November 15, 1996

MEMORANDUM TO: File

FROM: Joseph F. Williams, Project Manager /s/
Project Directorate II-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

SUBJECT: INFORMATION REGARDING SAFETY/RELIEF VALVE PERFORMANCE OBTAINED DURING SITE VISIT - BROWNS FERRY NUCLEAR PLANT UNIT 2

During a site visit on November 5, 1996, Tennessee Valley Authority (TVA) personnel briefed me regarding safety/relief valve (S/RV) test results obtained following the Browns Ferry Nuclear Plant Unit 2 reactor scram on October 29, 1996. This preliminary data (enclosed) is being provided to other NRC staff members for their information. Therefore, it is appropriate to place the information in the Public Document Room.

TVA is expected to document final test results in Licensee Event Reports discussing the scram and the subsequent S/RV test program.

Docket No. 50-260

Enclosure: S/RV Test Results

cc w/enclosure: C.G. Hammer, EMEB
M.S. Wegner, AEOD

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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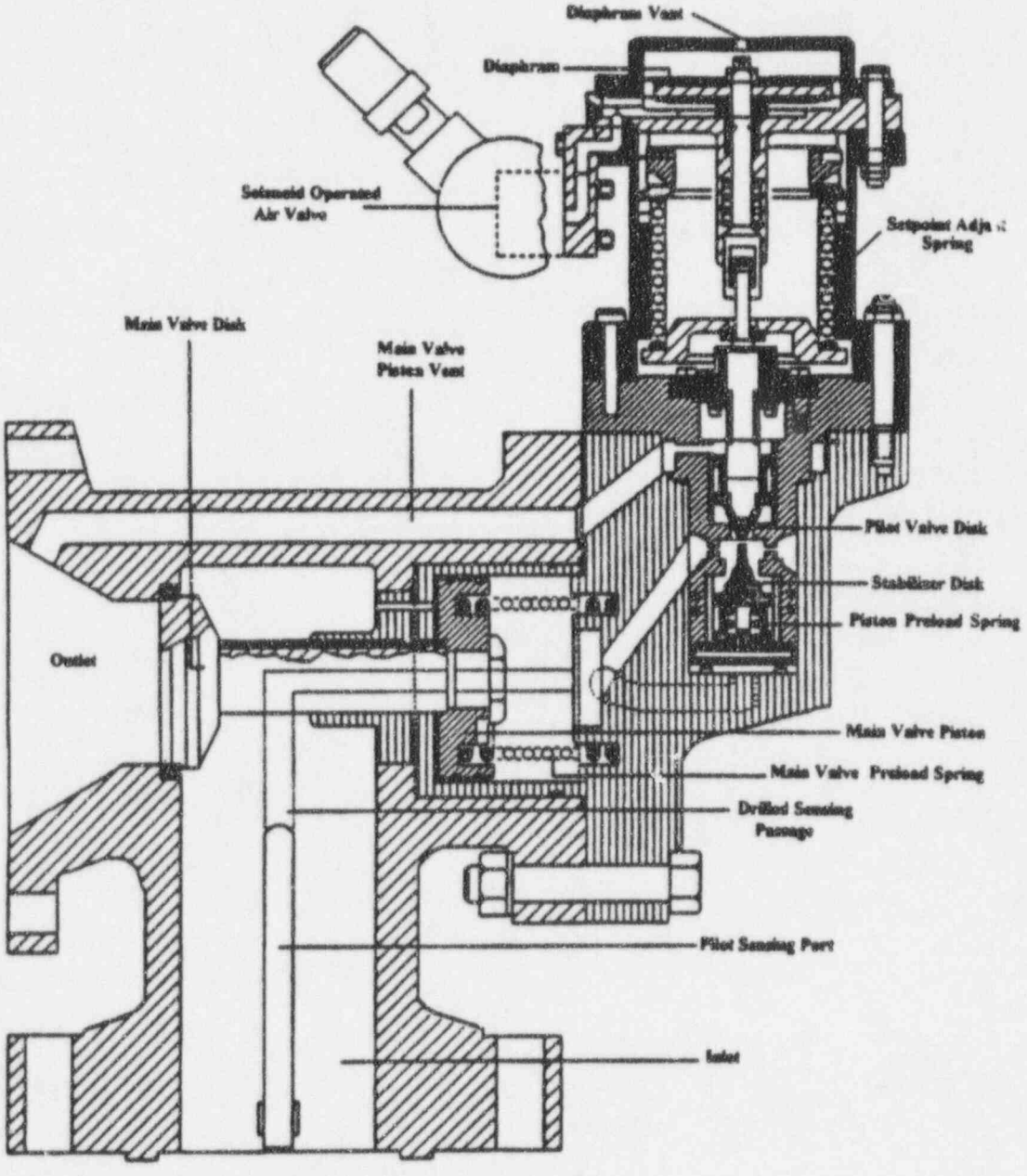
SAFETY/RELIEF VALVE

PRELIMINARY TEST RESULTS

ENCLOSURE

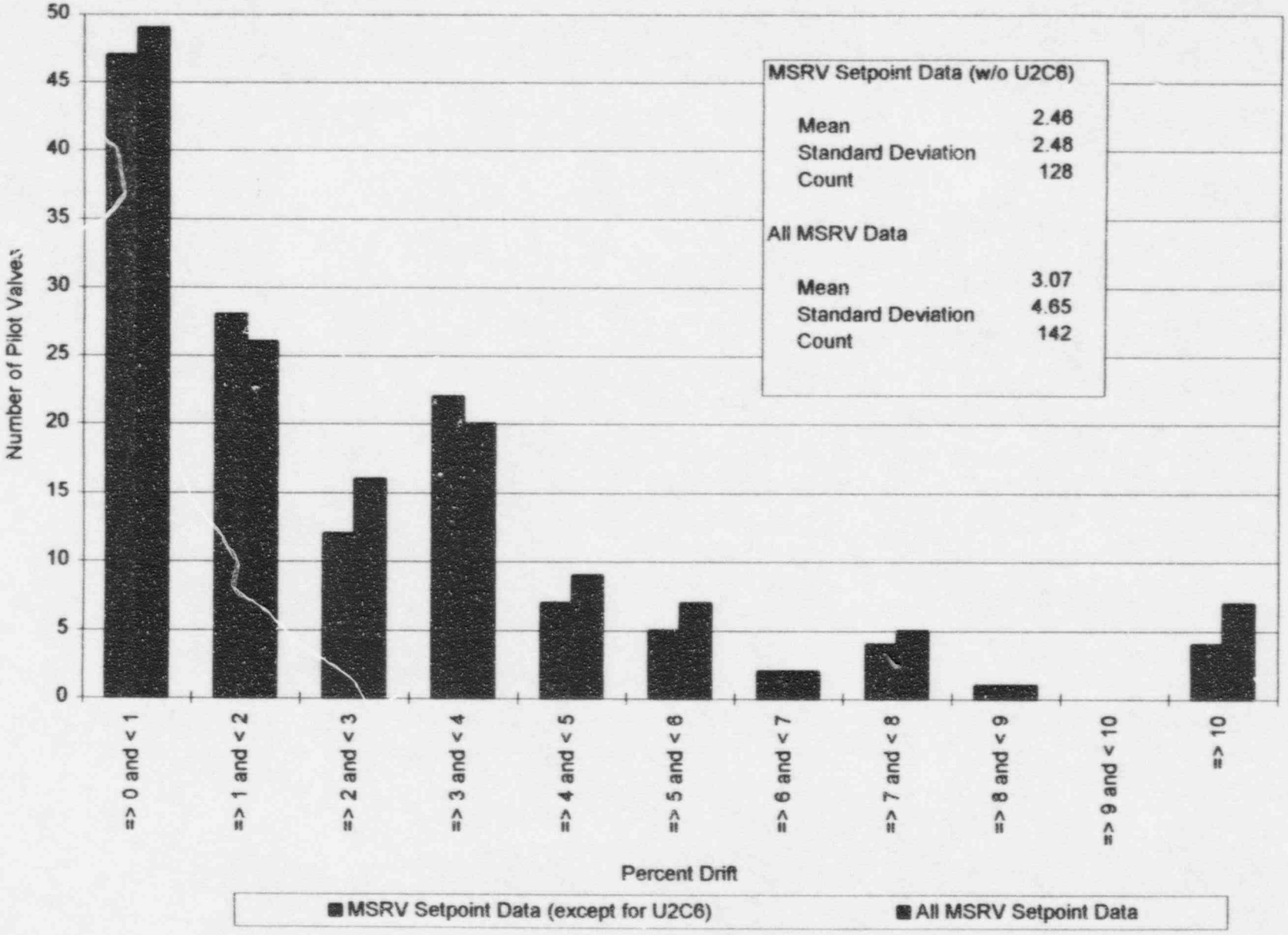

Diaphragm Vent
Diaphragm
Solenoid Operated
Air Valve
Setpoint Adjustment
Spring
Main Valve Disk
Main Valve
Piston Vent
Pilot Valve Disk
Stabilizer Disk
Piston Preload Spring
Outlet
Main Valve Piston
Main Valve Preload Spring
Drillot Sensing
Passage
Pilot Sensing Port
Inlet

