

DRAFT

REVIEW OF
GROUND WATER CORRECTIVE ACTION
Annual Review - 1990
UNC CHURCH ROCK SITE
GALLUP, NEW MEXICO

U.S. EPA REGION 6

TES X

Contract No. 68-W9-0007
Work Assignment No. C06027

METCALF & EDDY, INC.
Project No. 260027

WORK PERFORMED BY:

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25 January 1991

1.0 INTRODUCTION

With reference to the "Work Plan for United Nuclear Corporation Site, Churchrock, New Mexico" dated 30 November 1989 (TES X Contract No. 68-W9-0007, Work Assignment No. C06027), the "Ground Water Corrective Action - Annual Review -1990" report (UNC, 1990) has been reviewed.

The report consisted of raw data on groundwater quality, groundwater elevations, and pumping of extraction wells, along with a summary of activities performed during 1990 and the status of the groundwater remediation project in terms of compliance with the applicable EPA and NRC regulations.

The objective of this review was to evaluate the raw data, perform independent analyses of the data presented, and compare results with conclusions presented by UNC in the report. Based on this review, the effectiveness of groundwater remediation efforts at the UNC site will be evaluated and appraised, and recommendations and modifications to the groundwater remediation program will be proposed and implemented by the regulatory agencies.

The procedure for this review will be as follows:

- o Review the UNC report and raw data, and provide input to the EPA consisting of technical comments on the report, and (as appropriate) summary tables of the raw data, figures showing potentiometric surfaces for the three zones of concern, hydrographs showing variation in water levels, isoconcentration maps for hazardous constituents of regulatory concern, and plots of concentration variation with time for hazardous constituents.
- o Participate in a meeting with the EPA, NRC, NMEID, and Navajo Tribe to discuss the status of the remediation project and decide on modifications to the program to enhance compliance with applicable groundwater protection regulations.
- o Summarize results of the meeting and provide documentation of the consensus of decisions of the regulatory agencies and the required modifications to be implemented.

2.0 GENERAL OBSERVATIONS AND COMMENTS

Based on a review of the data presented by UNC, there is little evidence that the groundwater remediation efforts are being effective in reducing concentrations of hazardous constituents in groundwater in the three zones of concern, based on the indicator parameters (pH for Zones 1 and 3, and chloride for the Southwest Alluvium) selected by UNC to monitor the

effectiveness of the remedial activities. Evaluation of other parameters, including major ions, trace and radioactive elements, also indicates that groundwater conditions are remaining relatively stable. At this point, it does not appear that any of the other constituents would give a more reliable indication of the impact of the remedial activities on the achievement of regulatory objectives.

Hazardous constituents of concern in groundwater that significantly exceed the EPA ARARs include total dissolved solids, sulfate, and nitrate in the Southwest Alluvium, total dissolved solids, sulfate, (nitrate), arsenic, cobalt, manganese, molybdenum, nickel, and activities of radium-226/228 in Zone 3, and total dissolved solids, sulfate, nitrate, aluminum, cobalt, manganese, nickel and activities of radium-226/228 in Zone 1.

The question of background groundwater quality and ARAR determination by the EPA has been brought up again in the case of nitrate, total dissolved solids, and sulfate. UNC still contends that problems and misunderstandings exist (UNC, 1990, Page 30). Relative to the determination of the ARAR for nitrate, the monitor well data used by UNC to determine "background" appear to be indefensible because results from several of the monitor wells appear to represent nitrate concentrations from another source not related to the UNC tailings material. Therefore these concentrations do not indicate representative background conditions for the area of concern and should not be used for regulatory purposes. If in fact it could be determined that this anomalous source of nitrate was causing the elevated concentrations observed downgradient from the tailings pile, then using these data for background (or baseline) determination could be considered relevant to the situation. At this point it appears that concentrations of nitrate in excess of the EPA ARAR are indeed related to a nitrate source associated with the tailings material, and therefore need to be addressed. It also appears that under the circumstances, and in light of relevant data presented to support background nitrate conditions, that an ARAR of 30 mg/l (EPA MCL for nitrate as nitrogen is 10 mg/l) for nitrate (as nitrogen) is reasonable (JEG, 1990).

The scope and quality of the data collected at the UNC site and presented in the Annual Review appear to be adequate. A more comprehensive and realistic evaluation of the data would be useful, although this is sometimes difficult when positive results are not being achieved, nor expectations and objectives being met. It does not appear at this point that additional monitoring wells in other locations would enhance the evaluation of remedial efforts at the site. The data presented are generally sufficient to evaluate the status and achievements of the remedial activities.

