North Atlantic
February 28, 1994

ENCLOSURE TO NYN-94023

1993 SECONDARY CHEMISTRY ANNUAL REPORT

SEABROOK STATION
1993 SECONDARY CHEMISTRY ANNUAL REPORT

The Seabrook Station Secondary Chemistry Annual Report provides a summary and evaluation of critical chemistry parameters in the following systems: Condensate, Feedwater, Main Steam, and Steam Generator Blowdown. This report includes the total number of hours each critical parameter was out of specification during the year. Table 1 is included which identifies the specific period these parameters were out of specification.

The following is a brief summary of significant plant events during 1993. The Unit experienced five reactor trips during the year:

January 3	Trip due to Feedwater oscillations.
January 14	Trip due to ground on turbine generator.
May 20	Trip during 10% MSIV closure test.
July 27	Trip due to solid state protection system card failure.
September 22	Trip due to flashover on turbine generator alterex (turbine trip).

The September 22, 1993 trip forced the plant to a Mode 5 Cold Shutdown to replace MS-V-44.

On November 14, 1993 the Unit reduced power to 50% due to a seawater leak in the "C" main condenser. The reactor did not return to full power until November 26, 1993.

In addition to the above reactor trips and seawater leak, the secondary plant experienced several transients during the course of the year. Each of these contributed to chemistry upsets of varying degrees. Events such as isolating MSRs, which occurred in April, May, and twice in December are important events in terms of chemistry controls in the secondary plant. Historically, these events have been followed by increased contaminant levels and elevated metal transport. Also, Heater Drain fluctuations in the fourth quarter similarly exacerbated what is believed to be a pre-existing iron transport problem in Feedwater. Elevated Feedwater iron was observed during the second half of 1993 and is believed to have been predicated by extremely low dissolved oxygen levels in the Condensate and Feedwater Systems. This phenomenon is commonly referred to as Flow Assisted Corrosion (FAC).

REVISION 3 TO PWR SECONDARY WATER CHEMISTRY GUIDELINES

Revision 3 to the EPRI guidelines for secondary water chemistry was issued in May, 1993. North Atlantic adopted these guidelines into the Station Chemistry Manual, Section 3.2 after receipt of the EPRI report. Significant changes to the document are highlighted below:

- Feedwater iron and copper Action Level values have been reduced from 20 and 5 ppb, respectively, to 5 and 1 ppb. This change reflects industry's awareness of steam generator fouling issues, as well as accelerated corrosion mechanisms associated with buildup of iron and copper in the steam generators.

- Feedwater hydrazine has been increased from a nominal 20 ppb (or 3 times the oxygen level) to a minimum 100 ppb. This change reflects the reducing nature of hydrazine which scavenges residual oxygen and precludes the formation of metal species at higher oxidation states in the steam generators.

- An increased emphasis has been placed on monitoring the sodium and chloride input to the steam generators. Sodium and chlorides are typically too low to measure accurately in the feed train. Therefore these measurements are normally performed on blowdown samples. Caustic induced corrosion mechanisms (from a high concentration of sodium in the generators) have been responsible for plugging many steam generator tubes at other PWRs.

- The molar ratio of sodium to chloride is calculated daily as part of the Seabrook Station monitoring program. The Revision 3 guidelines also suggest that plants which have significant sulfates in steam generator blowdown to include sulfate in the ratio. Seabrook Station has always been one of these plants. Therefore both ratios are calculated for trending purposes. A graph is included in this report that depicts these trends.