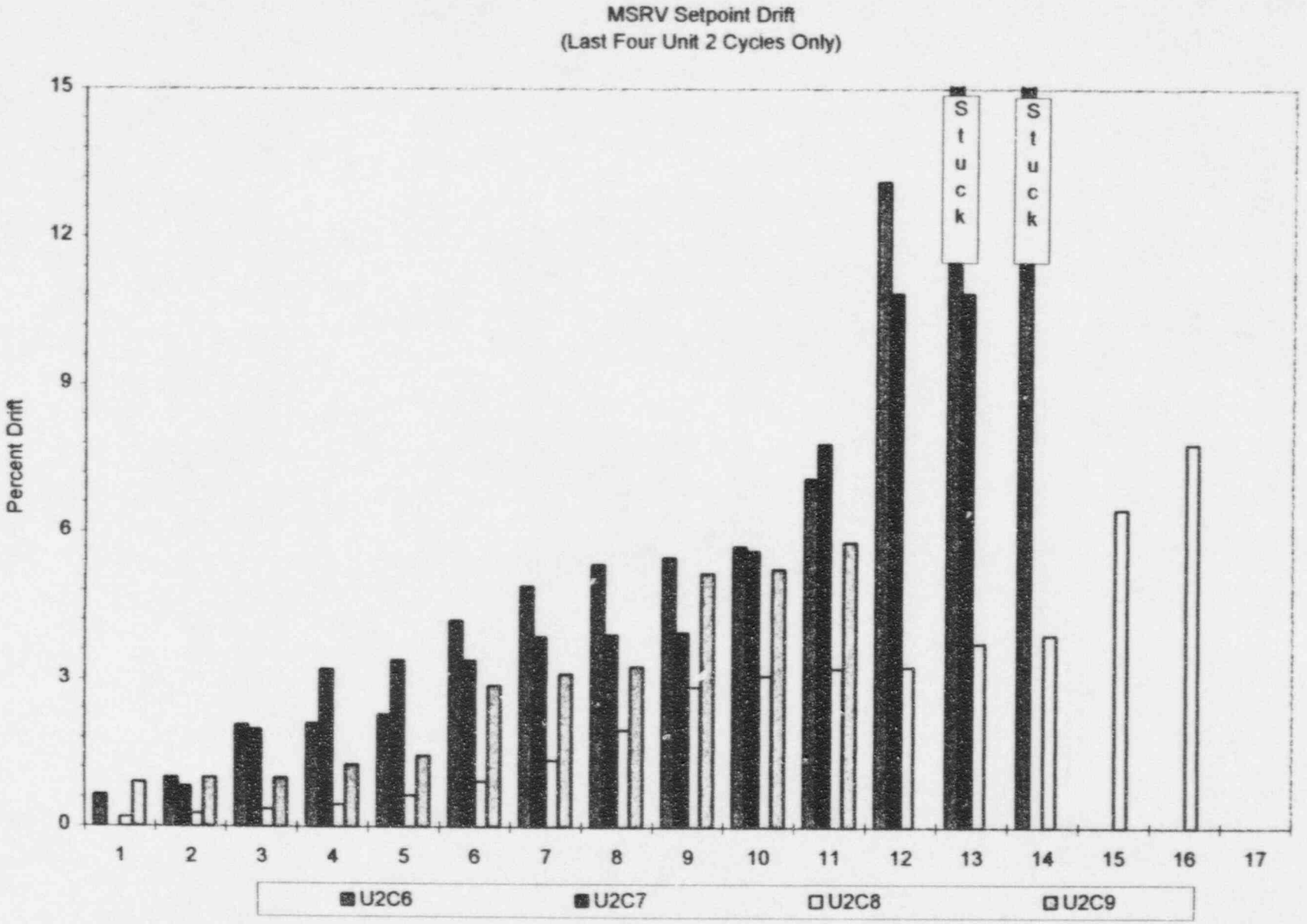
Valve Position	Setpoint	Serial Number	Test Type	Service Period From	Service Period To	Pilot Disc Composition	Setpoint (psig) 1st	2nd	3rd	4th	5th	6th	Setpoint Deviation	Pilot Leakage (ml / 5 min) Pre-Leak	Post-Leak	Notes
2-PCV-01-004	1125	1078	As-Found	4/23/96	10/29/96	Stellite	1135	ND	ND	ND	ND	ND	0.89	ND	ND	
2-PCV-01-005	1115	1017	As-Found	4/23/96	10/29/96	Stellite	1240	ND	ND	ND	ND	ND	11.21	ND	ND	
2-PCV-01-018	1115	1079	As-Found	4/23/96	10/29/96	Pt-Stellite	1147	1127	1123	1126	1121	ND	2.87	ND	ND	
2-PCV-01-019	1105	1072	As-Found	4/23/96	10/29/96	Stellite	1183	ND	ND	ND	ND	ND	7.06	ND	ND	
2-PCV-01-022	1115	1232	As-Found	4/23/96	10/29/96	Stellite	1129	ND	ND	ND	ND	ND	1.26	ND	ND	
2-PCV-01-023	1105	1084	As-Found	4/23/96	10/29/96	Stellite	1169	ND	ND	ND	ND	ND	5.79	ND	ND	
2-PCV-01-030	1115	1061	As-Found	4/23/96	10/29/96	Stellite	1131	ND	ND	ND	ND	ND	1.43	ND	ND	
2-PCV-01-031	1105	1031	As-Found	4/23/96	10/29/96	Stellite	1141	1128	1119	1117	ND	ND	3.26	ND	ND	
2-PCV-01-034	1105	1060	As-Found	4/23/96	10/29/96	Stellite	1163	ND	ND	ND	ND	ND	5.25	ND	ND	
2-PCV-01-041	1125	1015	As-Found	4/23/96	10/29/96	Pt-Stellite	1183	ND	ND	ND	ND	ND	5.16	ND	ND	
2-PCV-01-042	1125	1032	As-Found	4/23/96	10/29/96	Pt-Stellite	1160	ND	ND	ND	ND	ND	3.11	ND	ND	
2-PCV-01-179	1125	1064	As-Found	4/23/96	10/29/96	Stellite	1136	ND	ND	ND	ND	ND	0.98	ND	ND	
2-PCV-01-180	1125	1071	As-Found	4/23/96	10/29/96	Stellite	1136	ND	ND	ND	ND	ND	0.98	ND	ND	
							As of 0700 on 11/04/96, two valves still needed to be certified.									
							ND - data is not currently available. Will be obtained from Wyle test report and/or 0-SI-4.6.D.1									

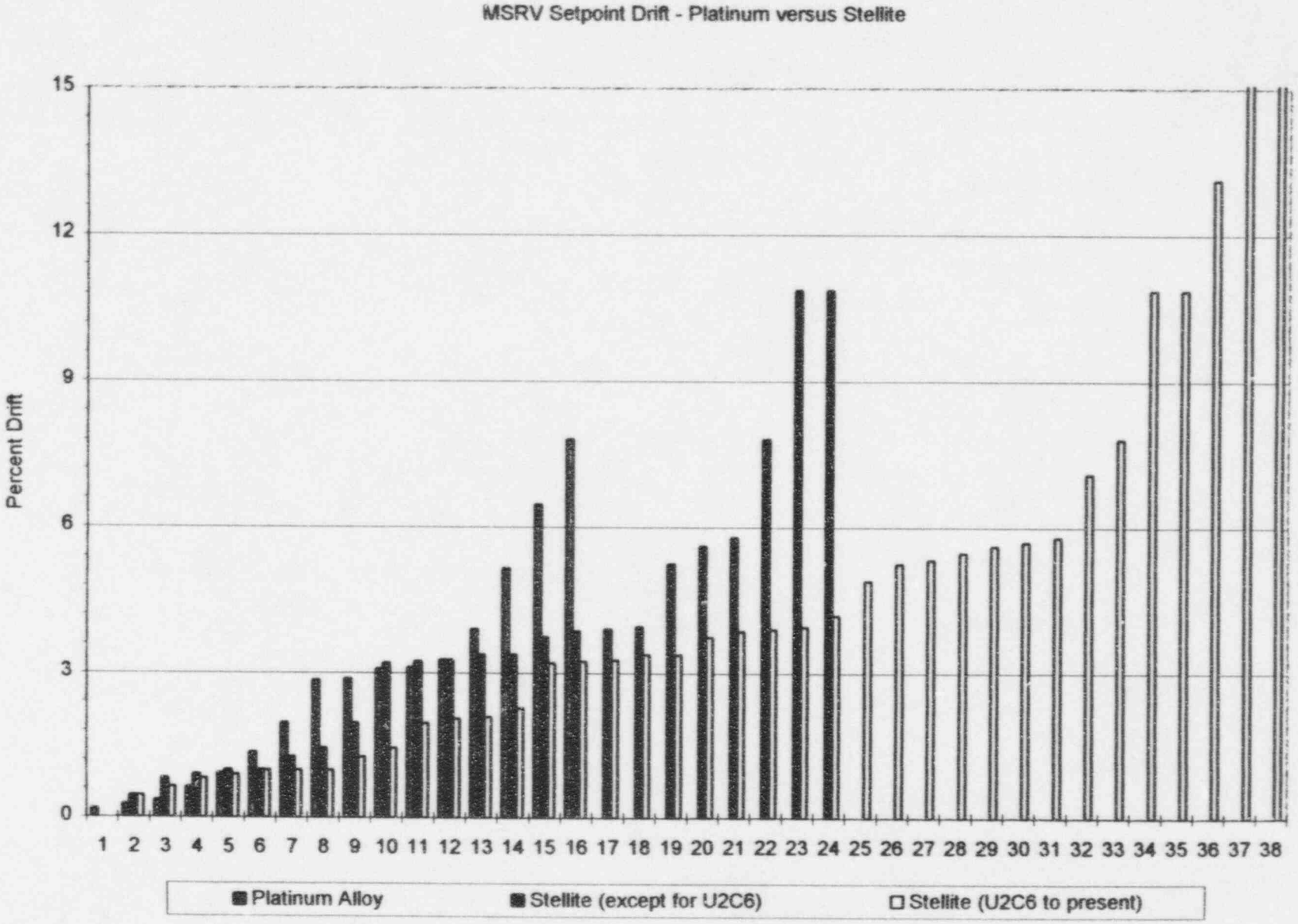
	Cycle 3 (All BFN Units)	Cycle 4 (All BFN Units)	Cycle 5 (All BFN Units)	Unit 2 Cycle 6 (With)	Unit 2 Cycle 6 (Without)	Unit 2 Cycle 7	Unit 2 Cycle 8	Unit 2 Cycle 9	Stellite	Pt-Stellite
Mean	2.41	1.73	2.29	8.86	4.48	4.56	2.52	3.79	3.11	2.76
Standard Deviation	2.09	2.5	2.25	11.57	3.42	3.4	2.25	3.05	4.81	2.25
Number	21	35	36	14	12	13	16	13	130	16

