**James S. Baumstark**
Vice President
Nuclear Engineering

Consolidated Edison Company of New York, Inc.
Indian Point 2 Station
Broadway & Bleakley Avenue
Buchanan, New York 10511

Internet: baumstarkj@coned.com
Telephone: (914) 734-5354
Cellular: (914) 391-9005
Pager: (917) 457-9698
Fax: (914) 734-5718

June 19, 2000

Re: Indian Point Unit No. 2
Docket No. 50-247

Document Control Desk
US Nuclear Regulatory Commission
Mail Station P1-137
Washington, DC 20555-0001

Subject: Response to the Staff's Requests for Additional Information (RAI) Regarding the Steam Generator Tube Examinations conducted during Spring of 2000 Outage, and the Root Cause Evaluation of the Steam Generator Tube Rupture Event of February 15, 2000 (TAC No. MA8219)

References:
1) NRC Letter to Con Edison dated March 14, 2000
2) NRC Letter to Con Edison dated March 24, 2000
3) NRC Letter to Con Edison dated April 28, 2000
4) Con Edison Letter to NRC dated April 14, 2000

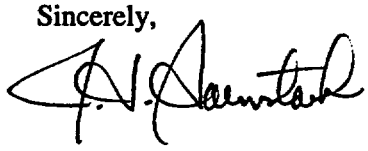
Pursuant to 10 CFR 50.54(f), Consolidated Edison Company of New York, Inc. (Con Edison) hereby provides additional responses to the Staff's requests for additional information, which were provided to us in References 1 and 2. Also provided is a response to one of the Staff's questions regarding the Root Cause Evaluation of the February 15, 2000 steam generator tube rupture event. This evaluation was previously transmitted to the Staff by Reference 4.

Specifically, this letter provides Con Edison's responses to Question 6 identified in Reference 1, Questions 16, and 19 identified in Reference 2, and Issue 12 identified in Reference 3.

No new regulatory commitments are being made by Con Edison in this correspondence. Specific actions noted within this letter were previously identified as regulatory commitments.

Should you or your staff have any concerns regarding this matter, please contact Mr. John McCann, Manager, Nuclear Safety & Licensing.

Sincerely,



Attachment

A001

C Mr. Hubert J. Miller
Regional Administrator-Region I
US Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. Patrick D. Milano, Project Manager
Project Directorate I-1
Division of Regulatory Projects I/II
US Nuclear Regulatory Commission
Mail Stop 14B-2
Washington, DC 20555

Senior Resident Inspector
US Nuclear Regulatory Commission
PO Box 38
Buchanan, NY 10511

Attachment

Response to Questions Regarding Steam Generator Tube Examinations
Performed During Spring 2000 Outage

Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
Docket No. 50-247
June 2000

NRC RAI Letter dated March 14, 2000

Question 6

Based on the observed leakage behavior just prior to the tube failure, discuss if you plan on making any changes to your operational procedures regarding changes in monitored leakage.

Reply

Review of the primary to secondary leakage monitoring program and the 150 gpd administrative limit indicates that there were no shortcomings, which could have prevented a plant shutdown prior to the event. Less that 15 minutes prior to the event, primary to secondary leakage was confirmed to be less than 5 gpd as indicated by the N-16 radiation monitor. Although at the time the N-16 radiation monitor recorder was out of service, control room alarm and indication at the Accident Assessment Panel, and a local alarm were available. Industry experience has shown that the small amount of leakage prior to the event was not an indicator of an imminent tube failure. However, for the planned shortened operating cycle for the current steam generators, the administrative limit will be reduced from 150 gpd to 30 gpd. This is more conservative than the 75 gpd limit proposed by EPRI in the new guidelines which became effective February of 2000.

NRC RAI Letter dated March 24, 2000

Question 16

For all indications identified by the Cecco and bobbin coil inspections, identify which indications were called by a single analyst versus those indications that were called by both analysts.