1993 CHEMISTRY REPORT: BY SYSTEM

CONDENSATE

North Atlantic undertook an aggressive campaign early in 1993 to reduce oxygen levels in the Condensate System. Historically, Seabrook Station has operated with oxygen levels in the 7-8 ppb range (Action Level 1 is > 10 ppb). Through the reduction effort, oxygen was reduced to 0.5 ppb by August 1993. A graph is attached depicting this downward trend. As discussed earlier, an oxygen starved environment may have contributed to the elevated iron levels experienced in Feedwater. As a result, oxygen was raised deliberately from 1-1.5 ppb to 3-4 ppb by the end of December 1993. North Atlantic continues to closely monitor a potential relationship between low condensate oxygen and elevated feedwater iron. Northeast Utilities has likewise observed a potential relationship between oxygen and iron at two of the three other PWRs within the Northeast Utilities system.

The breakdown of Condensate out-of-specification hours is as follows:

Parameter	0-0-S hrs
Oxygen	264
Cation Conductivity	49
SACC[1]	0
pH	31

[1]Strong Acid Cation Conductivity

Again, the majority of out-of-specification hours for oxygen took place during the five reactor restarts and the November 1993 main condenser leak period. February hours were accumulated between February 24-26, 1993 during the motor replacement work for the "B" condensate pump. Twenty-three hours were logged between September 29-30, 1993 while the Unit was in Mode 2 (the plant attempted a restart after the September 22, 1993 reator trip, but was forced to shut down on September 30, 1993 and then cooled down to Mode 5). Out-of-specification hours for pH were similarly recorded during power ascension from the September 22, 1993 reactor trip, and during the November 1993 main condenser tube leak.

FEEDWATER

The elevated pH program for Feedwater was continued in 1993. This program began in January, 1992 with the purpose of reducing iron transport to the steam generators. Feedwater pH was increased in 0.1 unit increments to 9.4 during 1992. Sufficient data at the 9.4 pH plateau had been collected through March, 1993 to permit an increase to a pH of 9.5 beginning April 7, 1993. Iron in the Feedwater was reduced from 6-8 ppb (steady state conditions) to 3-5 ppb in the May-June 1993 time frame. Iron levels began to increase noticeably with the August 1993 data and remained elevated throughout the remainder of the year. The majority of out-of-specification hours logged for copper occurred during this period as well. Feedwater Iron and copper graphs are included in this report. Iron accounted for nearly 70% of the 1993 out-of-specification (O-O-S) hours. The breakdown for Feedwater is as follows:

Parameter	O-O-S hrs
pH	37
Iron	5088
Copper	1344
Oxygen	111
Hydrazine	769

Out-of-specification hours were logged for hydrazine and oxygen during each power ascension after the five reactor trips during the year. These two parameters are particularly susceptible to being out-of-specification during reduced power operations and plant transients due to chemical feed limitations. Eighty-three percent of the hydrazine out-of-specification hours took place during the period the plant was at reduced power while locating and correcting the main condenser tube leak in November 1993. Eight hours were logged for oxygen during this period, as well. Out-of-specification hours were logged for pH in October 1993 during power escalation after the September 22, 1993 reactor trip, and several hours were logged during the main condenser tube leak incident. The monthly and annual totals are located in Table 1.

MAIN STEAM

There were a total of 428 out-of-specification hours for Main Steam during 1993. All out-of-specification hours were attributed to cation conductivity, and all occurred either during power ascension after the five reactor trips, or at reduced power levels during the November 1993 main condenser tube leak. No out-of-specification hours were logged for sodium.

STEAM GENERATORS

Steam Generator Blowdown out-of-specification hours occurred during power ascension after each reactor trip, and during the main condenser leak in November 1993. An 8 hour, 35 minute chemistry hold occurred during power escalation on July 30, 1993 to allow blowdown sulfate and cation conductivities to drop below Action Level 1 limits. This was the only chemistry-related hold during power escalation reported during the year. The breakdown of Steam Generator Blowdown out-of-specification hours is as follows (these hours are the sum of all four generators):

Parameter	0-0-S hrs
Cation Conductivity	569
pH	0
Sodium	28
Chloride	58
Sulfate	340
Silica	0

As can be seen from Table 1, the only time during the year sodium and chloride were outside specification was during the initial indication of a seawater leak in the main condenser, first identified on November 14, 1993. A histogram depicting blowdown chemistry during 1993 is included.