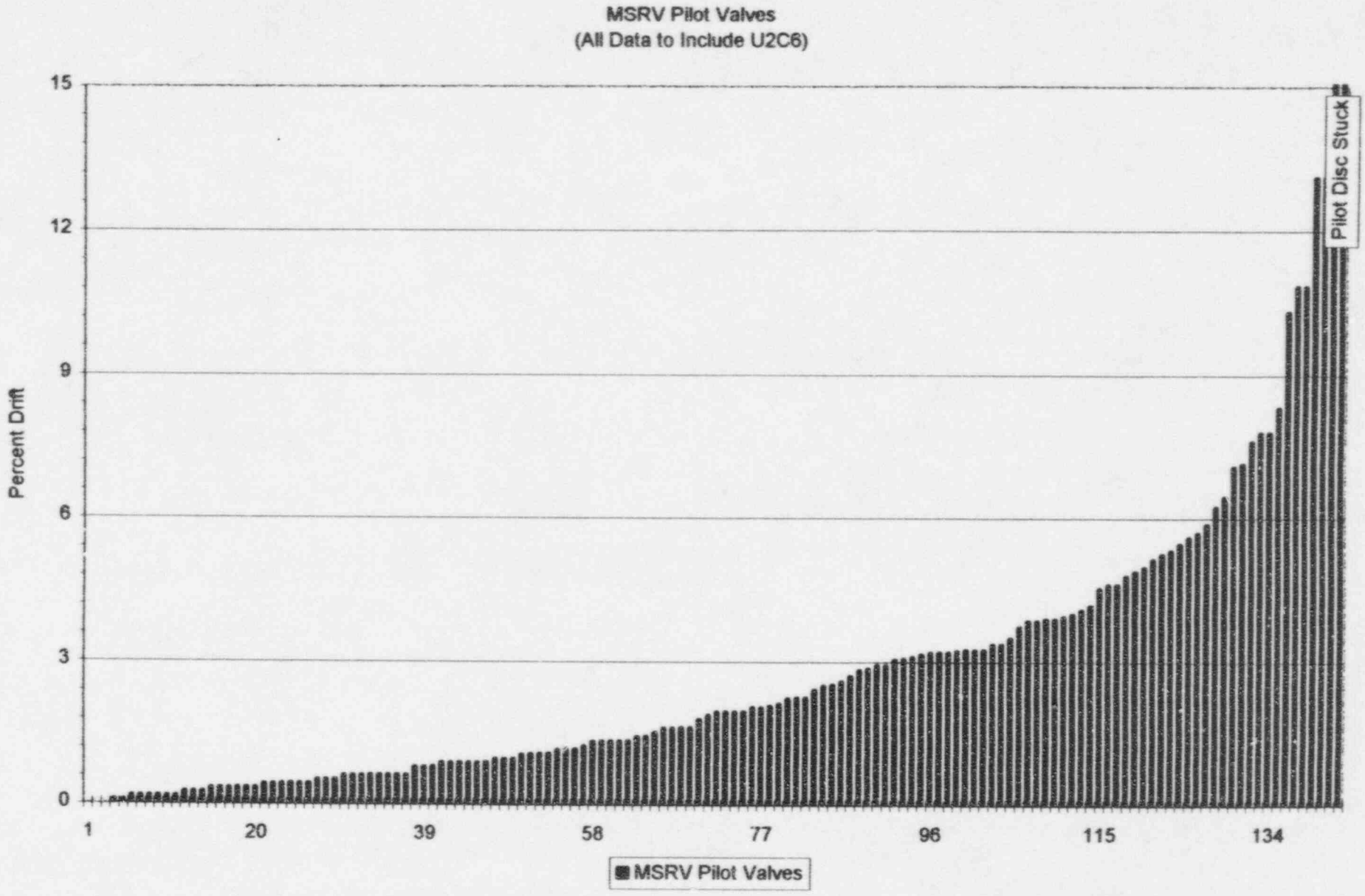
	U2C3				U2C4				U2C5				U2C6	
Setpoint	First Pop	Drift Percent		Setpoint	First Pop	Drift Percent		Setpoint	First Pop	Drift Percent		Setpoint	First Pop	Drift Percent
1125	1125	0.00		1115	1114	0.09		1105	1105	0.00		1115	1108	0.63
1125	1130	0.44		1125	1127	0.18		1115	1114	0.09		1125	1136	0.98
1125	1119	0.53		1115	1113	0.18		1125	1127	0.18		1125	1148	2.04
1105	1112	0.63		1115	1112	0.27		1105	1103	0.18		1105	1082	2.08
1125	1135	0.89		1115	1118	0.27		1105	1107	0.18		1105	1130	2.26
1115	1125	0.90		1125	1121	0.36		1115	1110	0.45		1125	1172	4.18
1115	1130	1.35		1125	1129	0.36		1115	1110	0.45		1125	1180	4.89
1105	1120	1.36		1115	1119	0.36		1105	1110	0.45		1125	1185	5.33
1115	1131	1.43		1105	1101	0.36		1125	1119	0.53		1115	1176	5.47
1115	1132	1.52		1105	1101	0.36		1125	1132	0.62		1105	1168	5.70
1115	1097	1.61		1125	1120	0.44		1115	1108	0.63		1115	1194	7.09
1105	1123	1.63		1125	1119	0.53		1115	1125	0.90		1105	1250	13.12
1115	1140	2.24		1125	1118	0.62		1125	1137	1.07		1115	1500 >	34.53
1105	1130	2.26		1115	1122	0.63		1115	1128	1.17		1105	1500 >	35.75
1115	1142	2.42		1105	1112	0.63		1115	1130	1.35			ASSUMED	
1115	1144	2.60		1125	1134	0.80		1105	1121	1.45			VALVES	
1125	1177	4.62		1105	1114	0.81		1115	1133	1.61			FOR	
1125	1181	4.98		1125	1135	0.89		1105	1123	1.63			STUCK	
1105	1170	5.88		1115	1127	1.08		1115	1135	1.79			VALVES	
1105	1036	6.24		1105	1117	1.09		1125	1147	1.96				
1105	1184	7.15		1105	1117	1.09		1125	1148	2.04				
				1105	1118	1.18		1125	1149	2.13				
				1105	1118	1.18		1105	1133	2.53				
				1125	1139	1.24		1105	1135	2.71				
				1125	1140	1.33		1125	1158	2.93				
				1115	1136	1.88		1125	1160	3.11				
				1125	1147	1.96		1125	1161	3.20				
				1115	1143	2.51		1125	1161	3.20				
				1115	1081	3.05		1125	1163	3.38				
				1105	1140	3.17		1115	1158	3.86				
				1105	1141	3.26		1125	1170	4.00				
				1115	1154	3.50		1125	1176	4.53				
				1125	1171	4.09		1105	1156	4.62				
				1115	1030	7.62		1125	1179	4.80				
				1105	1250	13.12		1105	1197	8.33				
								1105	1219	10.32				