Reply

Statistics for the bobbin and Cecco coil inspections are presented Tables 1 and 2 below:

Table 1: Bobbin Coil Analyst Results

| Indications | Primary Only | Secondary Only | Both Analysts | Total |
|---|---|---|---|---|
| | | | | |
| Number | 170 | 130 | 310 | 610 |
| Percent | 27.9% | 21.3% | 50.8% | 100% |

Table 2: Cecco Probe Analyst Results

| Indications | Primary Only | Secondary Only | Both Analysts | Total |
|---|---|---|---|---|
| | | | | |
| Number | 100 | 61 | 894 | 1055 |
| Percent | 9.5% | 5.8% | 84.7% | 100% |

For completeness, a summary of similar statistics for the +Point expansion program are provided in Table 3.

Table 3: Plus Point Expansion Program Analyst Results

| Indications | Primary Only | Secondary Only | Both Analysts | Total |
|---|---|---|---|---|
| | | | | |
| Number | 243 | 341 | 803 | 1387 |
| Percent | 17.5% | 24.6% | 57.9% | 100% |

The statistics in each grouping are for the call types expected to be made for that probe. For bobbin, that is primarily freespan and Anti Vibration Bar indications. The resolution process is conservative for the bobbin probe because the final disposition of an indication is based on the RPC test of the location. The bobbin probe may detect an indication, but the RPC test characterizes it so that a proper disposition can be made. This led to a larger number of single party calls being kept through the resolution process. For the Cecco probe, the call types included top of tubesheet, support plate, sludge pile, crevice and roll transition indications. A large fraction of these calls were related to roll transition indications. For the RPC (Plus Point) expansion program, the call types were pits, axial, circumferential and volumetric indications.

Additional Information:

An evaluation of the incidence of analyst identification of eddy current test (ECT) indications was conducted on inspection data from the 2000 outage. This evaluation, which is presented below, establishes that there is an acceptable level of confidence in the ECT results and the Condition Monitoring and Operational Assessment (CMOA) that was performed following refueling outage 14 (RFO14).

General Considerations

The condition of the steam generators at the end of the cycle, as defined by the commencement of RFO14, has been determined by inspection of the tubes using multiple techniques. Tubes were examined using up to six different types of eddy current coils (bobbin, Cecco-5, mid-range pancake, high frequency pancake, mid-range +Point and high frequency +Point) plus ultrasonic testing, and in-situ pressure testing. The various examinations showed a range of degradation modes (pitting, wear, ODSCC and PWSCC). The most limiting is axial cracking in freespan or unsupported regions of the tube. For low row U-bends, identification of degradation was addressed by both mid-range and high frequency +Point examinations, along with a conservative plugging of all row 2 U-bends irrespective of the "as-found" condition. At IP2 the 'sludge pile' region is considered to be from the top of the tube sheet to a distance approximately 6 inches above the top of the tube sheet.

The other region of the generators for which a question was raised with respect to axial cracking is in the tubesheet crevice and sludge pile regions. The unrestrained opening of an axial crack in the tubesheet crevice is a minor concern with respect to a tube rupture event because the tubesheet provides physical support to restrain the opening of an axial crack; however the occurrence of leakage still must be considered for the CMOA. The sludge pile region is not supported, and there is a potential for crack growth in this region that could lead to leakage that could eventually exceed plant technical specification or administrative limits. Therefore, the condition of this region also must be considered with respect to potentially limiting or structurally challenging indications. There were a number of criteria and techniques used in the sludge pile region to determine and characterize the condition of the tubing. To fully comprehend how the limiting case of freespan axial indications was assessed; it is necessary to understand the complementary nature of the various examinations performed and other factors present during the inspection of the steam generators.

The combination of the examinations performed and these other factors, as described in the following paragraphs, ratify the basis for the CMOA report and demonstrate confidence in the inspection conclusions.