COMPARISON: 1993 VS 1992 OUT-OF-SPECIFICATION HOURS

Below is a comparison of out-of-specification hours reported during 1993 versus 1992:

System	1993	1992
CO	344 hrs	288 hrs
FW	7349	1273
MS	428	462
S/G	995	1157
Total	9116 hrs	3180 hrs

The increase in 1993 hours over 1992 is largely attributable to metal transport in the Feedwater System. Iron and copper transport accounts for 70% of the total out-of-specification hours for 1993. Other than for metal transport, 1993 was an improvement over 1992, especially given that most of the non-metal transport hours occurred either during the condenser seawater leak, or after startups following the five reactor trips during the year.

SEABROOK STATION
1993
OUT-OF-SPEC HOURS

Table 1

STEAM GENERATORS

PARAMETER	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Cat. Cond.	97.4				81.6		84			217.8	88		568.8
pH													0
Sodium											28		28
Chloride											58		58
Sulfate							76.4			264			340.4
Silica													0
Total	97.4	0	0	0	81.6	0	160.4	0	0	481.8	174	0	995.2

CONDENSATE

PARAMETER	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Oxygen	14.1	27.2	0.9		23.5		11.4		22.8	19.8	144.8		264.5
Cat. Cond.	22.6				26.5								49.1
SACC													0
pH										19.8	11		30.8
Total	36.7	27.2	0.9	0	50	0	11.4	0	22.8	39.6	155.8	0	344.4

FEEDWATER

PARAMETER	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
pH										28.8	8		36.8
Iron			24	504	576	168	744	744	504	336	744	744	5088
Copper				168	24			192		168	456	336	1344
Oxygen	14.9				23.5		13.4		22.8	28.8	8		111.4
Hydrazine	22.7		8		16.5		8.4		14.8	53.8	636.5	8	768.7
Total	37.6	0	32	672	640	168	765.8	936	541.6	615.4	1852.5	1088	7348.9

MAIN STEAM

PARAMETER	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Cat. Cond.	66.6				58.5		50.3			59	193.5		427.9
Sodium													0
Total	66.6	0	0	0	58.5	0	50.3	0	0	59	193.5	0	427.9

