U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

Region I

Report No. 50-247/80-19A

Docket No. 50-247

License No. DPR-26 Priority -- Category C

Licensee: Consoldiated Edison Company of New York, Inc.

4 Irving Place

New York, New York 10003

Facility Name: Indian Point Nuclear Generating Station, Unit 2

Meeting at: King of Prussia, Pennsylvania

Meeting conducted: December 3, 1980

NRC Personnel:

James M. Allan — 12/4/80
J. M. Allan, Deputy Director — date signed

J. C. Higgins — 12/4/80
J. C. Higgins, Senior Resident Inspector, Shoreham — date signed

H. B. Kister — 12/4/80
H. B. Kister, Chief, Reactor Projects Section No. 4 — date signed

T. T. Martin — 12/4/80
T. T. Martin, Chief, Reactor Projects Section No. 3 — date signed

G. Napuda — 12/4/80
G. Napuda, Reactor Inspector, Nuclear Support Section No. 2 — date signed

Approved by: Bruce H. Grier — 12/4/80
B. H. Grier, Director — date signed

Meeting Summary

A meeting was held to discuss additional factual information not previously made available to the NRC investigation Team.

Region I Form 12-1
(Rev. August 77)

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DETAILS

1. Persons Contacted

On December 3, 1980, a meeting was held at NRC Region I offices for the licensee to present new factual evidence related to the investigation of the October 17, 1980, Vapor Containment Flooding event.

a. Licensee Personnel Present

Mr. B. Brandenburg, Assistant General Counsel
Mr. K. Burke, Attorney
Mr. A. Flynn, Chief Mechanical and Maintenance Engineer
Mr. J. Halpin, Maintenance Engineer
Mr. C. Jackson, Director-Quality Assurance and Reliability
Mr. E. McGrath, Vice President-Power Generation
Mr. S. Rothstein, Consulting Engineer

b. NRC Personnel Present

Mr. J. Allan, Deputy Director, Region I
Mr. B. Grier, Director, Region I
Mr. J. Higgins, Senior Resident Inspector - Shoreham
Mr. H. Kister, Chief, Reactor Projects Section #4
Mr. T. Martin, Chief, Reactor Projects Section #3
Mr. G. Napuda, Reactor Inspector

2. Information Discussed

a. Maintenance Work Requests (M.W.R.s)

The licensee provided to the NRC investigation team summaries of seven additional M.W.R.s., related to repairs of Fan Cooler Unit (F.C.U.) Service Water leaks not previously included on their Fan Cooler Unit maintenance summary. The team reviewed the information and revised NRC Investigation Report 50-247/80-19, figures 4 and 6, to reflect the additional information.

b. Failure Analysis Report

The licensee provided to the NRC investigation team a copy of a licensee memorandum dated March 15, 1973, titled "Recirculation Fan Motor Coolers, Unit No. 2 - Indian Point." The memorandum documented the results of a failure analysis performed in early 1973 on five replaced F.C.U. Motor Heat Exchangers. During the period September 1971 to January 1973, the licensee identified excessive

incidents of leakage from the Heat Exchangers, warranting their replacement. The failure analysis was performed to determine if the cause of the leakage was due to excessive cooling water flow rates or other problems. The analysis concluded the cooling water flow rate was excessive, but that the failures were due to poor design and/or assembly.

Discussion with the licensee indicates the 1973 replacement Motor Heat Exchangers were fabricated and inspected to tighter specifications, which should have eliminated leakage problems in the replacement Heat Exchangers. The licensee maintained that, in their engineering judgement, the cause of F.C.U. Cooling Coil leaks was understood, based on: their knowledge of the previous determination of the leakage cause on the F.C.U. Motor Heat Exchanger; the fact that the F.C.U. Main Cooling Coils were made by the same organization with the same specifications as the original Motor Heat Exchangers; and the similarities between some new leaks appearing on the F.C.U. Cooling Coils and those on the original Motor Heat Exchangers.

The licensee indicated he was currently unaware of any other documented failure analysis for the F.C.U. Service Water System leaks.

The NRC investigation team maintained that the licensee had failed to determine and document the cause(s) of (1) F.C.U. Motor Heat Exchanger leaks, following their discovery on the new design replacement units; of (2) F.C.U. Cooling Coil leaks, assuming but not verifying the leaks were caused by the same problems identified on the replaced Motor Heat Exchangers; of (3) F.C.U. Cooling Coil leaks, when leakage not characteristic of previous brazed joint failures of tube to tube header joints occurred; and, of (4) F.C.U. Cooling Coil tube and tube header problems, identified during the Summer 1980 boroscopic examination, which revealed additional leakage cause potential (some active corrosion sites on header, possible de-nickelfication, some active pitting sites of tubes, deposits in tubes, etc.).

c. F.C.U. Performance Perspective

The licensee provided to the NRC investigation team an approximate count of total F.C.U. Cooling Coil and Motor Heat Exchanger straight tubes (3,000) and brazed joints (18,000). The licensee maintains that the failure rate of F.C.U. components is extremely low.