General Analyst Training

Per the EPRI PWR Examination Guidelines, each analyst was required to complete a site specific performance demonstration (SSPD) prior to commencing work on the 2000 RFO inspection program. The SSPD consisted of training on the site specific analysis guidelines and site data from the 1997 outage. The examinations for the SSPD were both written and practical in nature. The practical examination included representative data taken from all probe types utilized during the 1997-outage inspection. This primarily consisted of ODSCC, PWSCC and pitting data at supports and in the tubesheet, sludge pile region and low row U-bends. The bobbin and rotating probe (RPC) data tests were graded as a reduced data set. The Cecco data tests were graded based on the statistical basis called out in the EPRI guidelines; 80% probability of detection at a 90% confidence level.

As the 2000 RFO inspection progressed, additional training supplements were provided in order to address issues of data quality and analysis technique in the low row U-bend region. This served to raise the level of analyst sensitivity for this region. This training was used by the analysts in the analysis of both mid-range and high frequency U-bend +Point data.

Concerning consistency of analysis in the initial inspection of the sludge pile regions, Con Edison requested that Westinghouse review analysis criteria and analyst generated data. In order to enhance the reliability of inspection findings, it was decided to develop an additional data review for the analysts and expand the RPC program. This expanded RPC program was used as a separate test of record for the tubesheet and sludge pile regions and is described below.

Analyst Training for the Expanded RPC Program

The timing of the expanded RPC program led to the usage of an analysis crew, for both the primary and secondary analyses, which consisted of about 50% return analysts – i.e. analysts that already had worked for some time during the course of the IP2 Spring 2000 outage – and about 50% new analysts. The new analysts assigned were primarily Westinghouse senior analysts. There were approximately 20 analysts used for this phase of the program.

All analysts, both return and new, utilized in the expanded RPC program had successfully completed the SSPD. It was decided that the training and testing data set use the 1997 data supplemented with data from the RFO14 IP2 outage. This supplemental and enhanced analyst training served to alert the analysts as to the types, locations and amplitude levels of the indications reported during the RFO14 IP2 outage. The heightened level of training led to a very conservative analysis, and comprises an enhancement to the analysis process. This training is described below.

Supplemental Analyst Training Details

Supplemental analyst training was an integral element of the expanded RPC program. In addition to the original training and testing of the analysts with respect to RPC data, a review of indications was done prior to the analysts starting the expanded program analysis. This was an informal review – approximately four hours – that consisted of the analysts, who participated in the expanded RPC program, reviewing the results of several calibration groups and identifying low amplitude indications in the crevice, at the tube end, in the roll transitions and in the sludge pile. All of these data were from the current (RFO 2000) inspection. This review helped to further familiarize the analysts with the site-specific data from the current outage.

Evidence that the analysts were capable of identifying even small indications in the tubesheet crevice and sludge pile regions during the course of the expanded RPC program is twofold. First, there was an overcall rate of approximately 7.7% during the expanded RPC program (typical performance on the QDA examination is approximately 4-5%; 10% is the allowed maximum for the examination). Second, the indications reported by these analysts were on the average somewhat smaller in length and amplitude than those reported prior to the original inspection program.

Indication Identification Review

It is an expected NDE result that there will be some discrepancies in calls between primary and secondary analysis, which is the reason in part for analyst redundancy. A review of the indication identification history and the agreement between the primary and secondary analyses was performed as part of the expanded RPC program.

An additional review was performed by Westinghouse on the 210 crack-like indications reported in the expanded RPC program in order to examine the potential for indications associated with single analyst calls in the expanded RPC program. Regulatory representatives also reviewed the data to ascertain the incidence of tubes with indications reported by a single party in the expanded program. The results of these reviews indicated that there were no tubes presenting significant amplitude indications, which were called by only a single analyst, identified in the expanded RPC program. There was only one tube identified, where only one of the two analysts reported the indication. The indication was a fraction of the amplitude and signal-to-noise ratio of those identified from that original program. In short, there is a high level of confidence that no significant single analyst calls were missed in the expanded RPC program. This provides strong support for the conclusion that data analysis from the expanded RPC program is complete and presents a robust data set for the purpose of CMOA conclusions.