SEABROOK STATION

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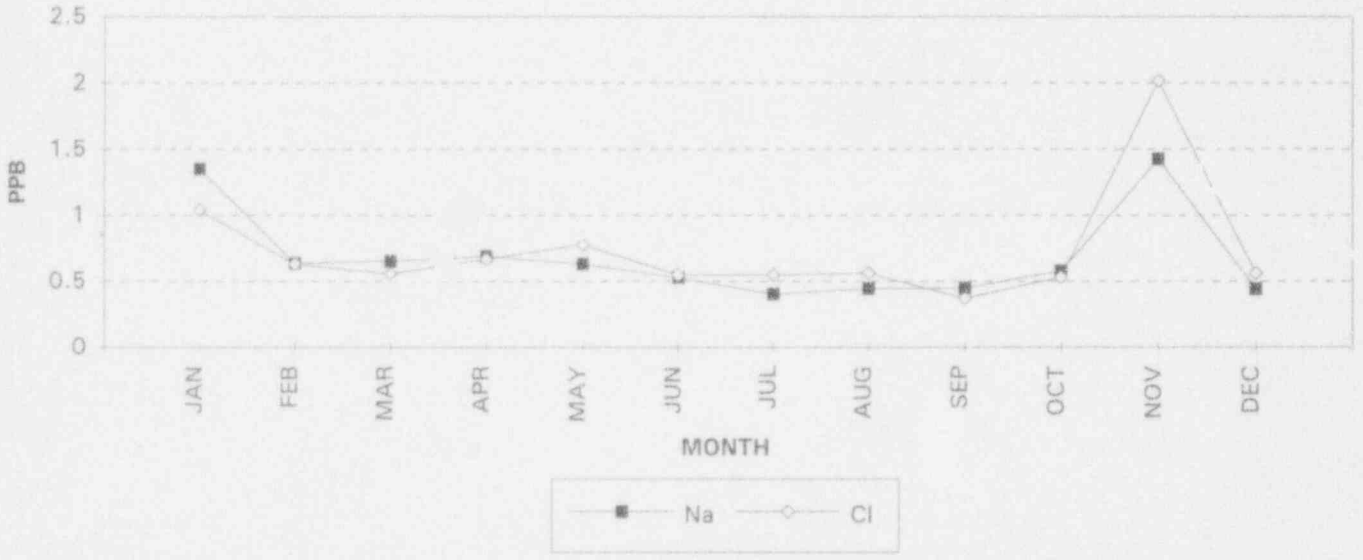
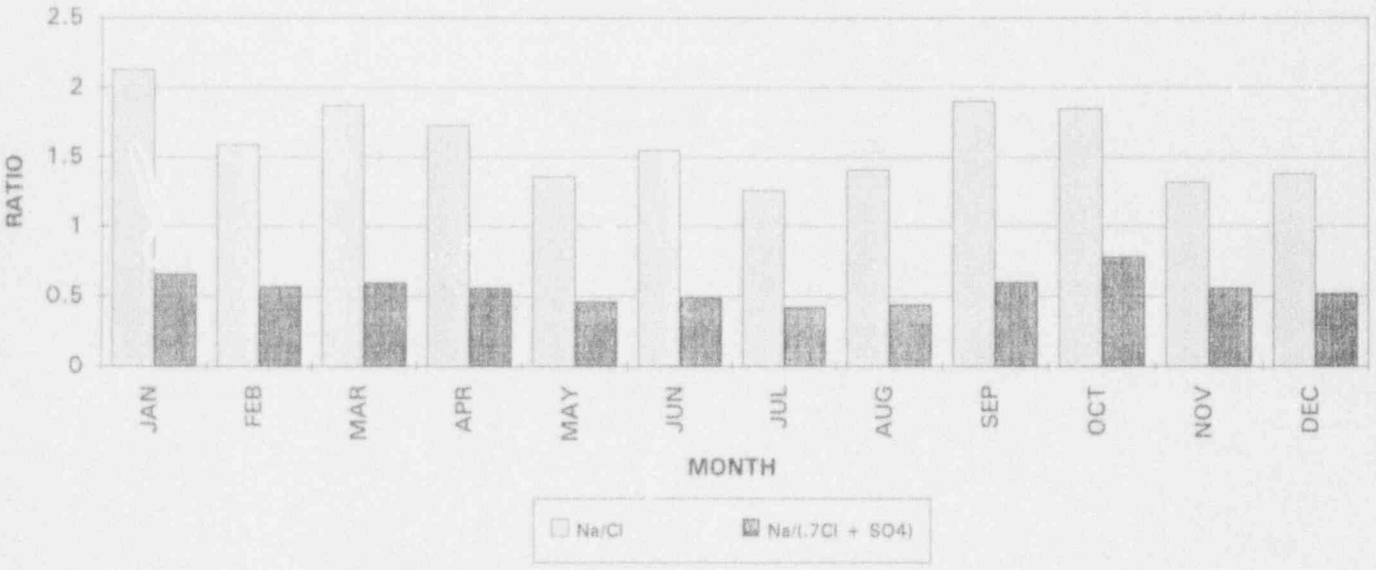
STEAM GENERATOR BLOWDOWN