The NRC investigation team acknowledged the failures shown in figure 6 of NRC Investigation Report 50-247/80-19 represent a small percentage of components available for failure, but maintains the increasing frequency of leaks, as indicated in figure 4 of the same report, should have been given over-riding consideration.

3. Proposed Technical Specifications

Mr. McGrath, Vice President-Power Generation informed the NRC investigation team that his staff was unable to meet his committed schedule for submission of proposed Technical Specifications for new, modified or effected systems, related to the October 17, 1980, Vapor Containment flooding event. Mr. McGrath revised his commitment to having the proposed Technical Specifications submitted by February 15, 1981, or plant startup, whichever is later.

ATTACHMENT

Investigation Report 50-247/80-19 Revisions

The following pages and figures of NRC Investigation Report 50-247/80-19 were revised and are attached to this meeting report.

Page 5

Date by which licensee is to submit Proposed Technical Specifications was revised to reflect current commitment.

Page 31

Bottom of page was removed, since information is duplicated on top of page 32.

Page 41

1. The statement that no failure analysis had been conducted by the licensee was revised to reflect the fact that a failure analysis was performed in 1973.

2. The subjects of discussion between the NRC inspector and the Assistant Vice President for Engineering were clarified, with an additional reference to the paragraph which provides greater detail.

3. The number of MWRs associated with F.C.U. Service Water System leaks was revised to reflect the additional MWR information provided by the licensee.

Page 41a

A new page was added to collect the over-run from revised page 41.

Page 42

1. The additional information related to the total number of straight tubes and brazed joints in the F.C.U.s was added.

2. F.U.C. was changed to F.C.U., the correct acronym.

Page 72

1. The description of the item of noncompliance was changed to reflect the fact that the continued leakage and repairs of concern to the NRC investigation team include Fan Cooler Unit Service Water System leaks, both within the units and their supply and return piping.

2. The reference to paragraph 11 closes the loop on information relative to this subject.

Figure 4

The figure was revised to reflect the additional MWR information provided by the licensee.

Figure 6

1. The figure was revised to reflect the additional MWR information provided by the licensee.

2. The information on the total number of F.C.U. Cooling Coil and Motor Heat Exchanger straight tubes and brazed joints is included in the notes to the figure to enable independent evaluation.

1 - Section Chief
2 - Senior Resident Inspectors
1 - Resident Inspector
1 - Reactor Inspector (Quality Assurance)
1 - Reactor Inspector (Non-Destructive Examination)
1 - Reactor Inspector (Corrosion and Metallurgy)
2 - Investigators

Information was gathered through the conduct of interviews, the taking of sworn statements, the inspection of equipment and tours of affected spaces, the review of procedures, records, logs, and computer printout, the witnessing of tests, independent computation of volumes and flooding elevations, the construction of charts and information flow diagrams, and the independent non-destructive examination of the Reactor Vessel and Incore Instrument Conduits.

The principle products of this investigation are the transcript of the NRC-licensee Technical Meeting in White Plains, New York on November 5, 1980, and this investigation report, including a detailed Sequence of Events attached as Enclosure 1 to the report.

Based on the findings of the NRC Investigation Team and that of the licensee, it was determined that additional information relative to the event and the corrective action required to prevent reoccurrence had to be developed and documented. Enclosure 2 documents those reports the licensee has committed to develop and submit to NRC by December 22, 1980. The licensee is further committed to propose new or additional Technical Specifications for the systems contributing to the flooding event, or modified as a result of the event, by February 15, 1981, or plant restart, whichever is later.

4. Licensee Management Activities

a. Event Narrative

(1) Friday - 10/17/80

Upon discovery of the problem with Nuclear Instrument Channel N42, shortly after midnight, operators notified the first shift Senior Watch Supervisor (S.W.S.) (first line supervision) of the condition, who then called the Chief Operations Engineer (C.O.E.) at home and informed him of the problem. It was decided that the S.W.S. would call the Reactor Engineer and request he come to the plant to conduct a flux map. The C.O.E. called the Plant Manager (P.M.) at home and informed him of the developing problem.