Expanded RPC Program

During the bobbin and Cecco analyses in the initial program, questions were raised regarding the consistency of detection of flaws of small amplitude and those in regions influenced by deposits. Due to these questions, the region from the tube end to a minimum of 48 inches above the top of the tubesheet was RPC inspected for 20% of the

hot leg, concentrating in the kidney region which should be most affected by scale deposits. The remaining 80% of the tubes were inspected with a +point probe to a distance of 24 inches above the top of the tubesheet for the hot leg and a 20% sample of the cold leg were inspected to the same distance. The inspection was restricted to a height of 24 inches above the top of the tubesheet for most of the tubes since the initial 20% sample did not identify any axial indications more than a few inches above the top of the tubesheet.

Both the hot and cold leg programs had expansion criteria defined in a manner consistent with the EPRI PWR Steam Generator Examination Guidelines. This led to 40% of the steam generator tubes being samples in the cold leg of steam generators 23 and 24. As a result, a minimum of six reviews (bobbin, CECCO and +point probes, each with primary and secondary analyses) utilizing multiple techniques as mentioned previously, were performed for this region for all of the tubes in the expanded RPC program. As a result of this expanded RPC program, a total of seven (7) additional axial indications were found above the top of the tubesheet. Expert review of these seven (7) indications by the lead analyst, prior to in-situ testing, considered three of these to be marginal calls and they were classified as deposits. Of the remaining four, only one of these was reported by a single analyst. This was the tube which, in its own independent potential significant missed indication review, the NRC's consultant identified as not being a significant indication.

Also, for the expanded RPC program statistics for axial indications in the hot leg crevice and above the hot leg tubesheet were compiled based on a binomial distribution. These statistics did not include indications reported prior to the expanded program. The primary analysis reported 180 of 210 indications for a probability of detection (POD) of 80% at a 98% confidence level (CL). The secondary analysis reported 175 of 207 indications for a POD of 80% at a 94% CL. (Note that the difference in the total population is due to the fact that the secondary analysis had considered three of the 210 tubes to be bad data and, therefore, they were not counted in the secondary statistic.)

To provide further assurance of adequate analyst indication identification, single analyst statistics were reviewed with EPRI and CE Nuclear representatives. This was done when the statistics were initially compiled and as the aforementioned review proceeded. Based on this review, the general statistics were considered to be reasonable and fully in conformance with industry guidelines. The combined POD for the overall process for 210 of 210 indications is 98% at a 98% CL.

| Analyst Performance For Axial Crevice And Sludge Pile Indications | | | | | |
|---|---|---|---|---|---|
| Hits | | Misses | | Total | |
| Primary | Secondary | Primary | Secondary | Primary | Secondary |
| 180 | 175 | 30 | 32 | 210 | 207 |
| 85.7% | 84.5% | 14.3% | 15.5% | ⇐ % Of Total | |
| | | | | 80%POD @ 98% CL | 80%POD @ 94% CL |

Also, for the expanded RPC program, individual analyst statistics were reviewed for the population of 210 indications described above. For this population, there was one analyst who reviewed data for more than ten of the identified indications and whose performance was considered to be potentially at a lower than normal level. Based on this analyst's performance, consideration was given by Westinghouse to the need to review additional data analyzed by this individual over the course of the expanded RPC program. However, since the performance statistic in question was for only a limited population of crack-like indications (16 for this analyst), it was considered that the statistic may not be indicative of that analyst's overall expanded RCP program performance. In order to assess whether or not this statistic was generally representative of this analyst's work, a more detailed review of overall statistics on the expanded RPC program was performed – this included all call types and locations. The following observations were made:

(1) The analyst detected 100% of the indications above the tubesheet, in the sludge pile region (the truly critical area). All of the analyst's "misses" were in the crevice, at the roll transition or the tube end and none were above the top of the tubesheet. (Note: a "miss" is defined as no call by an analyst where there is a resolved result, over-ruling that analyst, indicating degradation.)
(2) The overall fraction detected by this analyst was 82% (94 of 115).
(3) The analyst reported a significant number of low amplitude indications within the sludge pile region – PIT and VOL.
(4) The analyst also was observant with respect to other anomalies, like PLP signals.