SODIUM and CHLORIDE
MONTHLY AVERAGES



CATION/ANION MOLAR RATIO



SEABROOK STATION

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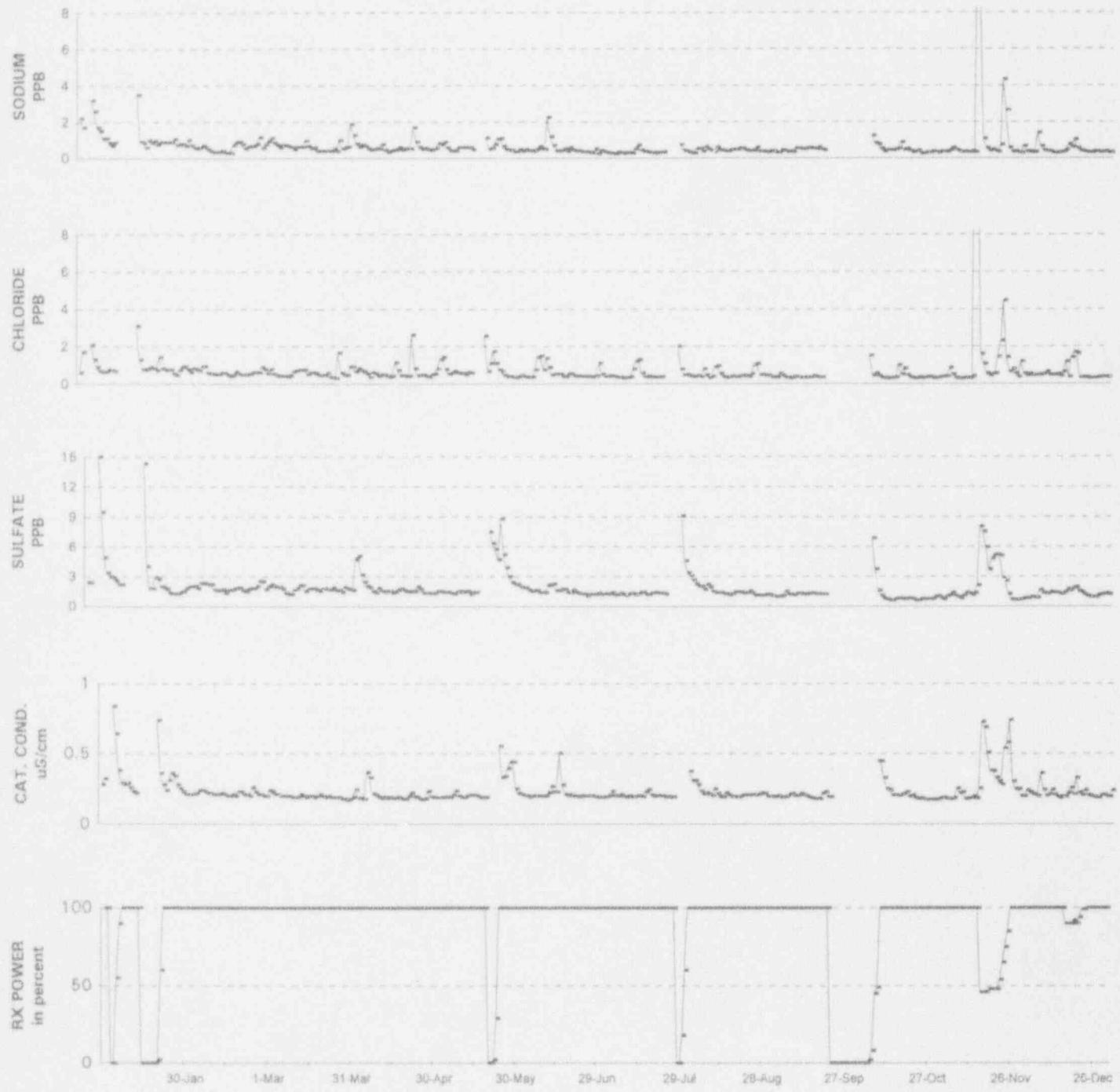
STEAM GENERATOR BLOWDOWN