Following the determination by the Reactor Engineer and S.W.S. that Channel N42 was failing and should be declared inoperable, the S.W.S. again called the C.O.E., requesting per licensee

9. Reactor Vessel Pit Sump Pumps

a. Description

The pit underneath the reactor vessel extends from about elevation 46' down to about elevation 19'. The initial plant design had no provision for pumping water which somehow managed to collect in the pit. During initial preoperational testing a service water line to an FCU failed, resulting in flooding of this pit. As a result of this occurrence, an Engineering Service Request (#238) was initiated on April 14, 1972 to install sump pumps in the pit. These pumps were actually installed during the 1976 refueling outage and pump the reactor vessel pit to the containment sump. The pumps installed are Crane Deming submersible pumps which are designed to operate submerged, not in air. They each have a 100 gallon per minute capacity and a check valve in their discharge. After individual pump check valves the discharge lines tie together, run up to about elevation 52', over to the containment sump and then down to the bottom of the containment sump. No anti-siphon vacuum breaker is included in the line. The motors have a tandem seal design with a moisture detection circuit between the two seals to detect impending or actual motor failure. All controls and the moisture detection alarm lights are inside containment.

(4) Flexible hose failures on the Motor Cooler Heat Exchanger. There is no information available to indicate whether these failures are caused by fatigue or corrosion, however, the most probable cause is fatigue.

c. F.C.U. Status and Maintenance History

The NRC inspector held discussions with site maintenance and corporate engineering personnel to determine if specific failure analysis studies were made on any of the F.C.U. related leaks. No failure analysis had been conducted by the licensee, other than those conducted on cement lined pipe failures, between 1973 and October 1980. (This deficiency is discussed further under QA/QC Program).

Based on information provided the NRC on December 3, 1980, the licensee had performed and documented a failure analysis of five F.C.U. Motor Heat Exchangers in 1973. During the period September 1971 to January 1973, the licensee identified excessive incidents of leakage from these Heat Exchangers. The failure analysis was performed to determine if the cause of these failures was due to excessive cooling water flow rates or other problems. The analysis concluded the failures were due to poor design and/or assembly.

Discussion with the licensee indicates the replacement Motor Heat Exchangers were fabricated and inspected to tighter specifications, which should have eliminated leakage problems in the replacement units.

The maintenance records for the fan coolers were reviewed with the Maintenance Engineer. The design, operation and maintenance of the F.C.U.s was discussed with the Assistant Vice President for Engineering and cognizant engineering personnel selected by him, as indicated in paragraph 11.f. A discussion was held with the Maintenance Engineer following his detailed inspection of the F.C.U.s. Later the NRC inspector conducted a thorough visual inspection of the F.C.U.s, accompanied by the Maintenance Engineer. The report of observations by the Maintenance Engineer of the five F.C.U.s on 10/26/80 indicated 46 previous repair locations (reported in 39 MWR's), and 8-12 current probable leaks. There were 7 currently installed pipe clamps, 8 re-brazed repairs and 18-25 epoxy repairs noted. The 18-25 number results from difficulty identifying general repaired areas as individual or group repairs. A Maintenance Department summary sheet made up from Maintenance Work Request (MWR) records indicates 4 repairs on F.C.U. #21, 4 on F.C.U. #22, 11 on F.C.U. #23, 8 on F.C.U. #24 and 12 on F.C.U. #25. The total of 39 "MWR repairs" includes some multiple repairs conducted under one MWR. The failure rate of the F.C.U.'s Service Water System, due to leaks, is presented on attached Figure 4, in the form of a histogram.

Review of the header/stub tube/heat exchanger tube design by the NRC inspector reaffirmed the licensee's opinion of the difficulty in accomplishing effective repairs to the heat exchanger. The all-brazed design combined with the close spacing of the tubes and relative thickness of tubes and headers (0.035"/0.154-0.237"), makes localized re-brazing almost impossible. (Fix one joint and damage the braze on the adjacent tube joint.) The Maintenance Department first attempted re-brazing of the Cu-Ni materials to repair a leak. This was marginally successful along the length of the tubes, but unsuccessful at the header/stub end joints. The only successful leak repair utilized was a "temporary fix" with epoxy resins and fiber glass tape.