Based on these observations, the overall performance of this analyst is considered to be acceptable and within reasonable expectations for this program.

Based on the tube which was identified but not considered to be significant by the NRC consultant as a part of the NRC's independent review noted above, the general performance of the analyst associated with missing that call was reviewed on the same basis as the analyst previously cited. This analyst's fraction reported was 80% (225 of 282). This analyst also reported a significant number of low amplitude indications within the sludge pile region. Based on these observations, the overall performance of this analyst also is considered to be acceptable and within reasonable expectations for this program.

For the expanded RPC program, the primary and secondary analysis POD's were within accepted industry norms. The reviewed performance of selected individual analysts showed that they performed as would be expected. Based on these observations, it can be concluded that the performance of all of the analysts participating in the expanded RPC program fell within accepted industry guidelines, standards and expectations, and provides an ample basis for support of the CMOA.

Structural Integrity

All axial indications reported above the top of tubesheet, irrespective of measured depth or dimension, were in-situ pressure tested. The in-situ population also included all low row U-bends with axial indications, a sampling of pits and volumetric indications in the sludge pile region, crevice indications, and four (4) tubes with no detectable degradation (NDD). In all, 51 tubes were in-situ tested. Of the 40 tubes with indications in the deposit, sludge pile or crevice regions, only one leaked S/G-22 R34 C51. This tube was identified as having an indication during the course of the initial Cecco-bobbin inspection scope. None of the tubes identified in the expanded RPC program – a population of smaller indications (in length, amplitude and depth) than those identified in the initial program - leaked when in-situ tested. This provides additional confidence that there were no significant unreported indications in the initial program.

Ultrasonic Testing

Two ultrasonic testing programs were performed during the 2000 inspections at Indian Point Unit 2. The first was performed solely to characterize/confirm indications in 22 tubes from the initial inspection program. This program showed the eddy current to be conservative with respect to indications termed as pits. The second program was to address a perceived detection issue raised by the NRC, and is discussed in the remainder of this section.

Concerns were raised about a region of the free-span above the tubesheet where potential degradation may be difficult to detect due to the presence of deposits on the tubes. However, as stated by the lead analyst, deposit conditions at IP2 are typical of older SGs, and eddy current techniques have been successfully used under these conditions. Deposits of this nature, while not typical of newer steam generators, have been common in the history of the industry and are reflected in the industry training via the QDA examination. These are also part of the site-specific training. Additional information on this topic is also contained in Question 18.

To better understand the effects of the deposit conditions on the IP2 inspection, a review of a number of tubes in one steam generator for eddy current signal noise was performed. Twenty-three of these tubes with a range of deposit signals and sludge influences between the tubesheet and the first support plate on the hot leg were selected for examination using ultrasonic testing (UT). Sixteen of these tubes were considered to have no detectable degradation revealed by eddy current. The remaining seven tubes had axial (four tubes), pitting (two tubes) and wear or volumetric (one tube) indications revealed by eddy current. The UT extended through the first support plate for twenty-two of these tubes. The twenty-third tube was restricted to the passage of the UT probe at the first support plate. In no case did UT of these 23 tubes detect any indication that was not previously reported by eddy current techniques.

The reason UT testing was of significant assistance in confirming the reliability of the eddy current analysis in the sludge pile and deposit regions is that the principles upon which UT operates are different than eddy current. UT assesses the condition of the tube

by the time of flight of directed sound waves rather than by electromagnetic induction. Sound is directed in three different directions in order to detect and characterize axial, circumferential and volumetric indications. UT is not affected by conductive and magnetic variations due to deposits and can more easily separate out the deposits from the tube itself. Thus, the UT results provide an independent technique to confirm the accuracy of eddy current analysis.

The results of the second UT program and the agreement of the results of the UT with the eddy current for the 23 tubes provide further confidence with respect to the capability eddy current techniques to detect degraded tube conditions in the presence of deposits. The correlation of the results between the eddy current and UT programs provides further support for the reliability and completeness justification for not conducting further reviews of inspection results in regions of suspected deposits.

