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October 16, 1978

2-108-8

Director of Nuclear Reactor Regulation
ATTN: Mr. J. F. Stolz, Chief
Light Water Reactors Branch #1
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Environmental Qualification of
Foxboro and Rosemount Transmitters
(File: 2-1510)

Gentlemen:

Following our letters of September 15 and September 26, 1978, on the above subject, we received two verbal questions from the staff. These questions are repeated, as we understood them, and addressed below.

Item 1. Since the Conax connector was not installed on the Rosemount transmitter during irradiation, demonstrate that the interface between the connector and the transmitter would not have been degraded if it had been irradiated and assure that the interface in the test is the same as the interface used for field installation.

Response 1. The interface between the Conax connector and the transmitter is the NPT screw threads on the connector and the transmitter. The connector threads are stainless steel and screw into stainless threads in the transmitter base. The effects of radiation on stainless steel are well known with stainless steel demonstrating no significant degradation at radiation levels of 3.7×10^7R (our test requirement). The insulating material inside the Conax connector is not part of the interface but has been tested in excess of these radiation levels previously without evidence of significant degradation. In addition, a Conax connector was installed on the Foxboro transmitter during the same irradiation and subsequently throughout the same test as the Rosemount. The interface between the Conax connector and the Foxboro is the same as for the Rosemount as the stainless steel NPT threads are the interface. During disassembly of the Foxboro transmitter following completion of the 30 day LOCA test, no evidence of steam leakage through the threads was found. We therefore conclude that the interface was acceptably tested and qualified.

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The interface in the test assembly was the same as the interface in the field assemblies.

Item 2. Figure 1 of the September 15, 1978, letter showed that the actual test temperature profile was below the ANO-2 DBA profile for a short period during the initial temperature rise. Demonstrate that your actual profile serves to adequately qualify the subject instruments.

Response 2. We have performed an analysis to determine the internal temperature response of the transmitters for both the test profile and the ANO-2 DBA profile. The analysis determines the thermal response of the interior wall of the transmitter housing as a function of time for each case. Since the only temperature sensitive components of the transmitter are located within the transmitter housing, the analysis demonstrates that the thermal response of the transmitter interior will not be significantly different for either external transient.

As shown on Attachment 1 the calculated internal Test Response is below the calculated internal ANO-2 DBA response for only 33 seconds. The maximum internal temperature difference is only 5F and deviates from the DBA internal temperature by only 3.2%. The actual time lag of the test response is less than 2.0 seconds. We believe that this small difference in internal temperature is insignificant and that the instrument would respond essentially the same while being subjected to either profile which demonstrates adequate qualification of the instrument.

Our letter of September 26, 1978, indicated that we had experienced a problem with the Foxboro transmitter at 12 days into the LOCA test. At that time the Foxboro output went outside acceptance criteria and remained constant regardless of input voltage indicating a short creating enough resistance to negate the effect of the variable resistance created by the transmitter. Following removal from the LOCA chamber, the transmitter internals were replaced in an effort to restore the instrument output to acceptable levels. The replacement, however, failed to correct the problem as the instrument output still remained constant.

Following an investigation, wire insulation degradation and water was found inside the cable which ran from the instrument house, outside, to the LOCA chamber. This cable was supplied by the test facility and had been exposed to the environment (sun, rain, etc.) for quite some time. Upon replacement of this cable, the transmitter satisfactorily responded to the input signal.

We then replaced the old (tested) internals in the transmitter and it responded satisfactorily and within acceptance criteria. We therefore concluded that since the short was outside the test chamber and extraneous to the LOCA environment and since the instrument responded within acceptance criteria following the 30 day test, that it met the

requirements of our test procedure and is adequately qualified for use at ANO-2.

Table 1 and Figures 1 and 2 are the reduced test data, for both the Foxboro and Rosemount transmitters, through 12 days of the LOCA test.