Leaks in large diameter cement lined pipes were temporarily repaired with "Adam's Clamps" (rubber gaskets clamped over the leak). Leaks in small diameter pipe sections were repaired with "Adam's Clamps" or by

replacement with austentic stainless steel pipe. The Engineering Department indicated that the life of a "temporary fix" was 1 to 3 years.

d. Service Water System

A walk down inspection was made of the observable portions of the service water piping providing cooling water for the F.C.U.s from the 6 Service Water Pumps and their Traveling Screens to the piping penetrations outside of the Vapor Containment. The piping system is cement lined pipe up to the F.C.U. heat exchangers, where the piping is then Cu-Ni. Review of maintenance records and visual observations indicated minimal problems in the large diameter cement lined piping system outside the Vapor Containment. It was reported to the NRC inspector that there have been problems in the piping system associated with localized high velocity (design related) erosion. These problems which occurred early in service life, resulted in installation of stainless steel dutchman sections, in the piping system outside the Vapor Containment.

e. Heat Exchangers

A review was made of maintenance records for the subject heat exchangers. The purpose of the review was to obtain, if possible, a categorization of the failures in these heat exchangers associated with the Service Water cooling system. Equipment failures not related to the Service Water cooling system were not evaluated. Difficulty was encountered in analysis of the maintenance files, due to lack of explicit information on location of failures and repair technique details. Maintenance files were fortunately segregated by Fan Cooler Unit. The results of this cursory analysis by the NRC inspector are shown on attached Figure 6. It should be noted that there are a total of about 6,000 straight tubes and about 18,000 brazed joints in all five F.C.U.s.

f. Meeting With The Licensee Regarding Fan Cooler Unit Heat Exchangers

On October 28, 1980, the NRC Corrosion and Metallurgy Specialist met with members of the licensee's engineering staff. The purpose of the meeting was to discuss the F.C.U. Heat Exchangers (and related parts of Service Water Cooling System) at Indian Point 2. The following information was obtained.

(1) Indian Point 2 (IP2) operation started in 1973-74, so the F.C.U.'s have seen approximately 6 1/2 years (interrupted) service.

(2) In February 1979, corporate engineering started to review the repair procedures utilized, i.e., the EPI SEAL tube plugging procedure.

quality levels and evaluation of material useage; and, 10 CFR 50.59(b) which reouires that safety evaluations be performed for changes to the facility and those records retained.

The inspectors also identified that the Station Nuclear Safety Committee did not review, as required by TS 6.5.1.6, the modifications made to Service Water Piping and Cooling Coils, associated with the Fan Cooler Units, between 1973 and October 21, 1980. These modifications were designated "temporary repairs" and were made to leaking components, using epoxy type sealants and pipe clamps.

The above constitutes an item of noncompliance (50-247/80-19-44).

(2) Despite continued Fan Cooler Unit Service Water System leakage and many repairs of these leaks between 1973 and October, 1980, the licensee had not made any determination of the causes of the leakage problem or recorded such action; nor had the evaluation of the causes for such leakage, which had been initiated, ever been completed. Additional details are included in paragraph 11.

This is contrary to: 10 CFR 50, Appendix B, and Criterion II, which requires programatic control over such activities; and FSAR Volume A, Attachment A-2, which commits to ANSI N18.7-1976, which in turn requires that the causes of malfunctions (i.e., leaks) be promptly determined, evaluated and recorded.

This is an item of noncompliance (50-247/80-19-45).

(3) Technical Specification (TS) 6.8.1 commits to ANSI N18.7-1972, Paragraph 5.1.6.1 of which requires that maintenance and modifications that may affect the functioning of safety related systems be preplanned and performed in accordance with written procedures appropriate to the circumstances.

Contrary to this requirement, site administrative procedures were not established, implemented and maintained to provide guidance as to: (1) when written and approved procedures were required for maintenance activities; and, (2) when maintenance activities constitute a modification; both of which require review and concurrence by the Station Nuclear Safety Committee. The inspector was aware of a memorandum that discussed modifications, which had been issued (March 14, 1977) by the Director of Quality Assurance. The inspector noted that these instructions did not appear to have been implemented in that: (1) there were no corresponding site or maintenance department instructions; (2) past and present Maintenance Engineers were unaware of it; and, (3) if the instructions had been implemented, the epoxy repairs discussed elsewhere in this report would have been considered as modifications, which they (the epoxy repairs) were not.