Statistics From Other Methods

Information from other test techniques which are independent from eddy current techniques (i.e. not based on the same principles) also can be used to develop confidence in the technique and analysis used for the IP2 eddy current inspection. The two supplemental techniques, which can be considered for this purpose, are UT (as noted above) and in-situ pressure testing. When one considers the number of tubes in-situ pressure tested and the number of tubes tested by UT during the RFO 2000 IP2 inspection program, a population of tubes which exhibit no additional degradation in the sludge pile and deposit region can be developed. For the in-situ tubes, a population of 41 tubes is relevant. These tubes were post-in-situ eddy current tested, with no additional indications detected in the region of interest. For the UT population, the cross population with the in-situ tested tubes must be removed. This leaves 29 tubes where UT showed no additional indications when compared to eddy current. Using this total population of 70 tubes as representative of the ability of eddy current to accurately reflect the condition in 70 of 70 tubes, including the fact that no additional 'hidden' indications were shown, supports a conclusion that the eddy current technique and analysis conducted in the 2000 IP2 outage exceed a 95% POD at 95% confidence.

Summary

The above discussion demonstrates that the IP2 RFO14 eddy current examinations and results are well within industry norms. This is corroborated by the multiple techniques utilized during the recent IP2 RFO14 inspection program. As shown by this assessment, the confidence in the analysis of the data and results from the IP2 inspection is based on the eddy current analysis itself, as corroborated by independent and alternate means. These means consisted of: the number of tests and analyses each tube received using multiple inspection techniques; the scope and results of the expanded RPC program; the acceptable performance level (POD) exhibited by the general analysis statistics; the results of the review of single analyst calls for significant indications; the enhanced further training received by the analysts participating in the expanded RPC program; the validation of the eddy current techniques by UT and in-situ testing to detect in the presence of deposits; and the structural margin observed by in-situ pressure testing. All

of these corroborating means viewed together as a whole and cumulatively, provide a high level of confidence that the condition of the IP2 SGs is fully and accurately represented in the 2000 RFO CMOA.

The preponderance of data regarding the condition of the SGs and the adequacy of the eddy current and other testing supports the conclusion that the inspection techniques and analyst performance provide reasonable assurance of the operation of the steam generators in accordance with applicable safety standards for continued operation. The scope of the inspection and the results achieved provide additional justification that the inspection scope is fully sufficient to assess the condition of the IP2 SG tubes without further analysis or data review.

NRC RAI Letter dated March 24, 2000

Question 19

Provide the acceptance criteria for the secondary side hydro test.

Reply

To ensure that the probability for primary to secondary side leakage is minimized, Con Edison has performed a secondary side pressure leak test. The leak test was conducted in each of the four steam generators in accordance with Indian Point Station Test and Performance Procedure PT-V9A, B, C and D, respectively. The leak test was conducted using a secondary side test pressure of approximately 750 psig during which the primary side tubesheet, active tubes and previously repaired tubes were visually inspected for evidence of leakage. The acceptance criterion for leakage is: "No evidence of leakage".

Failure to achieve a satisfactory test result requires the initiation of a Condition Report. The disposition of the CR complies with the following:

1. Any leakage that is a result of a loss of design integrity shall be repaired.
2. Leakage from leak limiting repairs shall be analyzed and the disposition will be based on an assessment of whether the leakage could cause operational leakage in excess of administrative limits.

The results of the secondary side pressure leak tests are summarized in Table 1. In Steam Generator 22 leakage was observed from three active tubes and in Steam Generator 23 two previously plugged tubes exhibited evidence of leakage.

The leaking tubes in Steam Generator 23 contained circumferential cracks just above the tube end at a location that approximately corresponds to the heat affected zone of the tube to tubesheet seal weld. The tube is hard rolled into the tubesheet at this location for a distance of about 2 ¼ inches. According to Con Edison's licensed F* plugging criterion, a sound hard roll provides an acceptable leak limiting mechanical joint that precludes the need for repair. These tubes were eddy current tested for compliance to the F* criterion and determined to be acceptable. The disposition of these tubes is to use as is.