We trust this information is sufficient to resolve your concerns in these areas.

Very truly yours,

Daniel H. Williams

Daniel H. Williams
Manager, Licensing

DHW:JTE:vb

Attachment

TABLE 1

Performance Calculations

Foxboro E11AH Transmitter

A. Trip Function:

LOCA Error -3/4% F.S. @ 21% input up to 50 seconds of LOCA
Radiation Error -1/4% F.S. @ 75% input up to .8 x 10^5R EXP (5 minutes)
Seismic Error ± 1/4% F.S. @ 21% input after 5 OBES
Cumulative Error + 1/4% F.S. (R.S.S.)
-.83%

B. Post Accident Monitoring:

LOCA Error + 8.0% F.S. @ 86% input and 12 days of LOCA
-4%

Radiation Error +0% F.S. @ 75% input @ 3.7 x 10^7R (during & after)
-7%

Seimsic Error ±1/4% F.S. @ 21% input after 5 OBES and 1SSE
Cumulative Error +8.0% F.S. (R.S.S.)
-8.1%

Rosemount No. 1153 Transmitter

A. (Containment) Trip Function:

LOCA Error +1/2% F.S. up to 35 seconds of LOCA @ 75% input
-3/4

Radiation Error +1/4% F.S. @ 75% input up to .5 x 10^6R (30 minutes) EXPO.

Seismic Error ±1/2% F.S. @ 75% input after 5 OBES

Cumulative Error +.75%
-.90% F.S. (R.S.S.)

B. (Pressurizer and S.G. Pressure & Level) Trip Function:

LOCA Error +1/2% F.S. @ 75% and 56.4% input up to 70 seconds of LOCA
-6.5%

Radiation Error +1/4% F.S. @ 75% input up to .5 x 10^6R (30 minute EXPO)

Seismic Error ±1/2% F.S. @ 75% input after 5 OBES
Cumulative Error +.75 F.S. (R.S.S.)
-.65

C. Post Accident Monitoring:

LOCA Error +17.75% F.S. @ 56.4% & 75% input up to 6 days LOCA
-6.75% F.S

Radiation Error + 3.5% F.S. @ 75% input up to 3.7 x 10^7R (during and after)
-.5%