FPI-MI-10 X 10 TO 1 INCH
5TH LINE ACCENTED, 10TH HEAVY

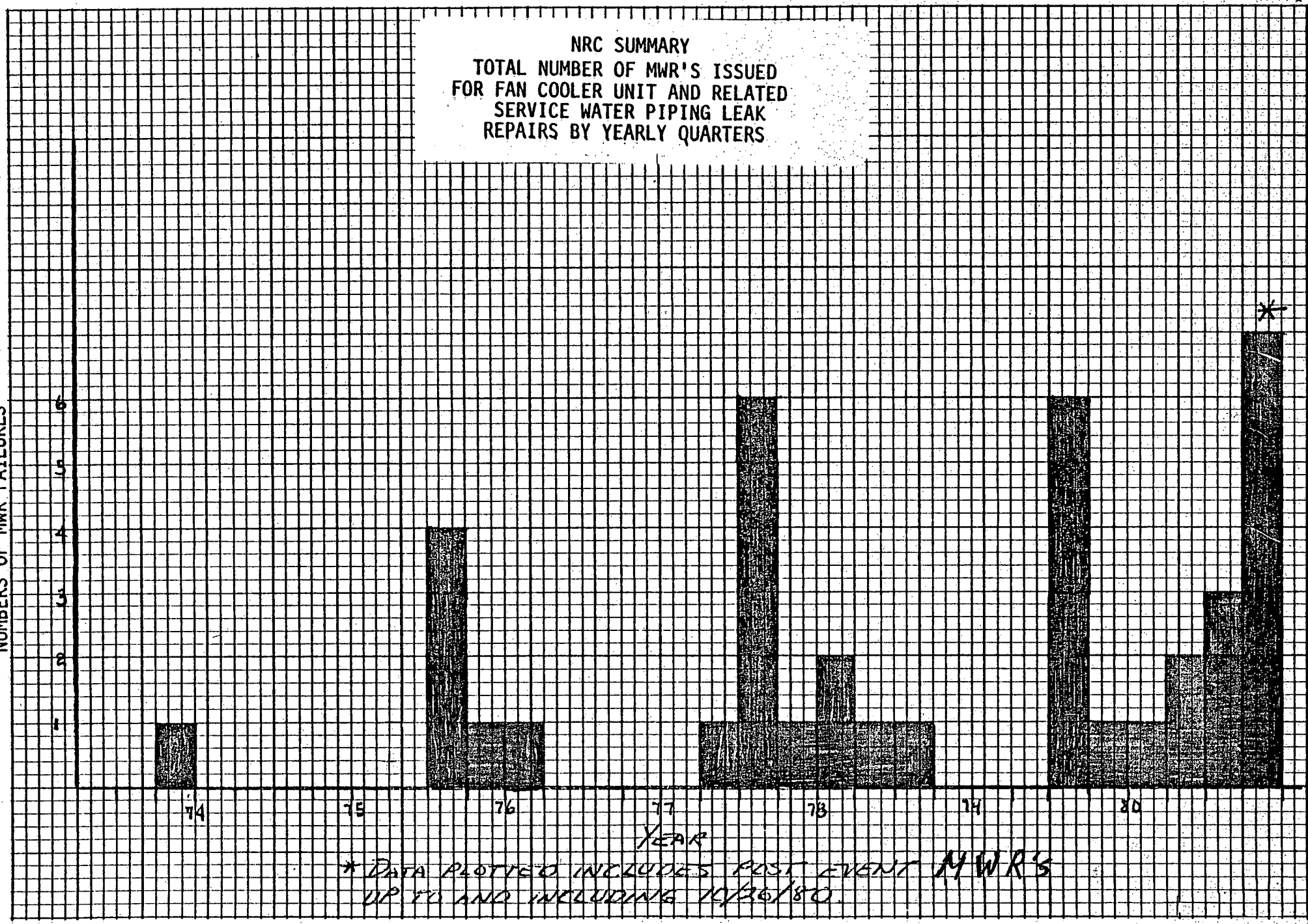

Figure 4 – Rev. 1

FAN COOLER UNIT/ SERVICE WATER LEAK MWR CATEGORIZATION

FAN COOLER UNIT	STUB TUBE BRAZING FAILURES	TUBE FAILURES	FLEX HOSE FAILURES	CEMENT LINED PIPE FAILURES	PREVIOUS REPAIR FAILURES	FIELD REPLACEMENT S.S. WELD FAILURES	BRAZED JOINTS OTHER THAN STUB TUBE FAILURES	TOTAL CORROSION AND JOINING FAILURES
21	2	1		1				4
22	1		2	1				4
23	1	2		4		2	2	11
24	1			3	3		1	8
25	3	2(1)	1	3	3			12
TOTAL	8	5	3	12	6	2	3	39

NOTE: (1) INCLUDES 5 TUBE FAILURES IN ONE TUBE AS ONE (1) FAILURE

(2) THERE ARE A TOTAL OF ABOUT 6000 STRAIGHT TUBES AND ABOUT 18,000 BRAZED JOINTS IN ALL FIVE FAN COOLER UNITS.

FIGURE 6 - REV 1