In Steam Generator 23 evidence of leakage was observed from two previously repaired tubes. These tubes contained Alloy 600 mechanical plugs that were repaired with a PAP device due to concern for plug cracking. PAPs are leak limiting devices that prevent a plug top release incident in the Alloy 600 plug. Each PAP contained a boron ring that indicated a potential for minor leakage. The PAP and plug in each tube were replaced with an Alloy 690 mechanical plug.

Subsequent to pressure leak testing of Steam Generator 23, a welded plug was installed as part of the repairs performed. Since the preparation for welding requires removal of the pressure seal weld and broaching of the pressure boundary, this steam generator was

re-tested in accordance with per Indian Point Station Test and Performance Procedure PT-V9C to ensure leak tightness of the weld joint. The test was satisfactorily concluded with no leakage.

## Table 1: Summary of SG Secondary Side Pressure Leak Test

| Test | Result | Condition Report | Disposition |
|---|---|---|---|
| Procedure PT-V9A for SG21 | Satisfactory | N/A | N/A |
| Procedure PT-V9B for SG22 | Three tubes leaking approx. one drop per 30 minutes. The affected tubes are R45C44, R44C42 and R45C39. | CR No. 200002094 | Accept as is. |
| 1. Procedure PT-V9C for SG23<br><br>2. Procedure PT-V9C for SG23 | 1. Boron on tubesheet of HL R20C35 and R28C38 which were previously plugged.<br><br>2. Satisfactory | 1. CR No. 200002195<br><br>2. N/A | 1. Remove plug and PAP and install Alloy 690 mechanical plug. Corrective action was implemented.<br><br>2. N/A |
| Procedure PT-V9D for SG24 | Satisfactory | N/A | N/A |

Root Cause Evaluation – Issue No. 12

*Section 6 further states that the 1997 inspection was the first 100% inspection since startup and thus the noted plugging of restricted tubes in 1997 is believed to be the result of a lager inspection sample in 1997. Is this a reasonable explanation given the most affected SG (SG 22) received a 47% sample full length inspection in 1995 with the finding of no tube restrictions. Full length inspection sample in other SGs in 1995 ranged from 67 to 100% with the finding of only one restricted tube.*

Response:

The number of tubes plugged for 610 mil probe dent restrictions as a percentage of the total number of tubes inspected each outage since 1979 is shown in Figure 1. This Figure showed that the percentage of tubes plugged for restriction to the 610 mil probe peaked in 1984 and has declined since that time.