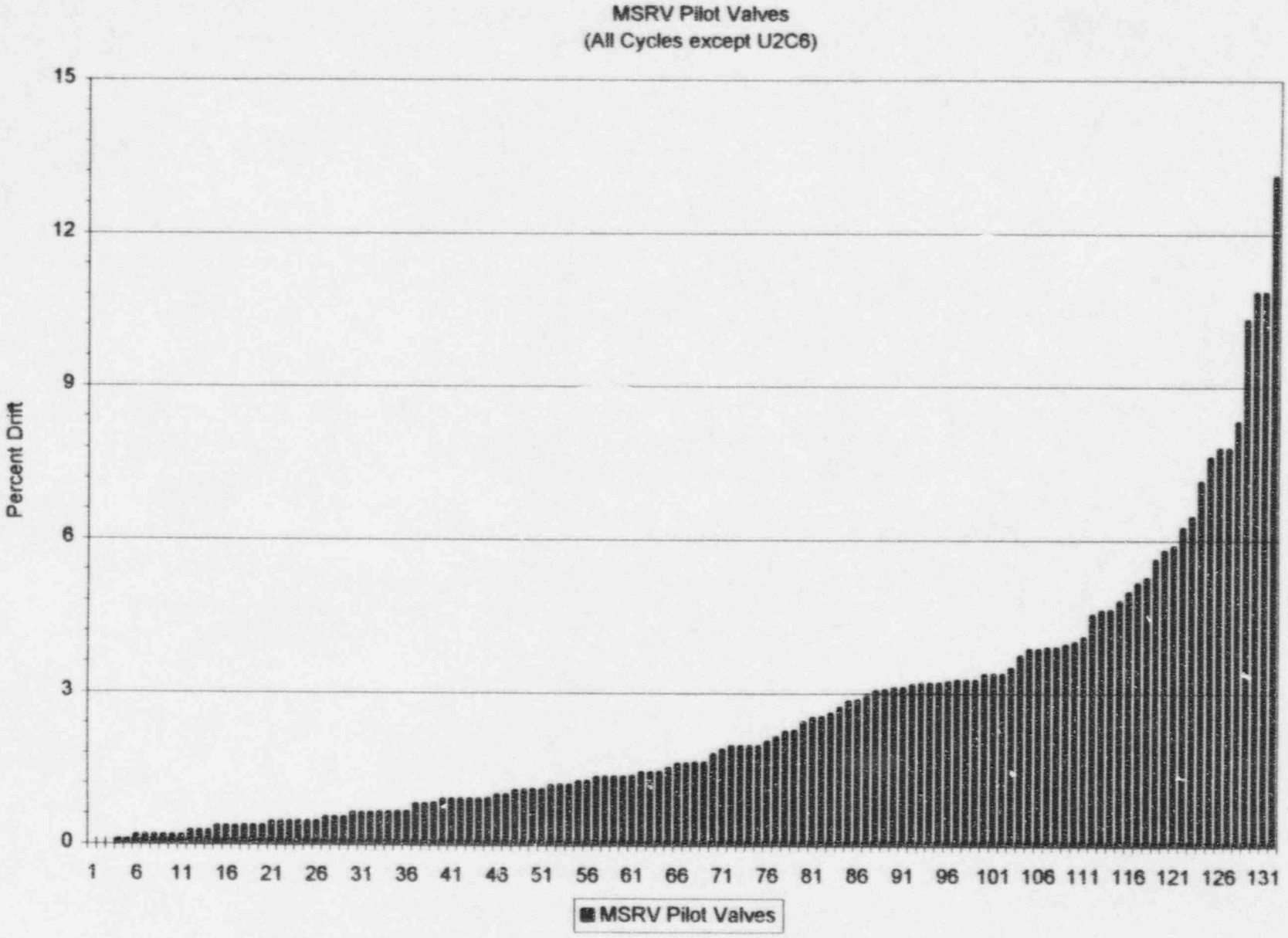
	U2C7			U2C8			U2C9	
Setpoint	First Pop	Drift Percent	Setpoint	First Pop	Drift Percent	Setpoint	First Pop	Drift Percent
1115	1115	0.00	1125	1127	0.18	1125	1135	0.89
1125	1134	0.80	1125	1122	0.27	1125	1136	0.98
1125	1147	1.96	1125	1121	0.36	1125	1136	0.98
1125	1161	3.20	1115	1120	0.45	1115	1129	1.26
1125	1163	3.38	1125	1132	0.62	1115	1131	1.43
1125	1163	3.38	1105	1115	0.90	1115	1147	2.87
1115	1158	3.86	1115	1100	1.35	1125	1160	3.11
1105	1148	3.89	1125	1147	1.96	1105	1141	3.26
1115	1159	3.95	1125	1157	2.84	1125	1183	5.16
1105	1167	5.61	1105	1139	3.08	1105	1163	5.25
1115	1202	7.80	1115	1151	3.23	1105	1169	5.79
1105	1225	10.86	1105	1141	3.26			
1105	1225	10.86	1125	1167	3.73			
			1105	1148	3.89			
			1115	1187	6.46			
			1115	1202	7.80			


MSRV Setpoint Data (w/o U2C6)
Mean 2.46
Standard Deviation 2.48
Count 128
All MSRV Data
Mean 3.07
Standard Deviation 4.65
Count 142
Number of Pilot Valves
50
45
40
35
30
25
20
15
10
5
0
=> 0 and < 1
=> 1 and < 2
=> 2 and < 3
=> 3 and < 4
=> 4 and < 5
=> 5 and < 6
=> 6 and < 7
=> 7 and < 8
=> 8 and < 9
=> 9 and < 10
=> 10
Percent Drift
MSRV Setpoint Data (except for U2C6)
All MSRV Setpoint Data


MSRV Setpoint Drift
(Last Four Unit 2 Cycles Only)
Percent Drift
15
12
9
6
3
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Stuck
Stuck
U2C6
U2C7
U2C8
U2C9


MSRV Setpoint Drift - Platinum versus Stellite
Percent Drift
15
12
9
6
3
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
Platinum Alloy
Stellite (except for U2C6)
Stellite (U2C6 to present)

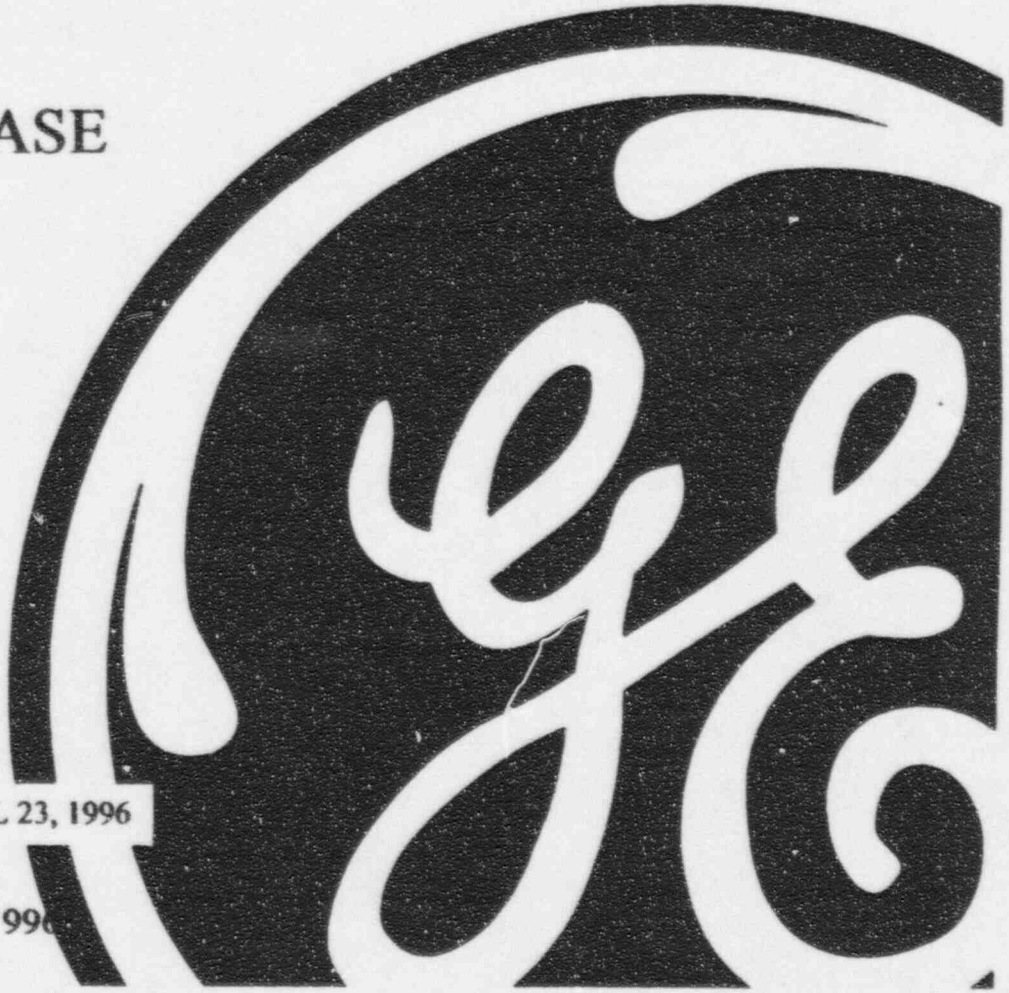

MSRV Pilot Valves
(All Data to Include U2C6)
Percent Drift
15
12
9
6
3
0
1
20
39
58
77
96
115
134
Pilot Disc Stuck
MSRV Pilot Valves


MSRV Pilot Valves
(All Cycles except U2C6)
Percent Drift
15
12
9
6
3
0
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86 91 96 101 106 111 116 121 126 131
MSRV Pilot Valves

GE Nuclear Energy

SRV SETPOINT DRIFT DATABASE

W. J. Roit, Sr. Engineer
Valve Design Engineering



ATTACHMENT 4

GE BWROG SRV DRIFT FIX COMMITEE MEETING, APRIL 23, 1996

BWROG SRV Setpoint Drift Fix Data as of April 18, 199

SRV SETPOINT DRIFT DATABASE

Status of Pt-Stellite Alloy Discs

SUMMARY OF DATABASE (PLANTS WITH 50/50 STELLITE/Pt-STELLITE)

- NUMBER OF DISCS: 33 Pt-STELLITE
  24 STELLITE

- AVERAGE DRIFT: Pt-STELLITE: 2.7 %
  STELLITE: 5.3 %

- NUMBER OF DISCS > 3% DRIFT: Pt-STELLITE: 11/33 (5 < 5%)
  STELLITE: 14/24 (4 < 5%)

- PLANTS:
  PLANT A — 5 Pt-Stellite, 6 Stellite
  PLANT B — 4 Pt-Stellite, 4 Stellite
  PLANT C — 11 Pt-Stellite, 11 Stellite
  PLANT D — 13 Pt-Stellite, 3 Stellite

SRV SETPOINT DRIFT DATABASE

Status of Pt-Stellite Alloy Discs

NOTES ON Pt-STELLITE ALLOY SETPOINT DRIFT RESULTS TO DATE:

SIX VALVES WITH Pt-STELLITE DISCS EXHIBITED DRIFT >5%.
THREE OF THE SIX HAD DRIFT CONSISTENT WITH HIGH LEAKAGE.
THREE VALVES HAD DRIFT CONSISTENT WITH DISC STICKING.

VISUAL OBSERVATIONS:

PLANT A DISC: SMOKY/SILVERY APPEARANCE (LOW OXIDE).