SEABROOK STATION

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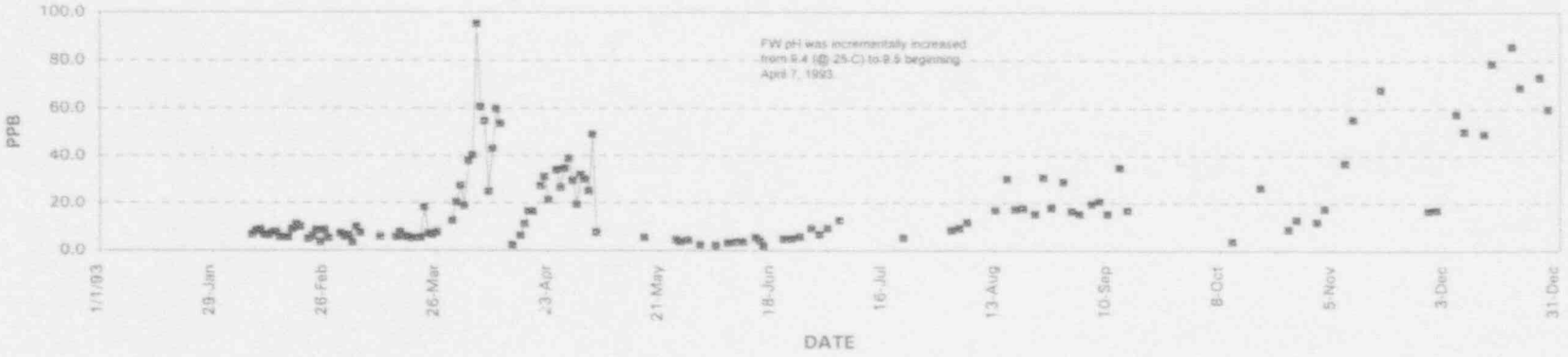
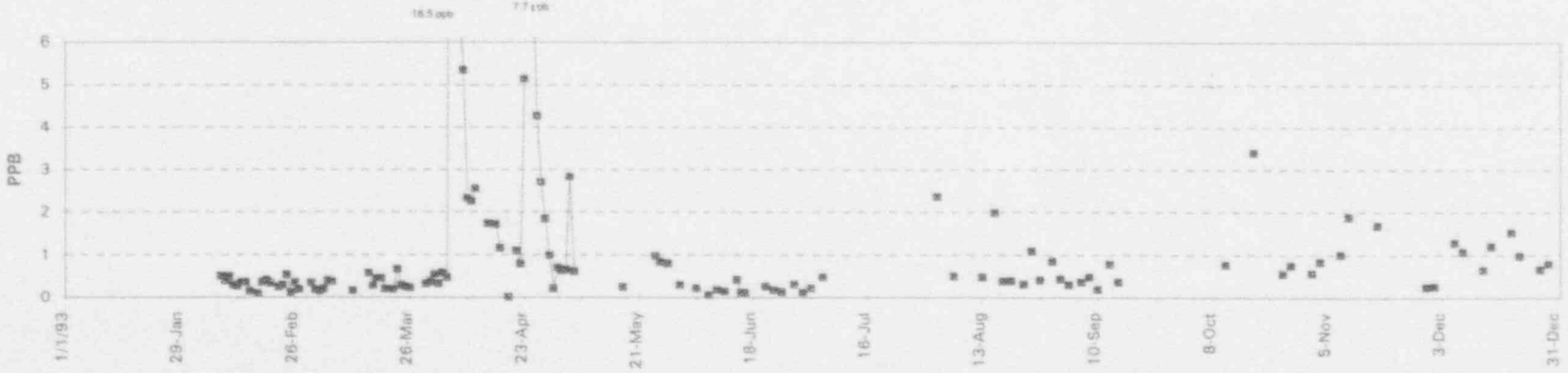
FEEDWATER

TOTAL IRON



TOTAL COPPER



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CONDENSATE OXYGEN