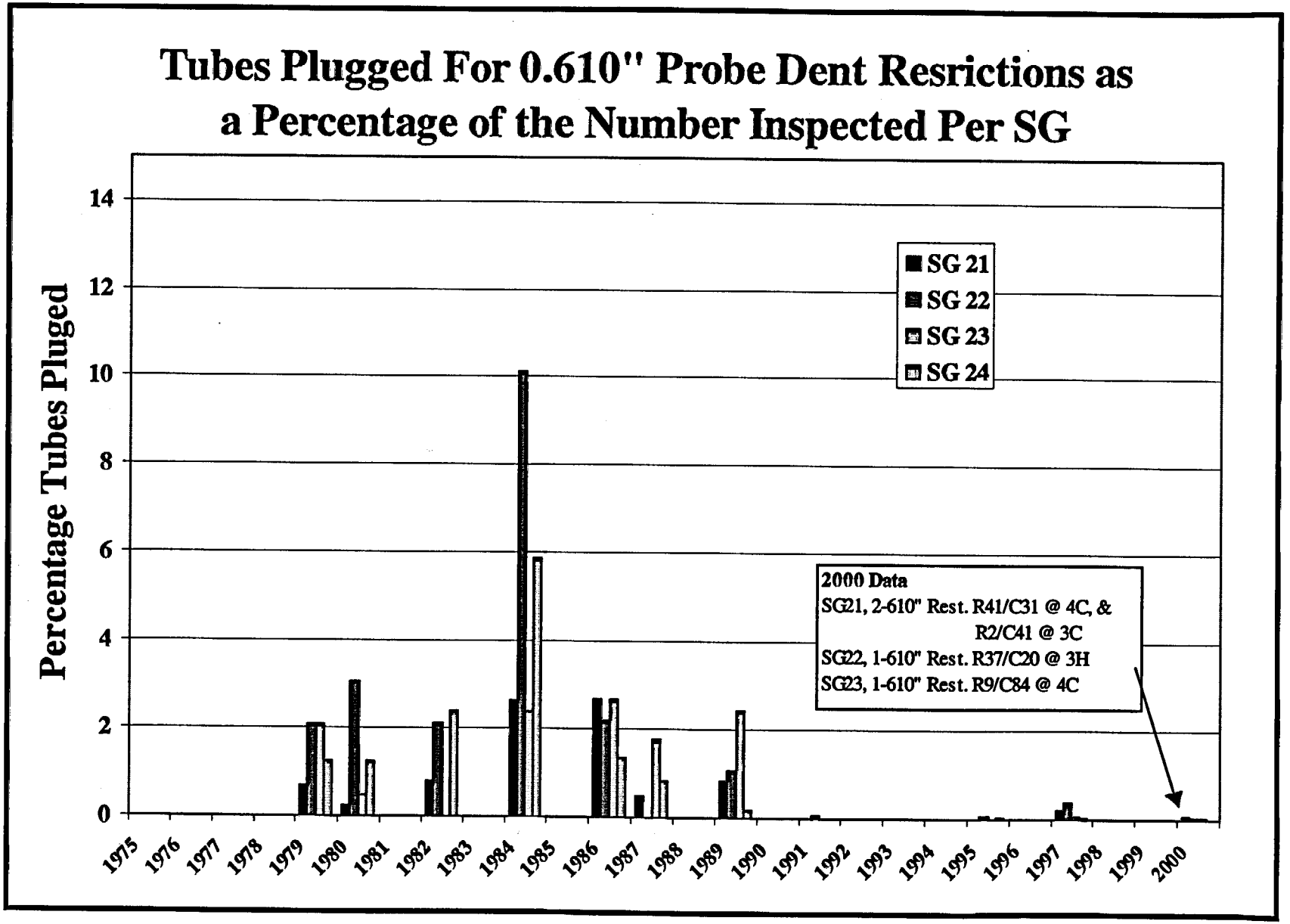
In 1995, the full length examination program consisted of 71%, 50%, 70% and 100% of the tubes in SG21, SG22, SG23, and SG24, respectively. The sampling at that time did not include a large number of lower row U-bends. The purpose of the full length inspection scope was to determine a baseline condition for AVB wear. The AVB sampling concentrated on tubes in rows 16 and higher. Almost all of the 1997 restrictions were in the low row U-bends. This would account for the difference in the higher number of 610 probe restrictions found in the 1997 versus the 1995 inspections.

During the 2000 inspection a total of only four tubes showed restriction to the 610 mil bobbin probe. None of these tubes were located at the u-bend or sixth TSP. Rather two were located in SG 21 at the third and fourth TSP, one in SG 22 at the third TSP, and one in SG 23 at the fourth TSP.

Therefore the data does indeed indicate that the increase in the number of tubes identified as being restricted to the 610 mil probe in 1997 was due to an inspection transient for three reason:

1) The 1995 inspection focused on AVB ware in rows 16 and higher. Almost all of the 1997 restrictions were in low row U-bend areas.
2) The number of tube restrictions decreased from 1997 to 2000, and
3) The inspection scope and probes used in 1997 and 2000 were the same.

# Figure 1


Tubes Plugged For 0.610" Probe Dent Resrictions as a Percentage of the Number Inspected Per SG
Percentage Tubes Pluged
0
2
4
6
8
10
12
14
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
SG 21
SG 22
SG 23
SG 24
2000 Data
SG21, 2-610" Rest. R41/C31 @ 4C, & R2/C41 @ 3C
SG22, 1-610" Rest. R37/C20 @ 3H
SG23, 1-610" Rest. R9/C84 @ 4C