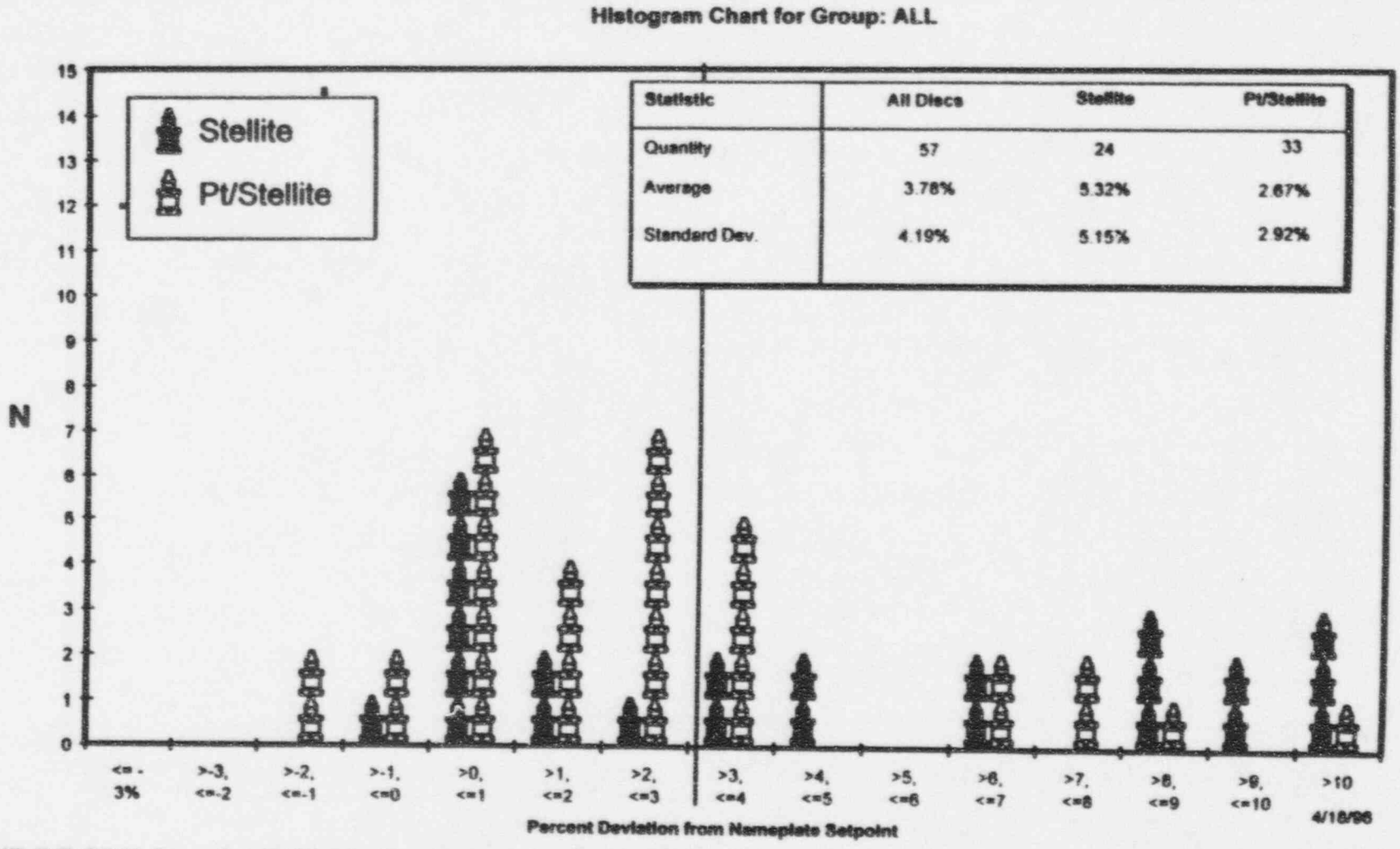
PLANT B DISC: SMOKY/GOLDEN APPEARANCE (LOW OXIDE).

PLANT C DISCS REPORTEDLY HAD A DARK COATING.
Pt-STELLITE DISCS REPORTEDLY APPEARED LESS OXIDIZED THAN STELLITE.

PLANT D Pt-STELLITE DISCS REPORTEDLY HAD EXCELLENT APPEARANCE.

SRV SETPOINT DRIFT DATABASE

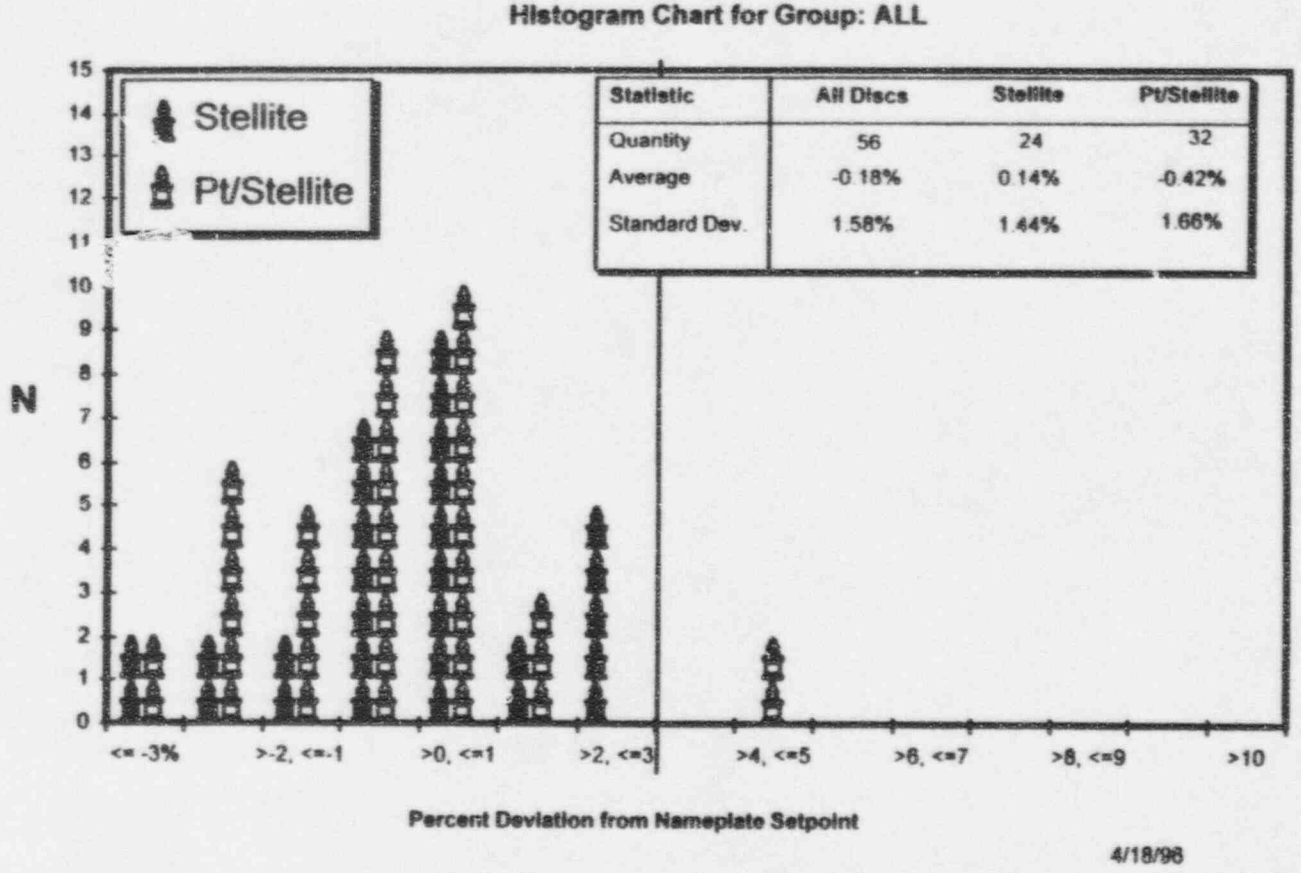
Histogram Chart of %Drift for Valves with Pt-Stellite and Stellite Discs