Specific observations for each zone of interest:

SOUTHWEST ALLUVIUM - Pumping of groundwater appears to be creating a hydraulic barrier in the vicinity of the pumping wells which should inhibit further migration of contaminants from tailings seepage. Pumping activities have not appeared to decrease concentrations of hazardous constituents in groundwater after approximately one year of pumping. At this point, concentrations of

most constituents of concern are less than the EPA ARARs. Those exceeding ARARs include total dissolved solids, sulfate, and nitrate.

ZONE 3 - Pumping of groundwater in this zone has been more extensive than in the Southwest Alluvium, but with no significant progress in reducing concentrations of hazardous constituents in groundwater - conditions have remained relatively stable throughout the period of observation. At this point, concentrations of constituents significantly exceeding EPA ARARs include total dissolved solids, sulfate, (nitrate), arsenic, cobalt, manganese, molybdenum, nickel, and activities of radium-226/228. Concentrations of several other constituents may exceed the ARARs to a small extent, or in very restricted areas, and therefore may not be of real concern.

ZONE 1 - Initial pumping of a number of wells did not produce significant results, and the program was modified during 1990 to abandon the original wells and pump four others (revised east pump-back wells) as recommended by the regulatory agencies. Only one round of water quality samples are available since implementation of this modification, so effectiveness can not yet be evaluated. At least three additional sampling rounds are recommended for adequate evaluation of this program. As with the other zones, concentrations of constituents in groundwater have remained relatively stable throughout the period of observation. At this point, concentrations of constituents significantly exceeding EPA ARARs include total dissolved solids, sulfate, nitrate, aluminum, cobalt, manganese, nickel and activities of radium-226/228.

3.0 SPECIFIC COMMENTS

Page 3 - paragraph 3: UNC mentions that additional Stage II extraction wells will be installed during 1991 in Zone 3, but does not evaluate the performance of the Stage I wells and relate this to determination of the number and location of Stage II wells to be installed.

Page 5 - paragraph 3: The revised east pump-back wells in Zone 3 should be monitored for at least four water quality sampling rounds (through July 1991) to provide information on the potential effectiveness of this pumping scenario. If these additional extraction efforts prove to be ineffective, than these data could be used to support an application for ACLs and waivers of ARARs if justified (actual period of observation should be adequate to support an application for ACLs and waivers).

Page 8 - paragraph 1: Regarding operational adjustments to accommodate excess water from extraction wells, it would be inadvisable to divert water to Borrow Pit No. 2 for temporary storage, as this was originally postulated as the source of contaminants in Zone 1.

Page 12 - paragraph 3: The statement that ". . . evaluation of the pH data provides confirmation that the wells are extracting seepage . . ." is contradicted in the same paragraph by the statement that ". . . comparison of the data from the fourth quarter 1989 and the fourth quarter

1990 sampling events indicates that the areal extent of tailings seepage represented by acidic pH remained unchanged . . . ". The fact that relative concentrations and distribution of pH in Zone 3 have remained unchanged is shown by the similarity of Figures 2-9 and 2-10, and a graph of pH concentrations over time (attached). This indicates that groundwater remediation by extracting groundwater has not been effective during this 15 month period, or that pH is not a reliable indicator of changes in concentration of selected hazardous constituents in groundwater.

Page 13 - paragraph 2: The same comment as above holds for the evaluation of remedial activities in Zone 1.

Page 13 - paragraph 5: The same comment as above holds for the evaluation of remedial activities in the Southwest Alluvium, but refers to chloride as the indicator parameter instead of pH.

Page 13 - paragraph 6: Contrary to the UNC statement that the ". . . remediation systems in all three zones are functioning as designed . . . ", the remediation activities to reduce concentrations of hazardous constituents in groundwater to date have been ineffective, based on the water quality data provided by UNC and using the indicator parameters selected by UNC for the three zones of concern. In light of this, changes in operations should be considered at this time. In response to the UNC suggestion to discontinue operation of the revised east Zone 1 pump-back wells see comment for Page 5 - paragraph 3.

Page 20 - paragraph 1: See comment for Page 12 - paragraph 3 regarding UNC contradictory statements on pH concentrations in groundwater in Zone 3.

Page 20 - paragraph 2: Again, water quality data generally indicate that conditions in groundwater are stable "or improving" (only slightly, and often within the range of variability for analytical laboratory procedures, and the natural environment). There are generally no indications of significant and consistent decreases in concentrations of hazardous constituents in groundwater that would represent effective remediation of groundwater in Zone 3 in the vicinity of the site.

