians	2-6-83
P-234	Brooks	115-4437	280-5225	392-5076	IE instrument technicians	2-2-83
P-235	Brooks	102-2901	162-4123	206-5736	IE instrument technicians	2-2-83
P-236	Brooks	332-2364	602-4094	889-5541	IE instrument technicians	1-28-83
P-237	Brooks	981-4797	1530-5383	2143-5225	IE instrument technicians	2-2-83
P-238	Brooks	849-4973	1455-5291	2032-6139	IE instrument technicians	2-1-83
P-239	Brooks	998-5225	1549-5383	2104-5928	IE instrument technicians	2-2-83
P-257	Brooks	500-43,500	1000-73,000	2000-98,000	Brooks	1-7-83
P-258	Brooks	500-44,000	1000-73,000	2000-100,000	Brooks	1-7-83
P-259	Brooks	500-43,500	1000-72,000	2000-98,000	Brooks	1-7-83
P-260	Brooks	500-43,500	1000-73,000	2000-98,000	Brooks	1-7-83

Notes:

1. Calibrated at 27 psig at 70F
2. Direct scale readout in sccm at 54 psig at 70F

0152E

TABLE 3

VALVE REPAIR SUMMARY

Valve	Penetration	Service	Leakage (sccm) As-Found	Leakage (sccm) After Repair	Problem/Repair Description/Remarks
CV-4415	X-7B	MSIV	119,000*	--	Ground valve seat/disk reworked actuator
CV-4416	X-7B	MSIV	23,500*	--	Ground valve seat/disk reworked actuator
				400	After repair CV-4415 and CV-4416 tested together
MO-4423	X-8	Steam line drain			Lapped valve seat, adjusted motor actuator torque switches
MO-4424	X-8	Steam line drain	--	--	Lapped valve seat, adjusted motor actuator torque switches
			122,200*	8,250	MO-4423 and MO-4424 tested together
MO-2400	X-10	RCIC steam supply	--	--	Adjusted motor actuator torque switches
MO-2401	X-10	RCIC steam supply	--	--	Adjusted motor actuator torque switches
			35,750*	4,500	MO-2400 and MO-2401 tested together
MO-2238	X-11	HPIC steam supply	350	0	Repaired galled shaft in motor actuator
CV-4371C	N-229A	Nitrogen compressor discharge	9,200	710	Lapped valve seat
CV-5718A	X-23A	Drywell water supply A	--	--	Sand encountered in initial test, lapped valve seat
CV-5719A	X-23A	Drywell water supply A	--	--	Sand encountered in initial test, lapped valve seat
			62,500*	1,650	CV-5718A and CV-5719A tested together

Table 3 (continued)

Valve	Penetration	Service	Leakage (sccm) As-Found	Leakage (sccm) After Repair	Problem/Repair Description/Remarks
CV-5718B	X-23B	Drywell water supply B	--	--	Lapped valve seats, exercised CV-5719B
CV-5719B	X-23B	Drywell water supply B	--	--	Lapped valve seats, exercised CV-5719B
			32,000*	11,500	CV-5718B and CV-5719B tested together
CV-4302	X-25	Drywell purge	--	--	Replaced O-rings and T-rings in accordance with prior commitment, reworked pneumatic actuator
CV-4303	X-25	Drywell purge	--	--	
			50	150	CV-4302 and CV-4303 tested together
CV-4306	X-26/N-220	Drywell and torus purge	--	--	Replaced O-rings and T-rings in accordance with prior commitment, reworked pneumatic actuator
CV-4307	X-26/N-220	Drywell and torus purge	--	--	Replaced O-rings and T-rings in accordance with prior commitment, reworked pneumatic actuator
CV-4308	X-26/N-220	Drywell and torus purge	--	--	Replaced O-rings and T-rings in accordance with prior commitment, reworked pneumatic actuator
			1,670	0	CV-4306, CV-4307, and CV-4308 tested together
CV-4311	X-26/N-220	Drywell and torus nitrogen makeup	31,000**	6,000	Valve exercised but not repaired
CV-1804B	X-32E	Recirculation pump A seal	10,500	0	Lapped valve seat
CV-1804A	X-32F	Recirculation pump B seal	12,000	85	Lapped valve seat
V-26-8	X-42	Standby liquid control	10,200	7,200	Lapped valve seats (V-26-8, two times; V-26-9, three times)

Table 3 (continued)