BWROG SRV Setpoint Drift Fix Data as of April 18, 1996

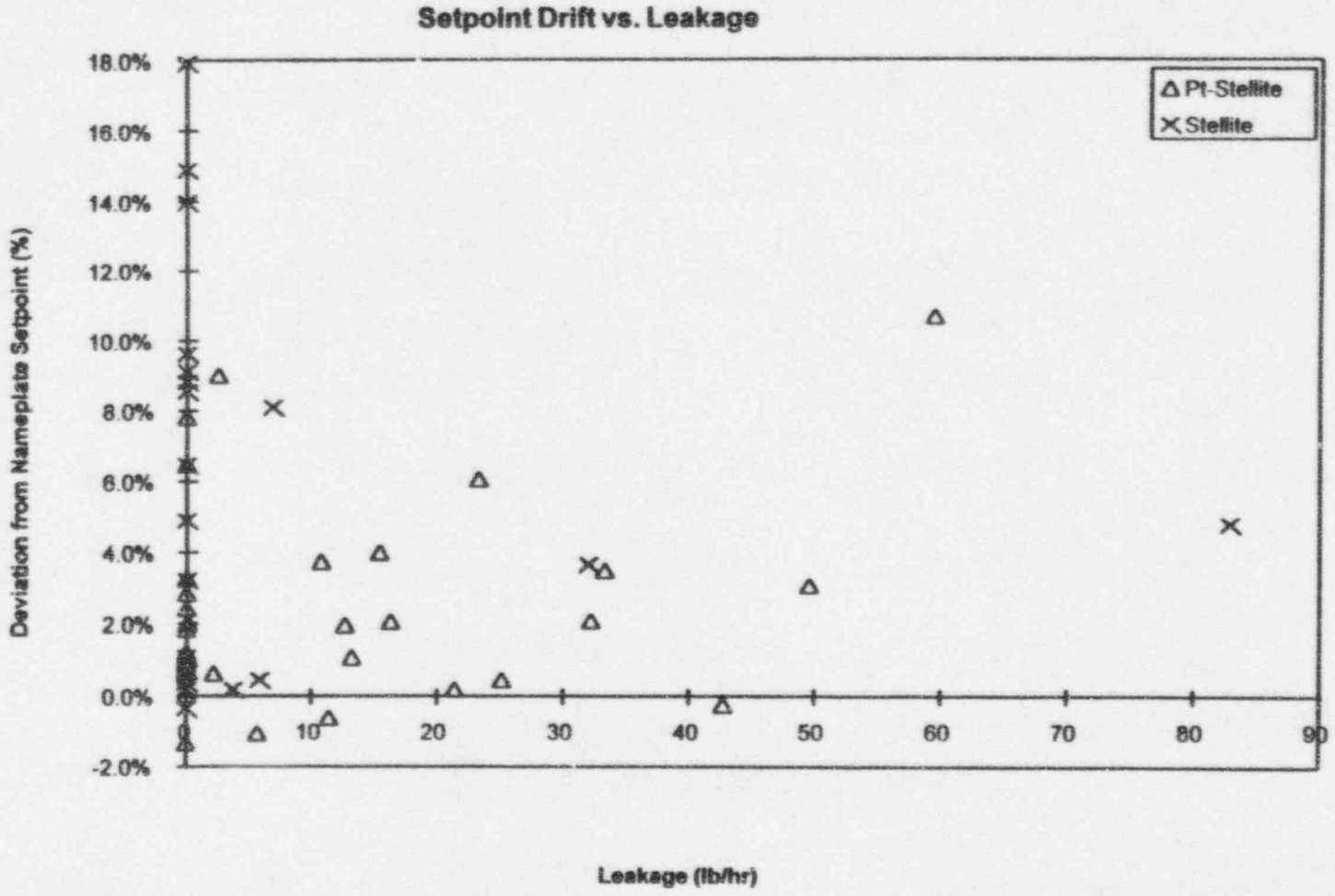
SRV SETPOINT DRIFT DATABASE

Histogram Chart of Second Pop Drift for Valves with Pt-Stellite and Stellite Discs



SRV SETPOINT DRIFT DATABASE

Effect of Leakage on Setpoint Drift from Stellite/Pt-Stellite Database



SRV SETPOINT DRIFT DATABASE

Summary of Results / Conclusions

- Pt-STELLITE DISCS HAVE PROVIDED A MAJOR IMPROVEMENT IN SETPOINT DRIFT AS COMPARED TO STANDARD STELLITE DISCS. (AVERAGE DRIFT AND FREQUENCY OF DRIFT CUT IN HALF).

- THREE Pt-STELLITE DISC EXHIBITED HIGH DRIFT WHICH MAY HAVE BEEN CAUSED BY DISC STICKING. THE SPECIFIC CAUSE OF THE DRIFT IS UNKNOWN.

- MORE DATA IS NEEDED TO PROVIDE GREATER SIGNIFICANCE TO THE Pt-STELLITE vs. STELLITE, AND LEAKAGE vs. DRIFT CONCLUSIONS.

- FURTHER OPTIONS MAY BE EXPLORED REGARDING IMPROVEMENT OF THE CATALYST MITIGATION METHOD (CLEANLINESS, ADDITIONAL CATALYST, ETC.).

ATTACHMENT 6

Will/John,
For your info. Sent to me by Mary Wegner.

John Boseman

AEOD TECHNICAL REVIEW REPORT

UNIT: Multiple
DOCKET: Multiple
LICENSEES: Multiple
NSSS/AE: Multiple

TR REPORT NO.: AEOD/T96-02
DATE: April 15, 1996
CONTACT: Mary S. Wegner

SUBJECT: TARGET ROCK TWO-STAGE SRV PERFORMANCE UPDATE

SUMMARY:

Beginning in 1982, the NRC issued several information notices (IN) related to the 2-stage Target Rock safety/relief valves (SRVs) failure to open at the expected setpoint: IN 82-41, "Failure of Safety/Relief Valves to Open at a BWR;" IN 83-49, "Failure of Safety/Relief Valves to Open at a BWR - Interim Report;" IN 83-82, "Failure of Safety/Relief Valves to Open at a BWR - Final Report;" IN 86-12, "Target Rock Two-Stage SRV Setpoint Drift;" IN 88-30, "Target Rock Two-Stage SRV Setpoint Drift - Update;" and IN 88-30, Supplement 1, "Target Rock Two-Stage SRV Setpoint Drift - Update."

The cause of the problem was identified as one or both of: (1) binding in the labyrinth seal area caused by tolerance buildup during manufacturing, or (2) disc-to-seat bonding caused by oxides of the disc and seat material forming a continuous film and inhibiting disc movement. Some time after 1990, the Target Rock 2-stage owners' group submitted two potential solutions: (1) the preferred solution was the use of platinum alloy disc to cause radiolytic oxygen and hydrogen in the valve to recombine, reducing oxygen available to cause corrosion and (2) the alternate solution was the installation of a pressure switch and control circuitry to operate the valve electrically when the set pressure of the pressure transmitter was reached.

On September 11, 1995, an event occurred at Limerick Unit 1 which resulted in a stuck-open SRV and an extended reactor blowdown into the suppression pool. Pilot disc leakage was identified as the cause of the stuck open SRV. This event was especially noteworthy in that sludge and fibers in the pool, roiled by the blowdown, settled on the emergency core cooling system strainers nearest the SRV tailpipe, clogging them.

The NRC issued IN 95-47, "Unexpected Opening of a Safety/Relief Valve and Complications Involving Suppression Pool Cooling Strainer Blockage," IN 95-47, Rev. 1, and Bulletin 95-02, "Unexpected Clogging of a Residual Heat Removal (RHR) Pump Strainer While Operating in Suppression Pool Cooling Mode" to address issues resulting from this event.

DISCUSSION:

Background:

The original General Electric Company's (GE) BWR-4 design employed the 3-stage Target Rock safety/relief valve (SRV) for over-pressure protection for the reactor coolant system (RCS). In the early 1970s, the valves exhibited a tendency to lift for no apparent reason, and on occasions, to stick open. About half of the plants with the 3-stage Target Rock SRVs experienced this problem.

The solution to the 3-stage problem was the 2-stage Target Rock SRV, which used a 3-stage body, modified to accept the new top works. The plants that experienced problems with the 3-stage valve installed the 2-stage modification. In 1982, a problem with the 2-stage valves became apparent: failure to open at the expected setpoint. On July 2, 1982, at Hatch Unit 1, all 11 Target Rock 2-stage SRVs failed to open at their setpoints of 1080 psig, 1090 psig, and 1100 psig. Pressure in the RCS rose to 1180 psig before three SRVs on one steam line opened and relieved RCS pressure.

Georgia Power, GE, and Target Rock initiated a study of the cause of the event at Hatch Unit 1. Other utilities that had installed 2-stage Target Rock SRVs joined Georgia Power in an owners' group to look at the nature of the problem and its solution.

The problem was ultimately identified as one or both of two situations: (1) binding in the labyrinth seal area caused by tolerance buildup during manufacturing, or (2) disc-to-seat bonding caused by oxides of the disc and seat material forming a continuous film and inhibiting disc movement.

A material, PH13-8 Mo, whose oxide would not form a continuous film with the oxide of the seat material, was chosen for new discs. Trial tests of valve performance, after installing the new discs on about 50 percent of valves at each plant, were conducted. After a promising first set of test results, Hatch Unit 1 reported in October of 1989 that one of the valves with the PH13-8 Mo disc lifted at 10.54 percent above its setpoint and a second at 9.18 percent above its setpoint. In November of 1989, Brunswick Unit 2 reported a valve with the
PH13-8 Mo material disc lifted at 10.4 percent above its setpoint.

Subsequently, the PH13-8 Mo discs were replaced with the Stellite 6B discs, until an appropriate solution to the corrosion bonding problem could be identified.

The NRC issued several INs which describe the foregoing events in greater detail. They are IN 82-41, "Failure of Safety/Relief Valves to Open at a BWR", IN 83-49, "Failure of Safety/Relief Valves to Open at a BWR - Interim Report"; IN 83-82, "Failure of Safety/Relief Valves to Open at a BWR - Final Report"; IN 86-12, "Target Rock Two-Stage SRV Setpoint Drift"; IN 88-30, "Target Rock Two-Stage SRV Setpoint Drift - Update"; and IN 88-30, Supplement 1, "Target Rock Two-Stage SRV Setpoint Drift - Update." IN 88-30, Supplement 1 was issued on February 2, 1990, and discusses the Hatch Unit 1 and Brunswick Unit 2 problems occurring in 1989.

Current Events:

The Owners' Group subsequently submitted two solutions which were to be pursued simultaneously. The preferred solution was the use of platinum (first as an inlay, also as a coating, and finally as a trace element in the disc alloy) to cause radiolytic oxygen and hydrogen in the valve to recombine, reducing oxygen available to cause corrosion.

Initial platinate discs were installed at Cooper, Millstone Unit 1, and Hatch Unit 2 in 1994. Brunswick Unit 1 and Unit 2 are using a platinum-coated disc, first installed in 1993 on Unit 2 and 1994 on Unit 1. Pilgrim is using Stellite 21 for their disc material which they first used in 1984. To date, setpoint test results involving SRVs using the platinate discs have been received from Millstone, Hatch, and Cooper. Also, results from Brunswick for as-found testing of their SRVs which have the platinum coated discs have been received. Figure 1 shows the results of the setpoint testing of platinate valve at each of the plants reporting. The shading indicates valve 1, 2, 3, etc.