Page 26 - paragraph 3: See comment for Page 13 - paragraph 2 regarding unchanged pH conditions in groundwater in Zone 1.

Page 28 - paragraph 4: See comment for Page 13 - paragraph 5 regarding unchanged chloride conditions in groundwater in the Southwest Alluvium.

Page 29 - paragraph 1: Observed increases in chloride concentrations in the Southwest Alluvium could be either a result of variations in laboratory analytical procedures or of natural conditions. The observed variations in chloride concentrations in groundwater are not significant and do not change much over time. Also, most concentrations of chloride are at or below the MCL and do not represent an impact to groundwater quality and, are thus not particularly relevant to the issue of regulatory compliance.

Page 30 - paragraph 3: The EPA established ARARs for potentially hazardous constituents at the UNC Churchrock site (including total dissolved solids, sulfate and nitrate) based on an evaluation of existing historical and recent, regional and local groundwater quality data (JEG, 1990). The "proposed maximum background concentrations" cited by UNC in the quoted reports were not acceptable to the regulatory agencies for reasons stated in the JEG report and related references. Consequently, the "Statistical Evaluation of Water Quality in Alluvium" (following paragraphs on pages 30-32) is based on premises and assumptions not considered valid by the regulatory agencies, and therefore the conclusions are likewise not relevant.

Page 36 - paragraph 4: See comment for Page 8 - paragraph 1 regarding temporary storage of contaminated groundwater in Borrow Pit No. 2.

Page 37 - Section 3.0: The conclusions should be interpreted in light of the above comments.

REFERENCES

- JEG (Jacobs Engineering Group Inc.), 1990. "Summary of Background Groundwater Quality, Vicinity of UNC Churchrock Operations, New Mexico", report prepared for the EPA, 15 November 1990.
- UNC (United Nuclear Corporation), 1990. "Ground Water Corrective Action - Annual Review - 1990", Volumes I and II, prepared by Canonic Environmental for UNC, submitted to the EPA in December 1990.
- UNC (United Nuclear Corporation), 1989. "Ground Water Corrective Action - Annual Review - 1989", Volumes I and II, prepared by Canonic Environmental for UNC, submitted to the EPA in December 1989.

REFERENCES

- JEG (Jacobs Engineering Group Inc.), 1990. "Summary of Background Groundwater Quality, Vicinity of UNC Churchrock Operations, New Mexico", report prepared for the EPA, 15 November 1990.
- UNC (United Nuclear Corporation). 1990. "Ground Water Corrective Action - Annual Review - 1990", Volumes I and II, prepared by Canonic Environmental for UNC, submitted to the EPA in December 1990.
- UNC (United Nuclear Corporation), 1989. "Ground Water Corrective Action - Annual Review - 1989", Volumes I and II, prepared by Canonic Environmental for UNC, submitted to the EPA in December 1989.

DATE Fri 25 Jun 81 SUBJECT

SHEET NO. _____

BY RHH CHKD. _____ UNC - 1980 Ann Rev.

JOB NO. _____

- Potentiometric surface maps and evaluation of static water level data are adequately provided in the UNC report.
- Iso concentration maps for indicator parameters are shown in the UNC report. Maps for additional constituents will be provided later, as needed.



DATE Jan 25, 1991

SUBJECT

SHEET NO. _____

BY RL CHKD. _____

UNC - 1990 Ann Rpt:

JOB NO. _____

Southwest Alluvium :

Concentration vs Time Graphs :

Cl

NO₃

SO₄

See Table 2.13 and Performance Monitoring Data in Volume II, UNC 1989 and 1990.

DATE 15 Jan 91

SUBJECT

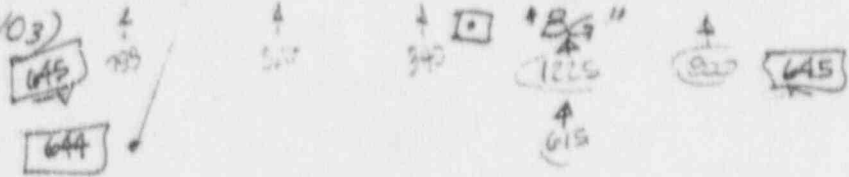
SHEET NO. 644

BY JW C.K.D. UNC - 1989 Sample

JOB NO. _____

UNC Churchrock site
 Southwest Alluvium
 Nitrate (NO₃)