Seismic Error ± 1.75% F.S. @ 75% input after 5 OBES & 1SSE

Cumulative Error +18.17% F.S. (R.S.S.).
-7.0

Summary

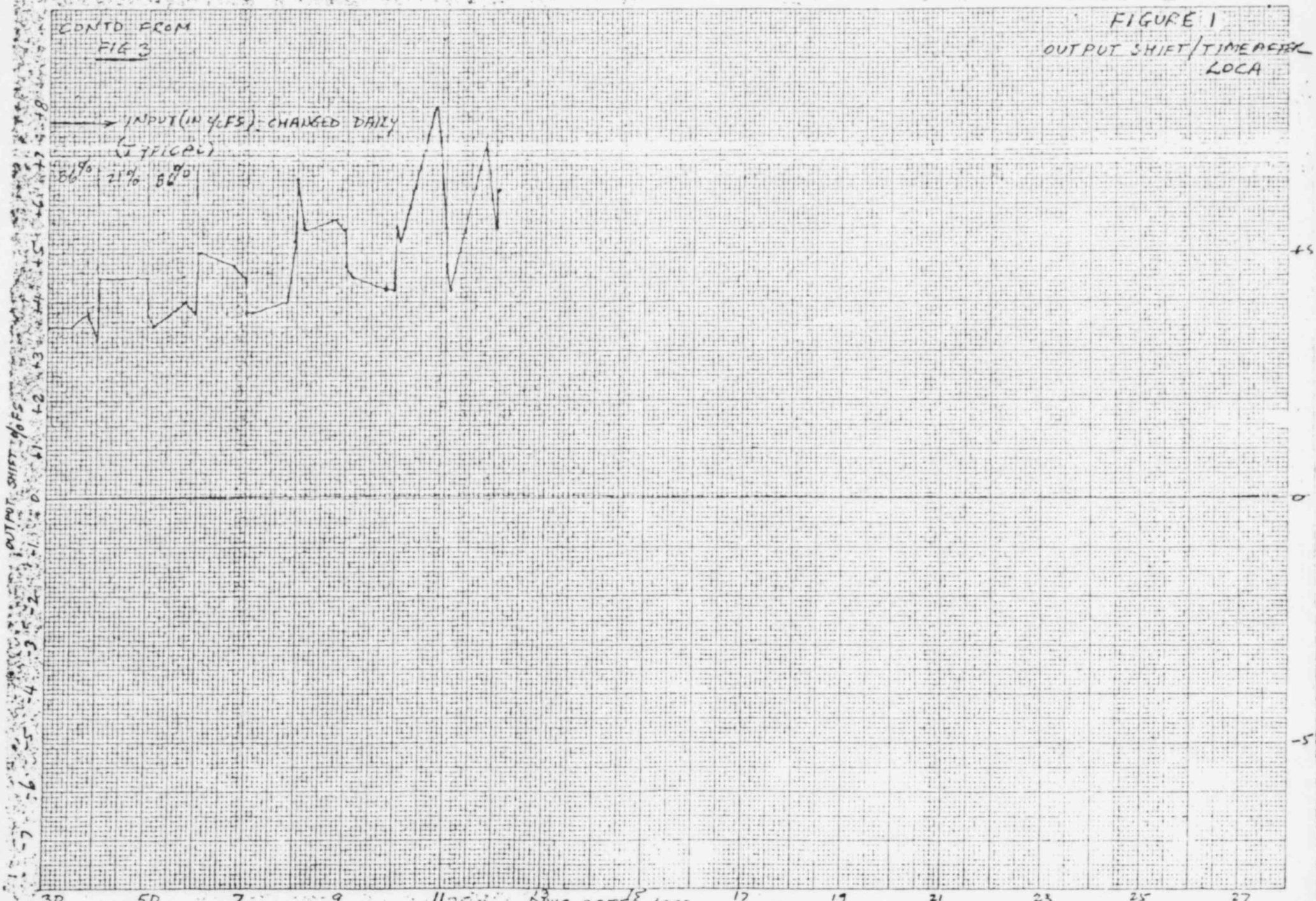
Function	Acceptance Criteria	Actual Performance
Containment Pressure	+ no limit - 2.3% F.S. (RSS)	Foxboro +1/4% F.S. (R.S.S.) -.85%
		Rosemount + .71% F.S. (R.S.S) -1.54% (NOTE)
Pressurizer & S.G. Pressure & Level	+3.7% F.S. (R.S.S.) - no limit	Rosemount + .71% F.S. (R.S.S) -6.7 (NOTE)
Post Accident Monitoring	±20% F.S. (R.S.S.)	Foxboro +7.25% F.S. (R.S.S.) -8.1%
		Rosemount +12.6% F.S. R.S.S. -7.3%

NOTE. The cumulative error is based on irradiation error of +1/4% up to 30 minutes (.5 x 106R) of irradiation at 106R/HR rate as evidenced by error curve drawn using chart-recorder readings (Fig. 17). Digital voltmeter readings were not taken during the initial period. If the error curve drawn from DUM readings is extrapolated and an error of .9% is used in analysis the cumulative error will be +1.14 and +1.14 respectively for
-1.54 -6.7
containment and pressurizer trip. These values are still within the acceptance. In addition this data compares well with the data presented in report #3788 previously transmitted.