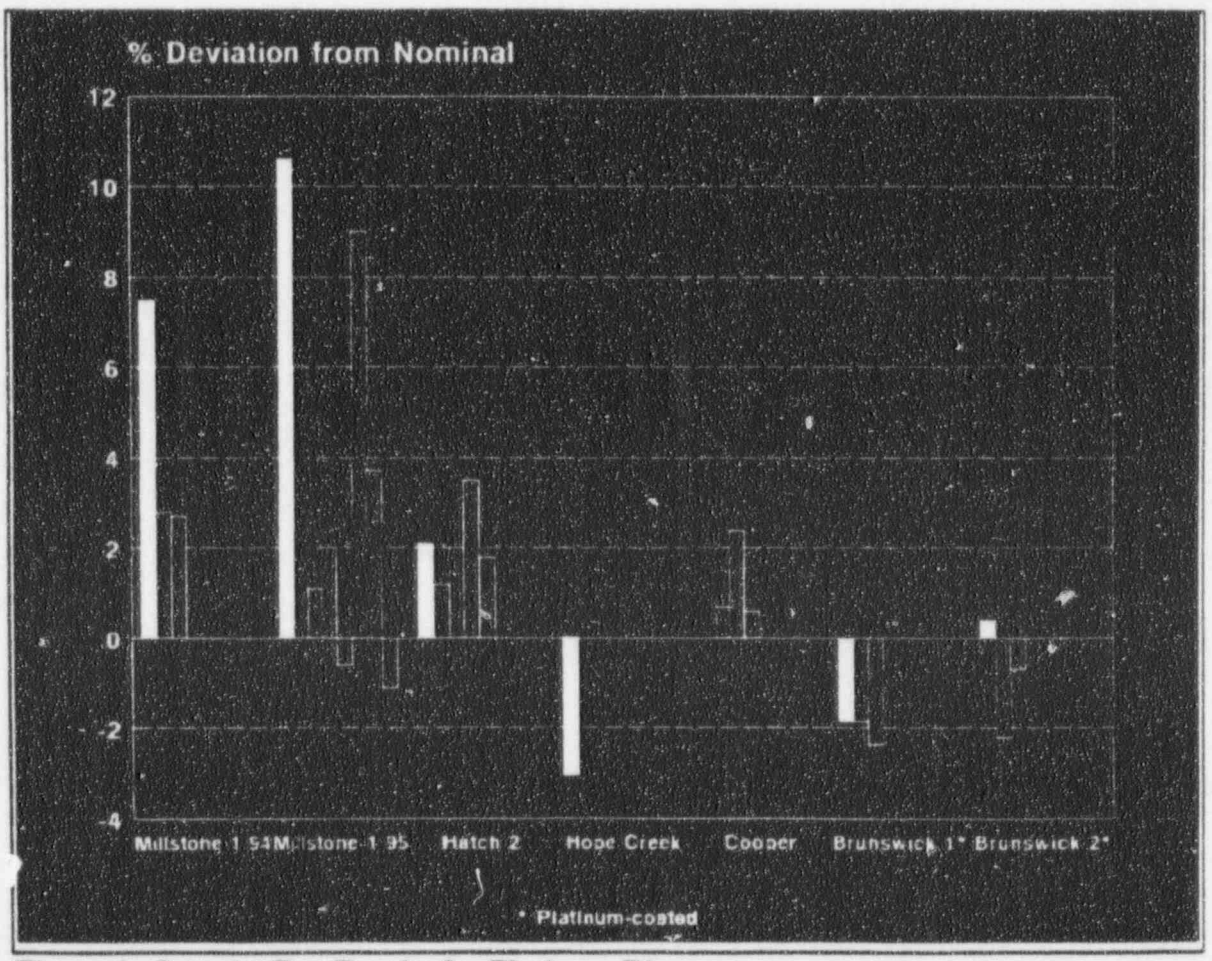


Figure 1: Setpoint Test Results for Platinum Discs

The alternate solution proposed was the "Pressure Switch/Transmitter for Two-Stage Target Rock Safety/Relief Valve," NEDC-32121P. The Target Rock SRV is a dual function valve

which can be actuated by spring force to open when the system pressure reaches its setpoint (the Code safety mode), or it can be actuated by an electrical signal from a pressure sensor to its electro-pneumatic actuator. The actuator removes the spring force so that full steamline pressure lifts the pilot disc. This mode of operation was originally installed for manual operation (the Code relief mode) and automatic depressurization system operation (the nuclear safety-related function). The pressure switch fix would extend the pressure sensor operation to the Code safety mode. GE recommended that the pressure switch sensor setpoints be set at the same values as used for the spring-actuated mode. The NRC found the proposed modification to be acceptable. The topical report was approved on October 24, 1995.

Some licensees made plant-specific submittals prior to the topical submittal. Hatch Unit 1 and Unit 2 and Brunswick Unit 1 and Unit 2 have installed the pressure switch fix in addition to changing the disc material and Millstone Unit 1 has committed to installing the pressure switch fix during the 1996 refueling outage.

About the same time as the platinate discs were first installed, another problem with the SRVs was identified, pilot disc leakage which could lead to a stuck open SRV as occurred in the September 11, 1995, event at Limerick Unit 1. The stuck open SRV caused an extended blowdown into the suppression pool. Sludge and fibers in the pool, roiled by the blowdown, settled on the emergency core cooling system strainers nearest the SRV tailpipe, clogging them.

The Limerick Event

Limerick Unit 1 and Unit 2 have 2-stage Target Rock SRVs unlike any other nuclear plant. While the pilot stage is identical to those used by other nuclear plants, the main stage is quite different. Figure 2 compares the Limerick orientation to the standard orientation.

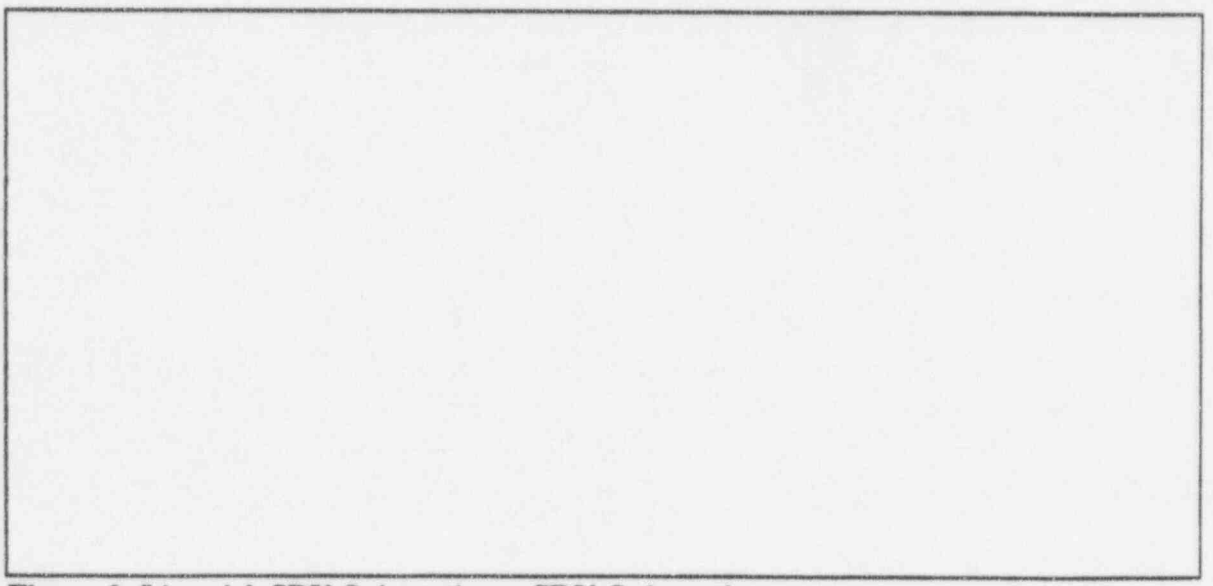


Figure 2: Limerick SRV Orientation – SRV Orientation

The difference in orientation is thought to be the cause of the leakage seen at Limerick – main-stage leakage. Pilot-stage leakage can eventually cause the main-stage to lift, but main-stage leakage can not cause the main-stage to lift. After the operability demonstration following the refueling outage in February of 1994, five SRVs were found to be leaking. Because of their history of main-stage leakage, Limerick personnel assumed that the five leaking SRVs had main-stage leakage. Four of them did, but not the M-SRV.

On September 11, 1995, the M-SRV lifted while Limerick Unit 1 was operating at 100 percent power and remained open. The reactor was manually scrammed. First the M-SRV and the S-SRV were sent to Wyle Laboratories for examination and testing, then the remaining leaking SRVs were sent.

The physical condition of the M-SRV disc and pilot rod is shown in Figure 3. The disc was eroded 360° in the seat area such that the nose separated from the remainder of the disc. Slots were worn in the body of the disc in three places. The disc material was verified to be Stellite 6B by part serial number, material certification, and by Rockwell C hardness testing. The pilot rod was eroded and deformed as shown.

The stuck open SRV caused an extended blowdown into the suppression pool.

The NRC issued IN 95-47, "Unexpected Opening of a Safety/Relief Valve and Complications Involving Suppression Pool Cooling Strainer Blockage," IN 95-47, Revision 1, and Bulletin 95-02, "Unexpected Clogging of a Residual Heat Removal (RHR) Pump Strainer While Operating in Suppression Pool Cooling Mode" to address issues resulting from this event.