Valve	Penetration	Service	Leakage (sccm) As-Found	Leakage (sccm) After Repair	Problem/Repair Description/Remarks
V-26-9	X-42	Standby liquid control	61,000*	2,530	Lapped valve seats (V-26-8, two times; V-26-9, three times)
CV-4300	N-205	Torus purge outlet	--	--	Replaced O-rings and T-ring in accordance with prior commitment, reworked pneumatic actuator
CV-4301	N-205	Torus purge outlet	--	--	Replaced O-rings and T-ring in accordance with prior commitment, reworked pneumatic actuator
			0	0	CV-4300 and CV-4301 tested together
V-22-16	N-214	HPCI turbine exhaust	--	--	Lapped valve seat
V-22-17	N-214	HPCI turbine exhaust	--	--	Lapped valve seat
			13,830	15	V-22-16 and V-22-17 tested together
CV-4304	N-231	Torus vacuum breaker	--	--	Replace O-rings and T-ring in accordance with prior commitment, reworked pneumatic actuator
CV-4305	N-231	Torus vacuum breaker	--	--	Replace O-rings and T-ring in accordance with prior commitment, reworked pneumatic actuator
			520	7,000	CV-4304 and CV-4305 tested together

*Deviation report submitted.

**No deviation report was written because CV-4311 was cycled immediately after initial test and retested at an acceptable leakage.

FIGURE 1

LOCAL LEAKAGE RATE TESTING UNIT

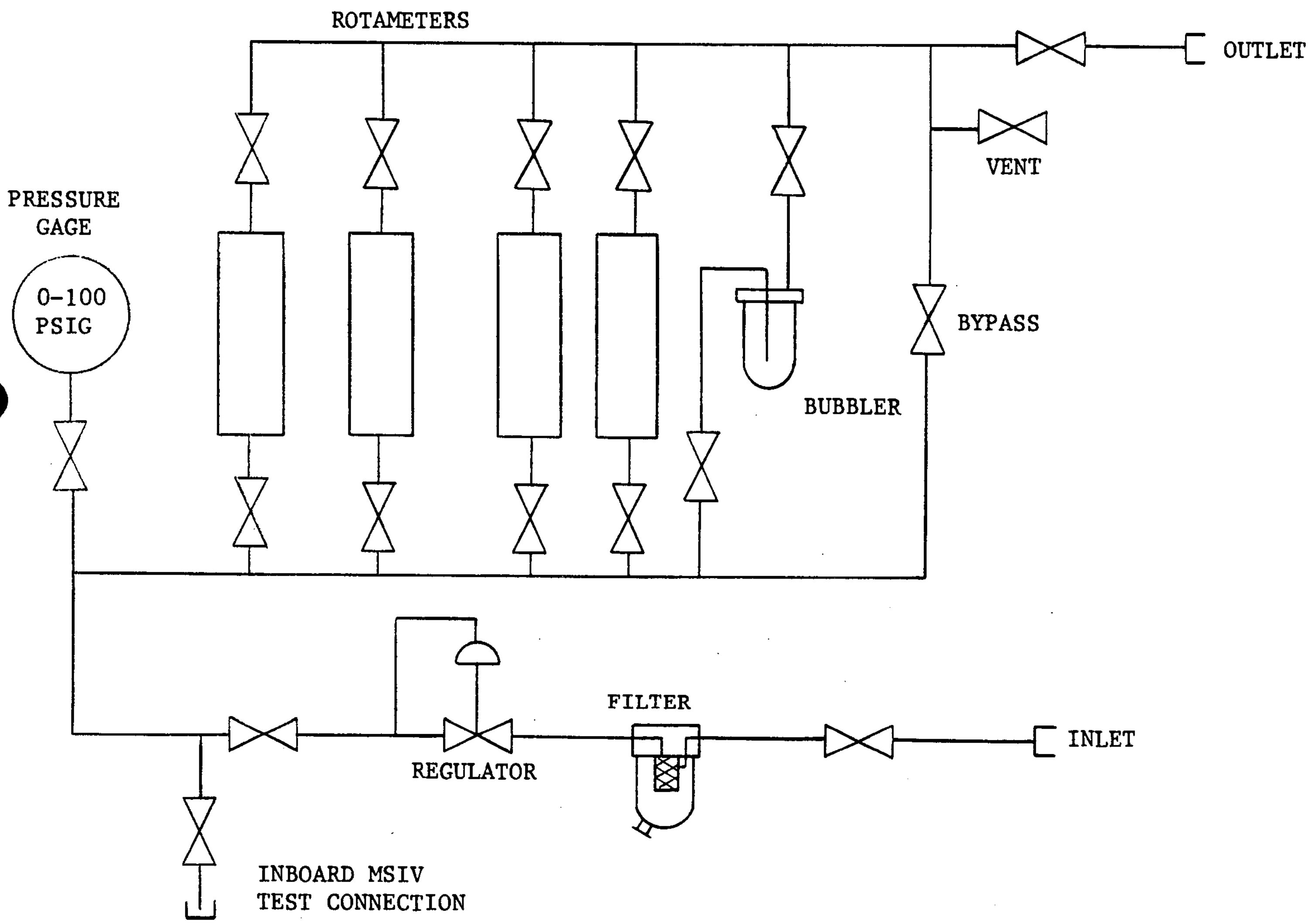

FIGURE 2

WATER TEST UNIT