FOXBORO E11AH

FIGURE 1

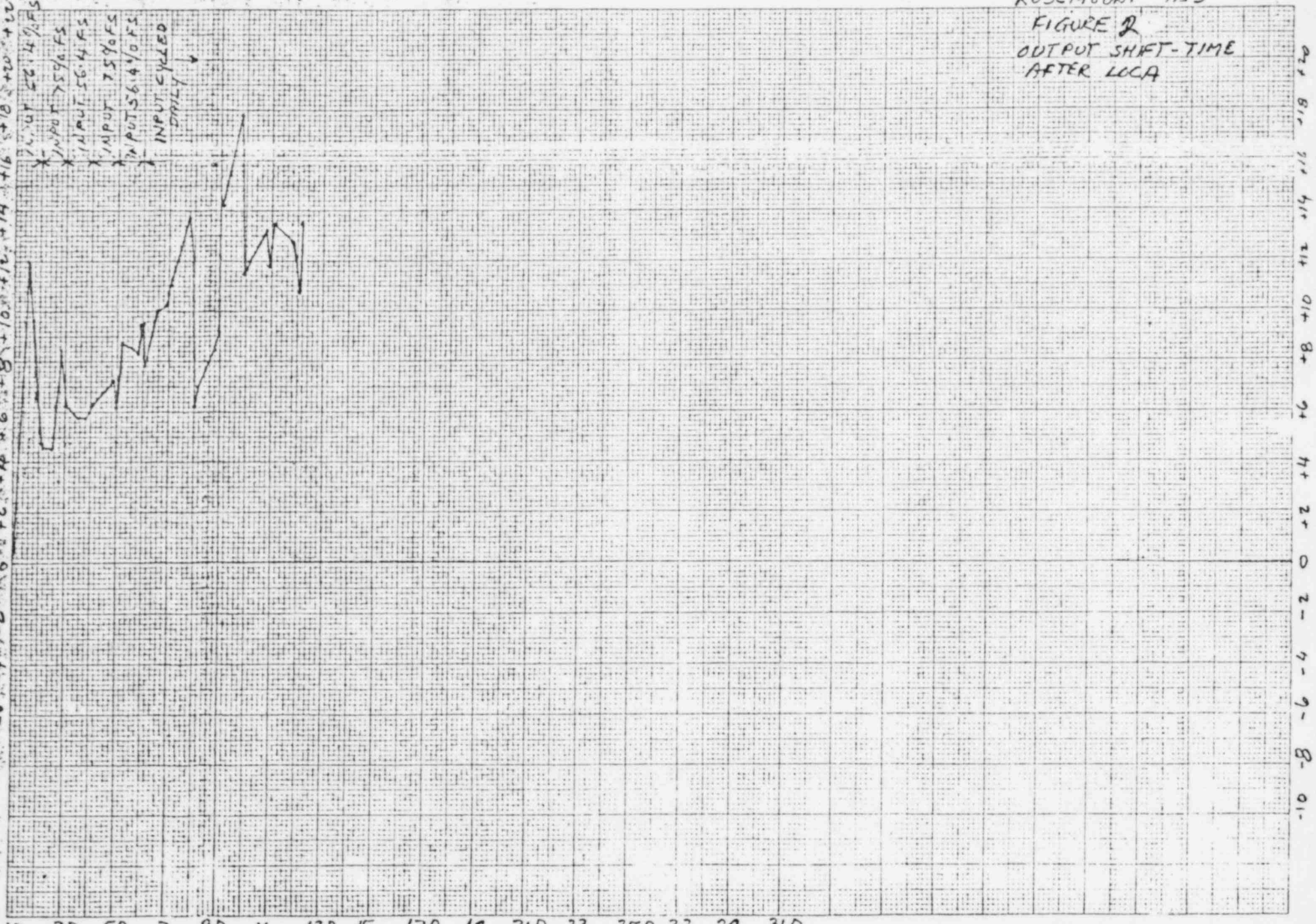
OUTPUT SHIFT/TIME AFTER LOCA



ROSEMOUNT 1153

FIGURE 2

OUTPUT SHIFT-TIME AFTER LOCA



Attachment 1