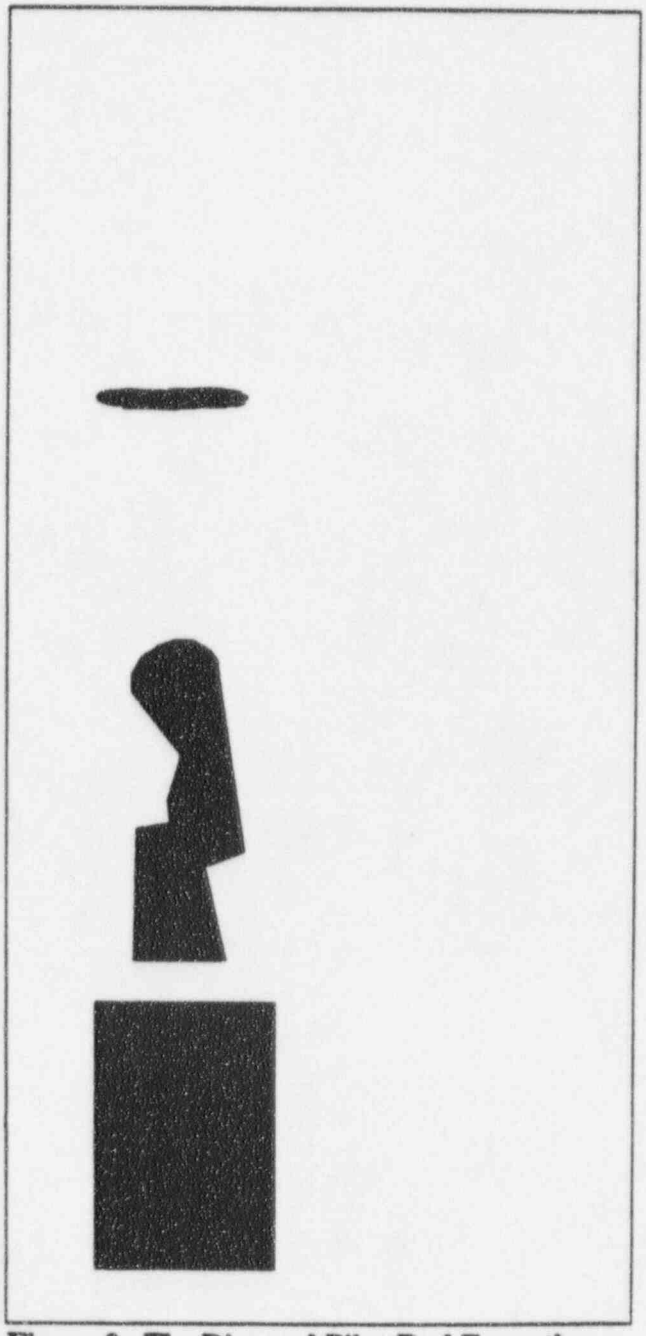


Figure 3: The Disc and Pilot Rod From the M-SRV

ANALYSIS

The 2-stage SRV issues remaining are 1) "setpoint drift" as the result of disc-to-seat corrosion, and 2) leakage past the pilot disc.

The results of setpoint tests of 2-stage SRVs conducted since 1987 (begins near the beginning of the testing of the valves containing PH13-8 Mo discs) until the present are summarized in Figure 4.

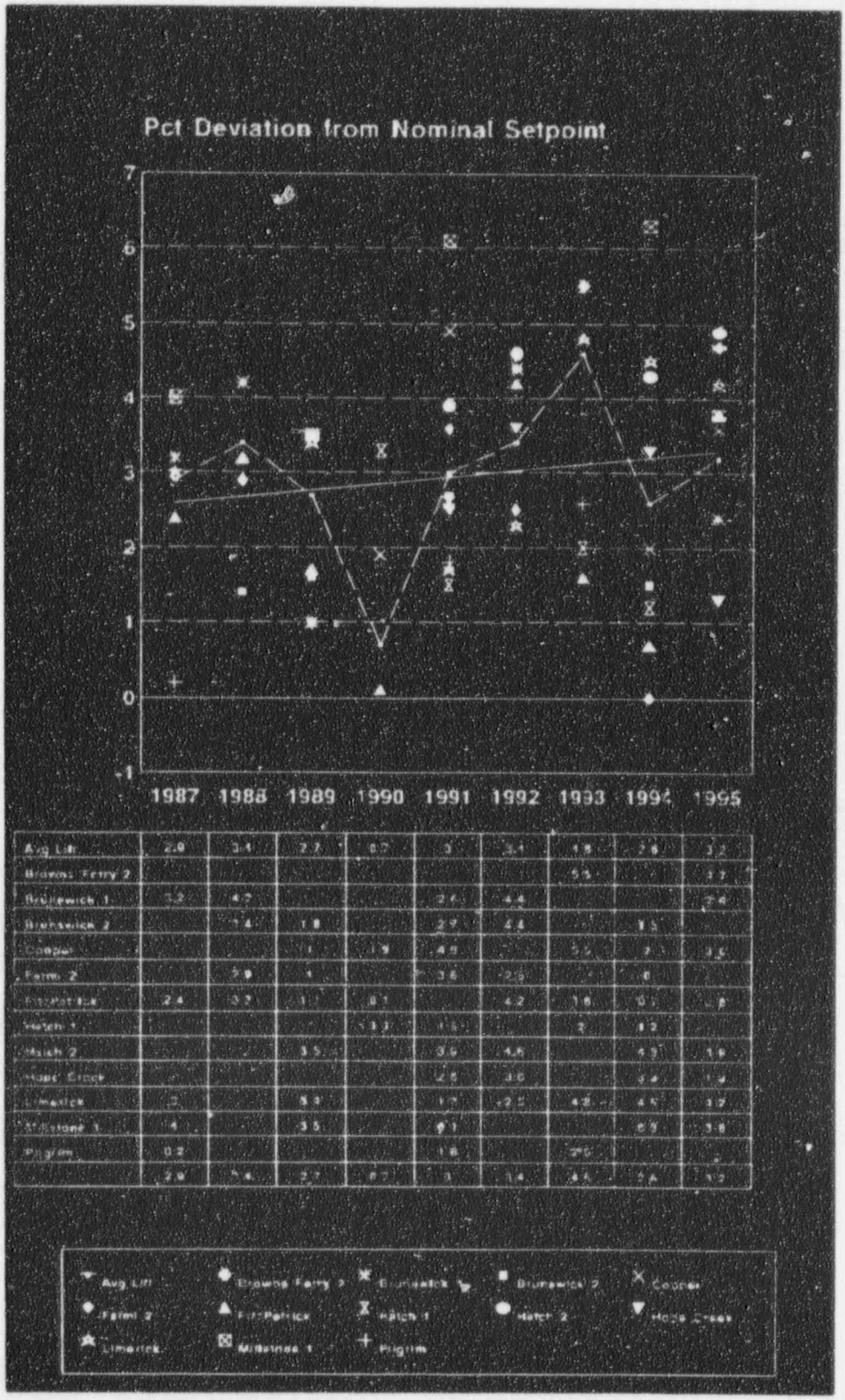


Figure 4: SRV Setpoint Test Averages

By design, setpoints for SRVs were a nominal figure such as 1100 psig ± 1%. The expectation was that the deviation from the nominal would be minimal and the average deviation would be 0. In fact, the deviation from the nominal has ranged from the minimal to values in excess of 67 percent, the majority being positive. The solid line in Figure 4 is the linear regression fit of average setpoints of all SRVs tested during the year. The average setpoint has trended upwards from about 2.5 percent above nominal in 1987 to about 3.5 percent above nominal in 1995. The various points represent the average setpoint for SRVs tested by a particular plant for the year. Of these 61 data points, 7 or 11.5 percent were within ± 1%, 29 or 45.5 percent were within ± 3%, and 5 or 8.2% were 5 percent or more above the nominal. There are no negative setpoint test averages.

It was common to stop setpoint testing at or near 1250 psig when an SRV would not lift; however, the raw data shows lift points in excess of 1250 psig for some valves. For representation in Figure 4, all valves which did not lift at or before 1250 psig were called stuck and their setpoints were called 1250 psig whether they lifted or not and whether they were pressurized above that pressure or not. The tolerance was then calculated using that number. It should be noted that the SRVs in Figure 4 do not all have the same disc material. Figure 4 includes SRVs having Stellite 6B, PH13-8 Mo and platinate materials.

A review of the generic implications of significant leakage of Target Rock 2-stage SRVs (particularly pilot valve leakage) is being conducted by the NRC. Factors being considered are: effects of significant leakage on valve operability, effects of operability testing on valve performance, risk significance of more frequent opening or multiple SRV opening, adequacy of methods (tailpipe monitoring, torus heatup rate) for detection of leakage for the range of BWR configurations, possible concerns about increased suppression pool cooling operation, and what leakage limit monitoring and reporting requirements apply or are needed. The staff plans to coordinate its review efforts with the Owners Group.

FINDINGS AND CONCLUSIONS

The corrosion bonding issue is being addressed by the Owners' Group and being monitored by NRC. The updated information on overall setpoint testing shows a gradual increase in the average liftpoint of the SRVs. This report also provides information currently available regarding setpoint testing results on platinate discs, but at least one full set of setpoint testing results are necessary to evaluate the test program. When sufficient information is available on the platinate test results to warrant an update, one will be issued.

The pressure switch fix has NRC's approval for the topical report, requiring a plant-specific submittal for the licensee to adopt it. Should the platinate disc experiment fail, the pressure switch fix is therefore ready for immediate use. Millstone Unit 1 is also installing the pressure switch fix, alleviating concerns for the adequacy of overpressure protection at that site.