○ POC MW
 • Other MW



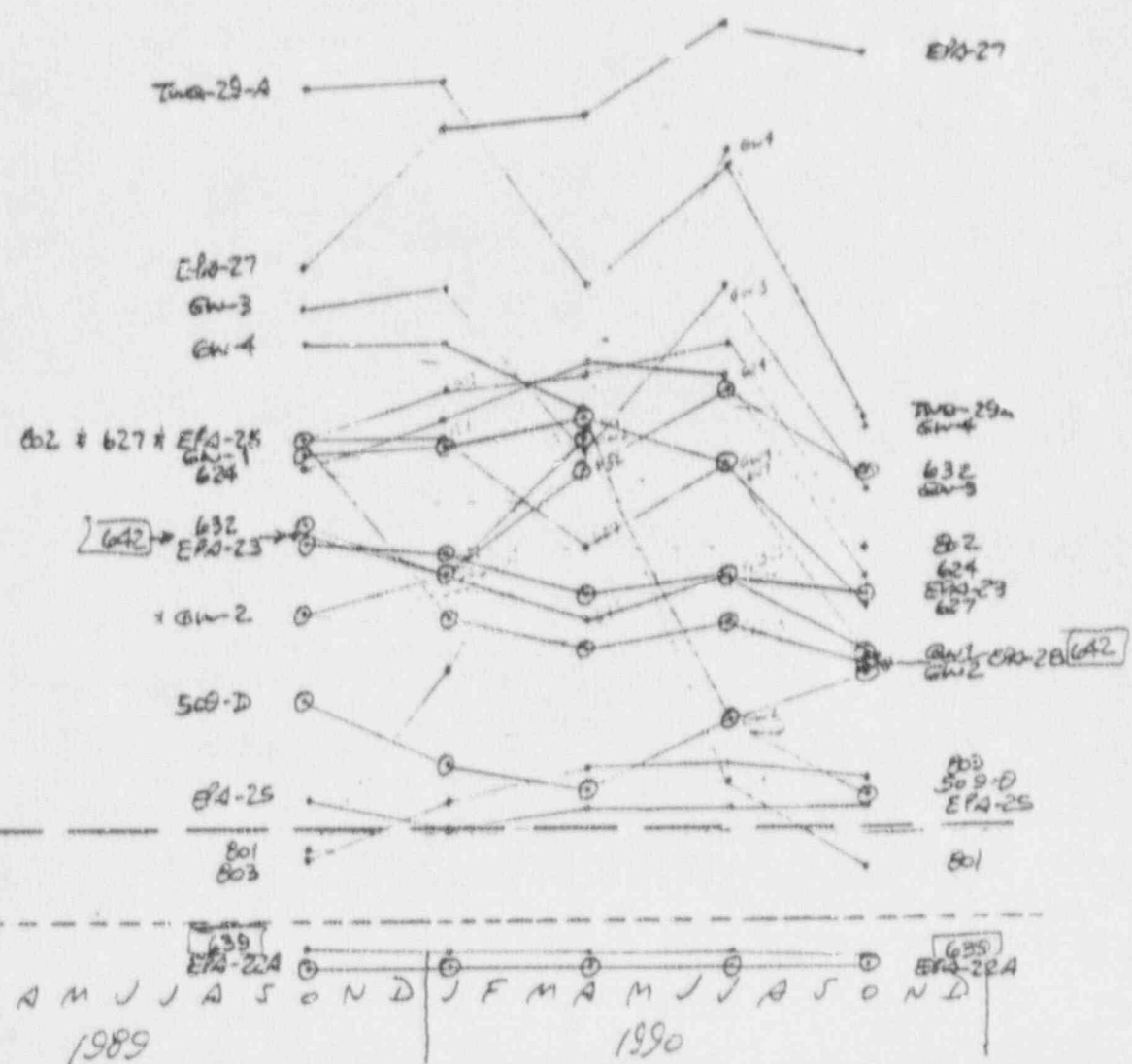
UNC-Proposed
 250

Nitrate (as N) mg/L

1300
 290
 260
 240
 220
 200
 180
 160
 140
 120
 100
 80
 60
 40
 20

EPA-ARAR
 30

(EPA-MCL)
 10



1989 1990

J F M A M J J A S O N D J F M A M J J A S O N D

DATE Feb 15 1991

SUBJECT

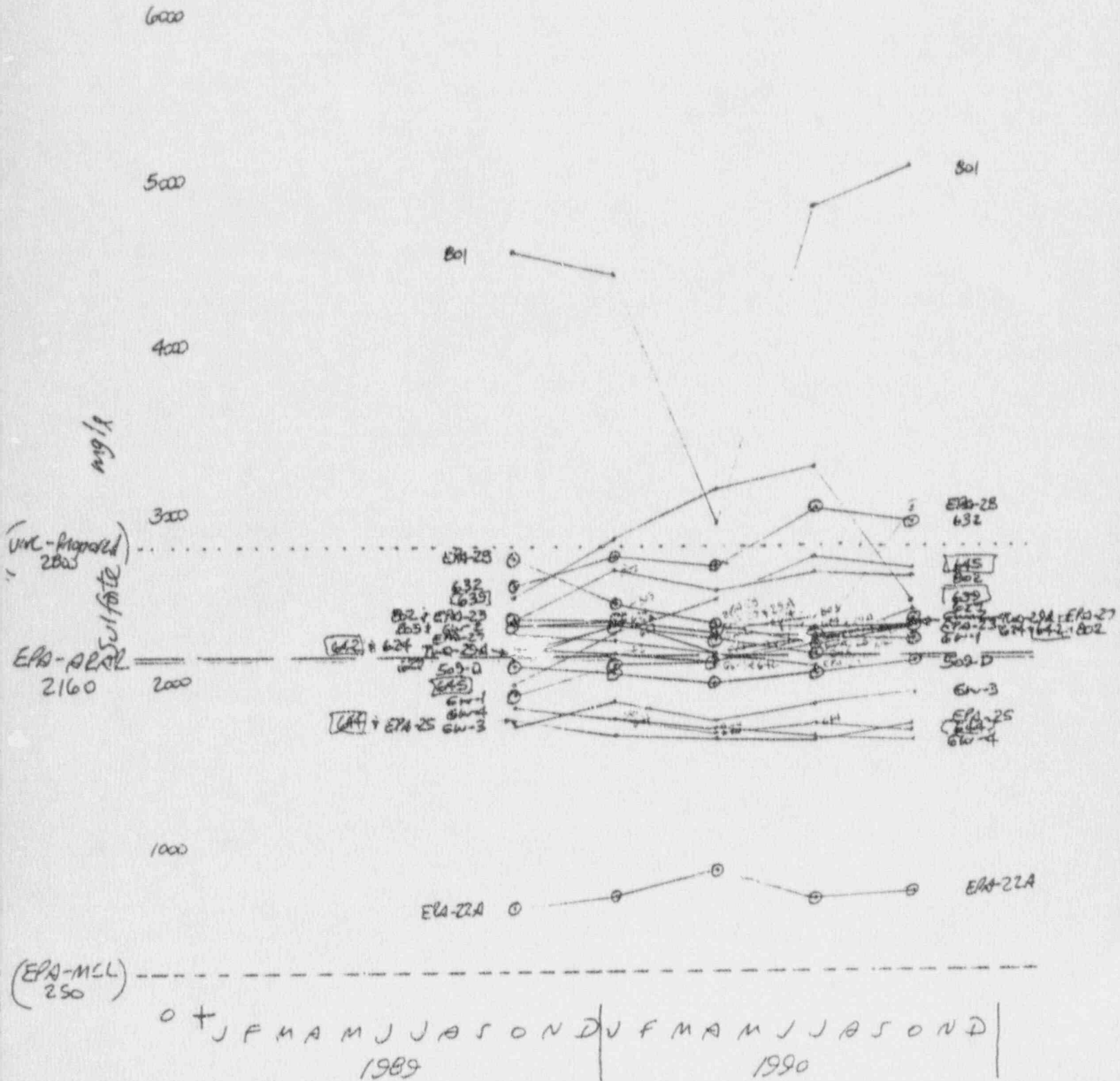
SHEET NO. _____

BY RLH CHKD. _____ UNC-1800 Ann Rev

JOB NO. _____

UNC Church road site
Southwest Alluvium
Sulfate (SO4)

- POC MW
- other MW
- "BG"





DATE Fri 25 Jan 91

SUBJECT

SHEET NO. _____

BY GAH CHKD. _____

UNC-1990 Ann Rev

JOB NO. _____

Zone 3:

Concentration w Time Graphs

pH

NO₃

Cl

SO₄

As

Ni

22-226/228

See Table 2.3 and Performance Monitoring Data in Volume II, UNC 1989 and 1990.

DATE Wed 16 Jan 91

SUBJECT

SHEET NO _____

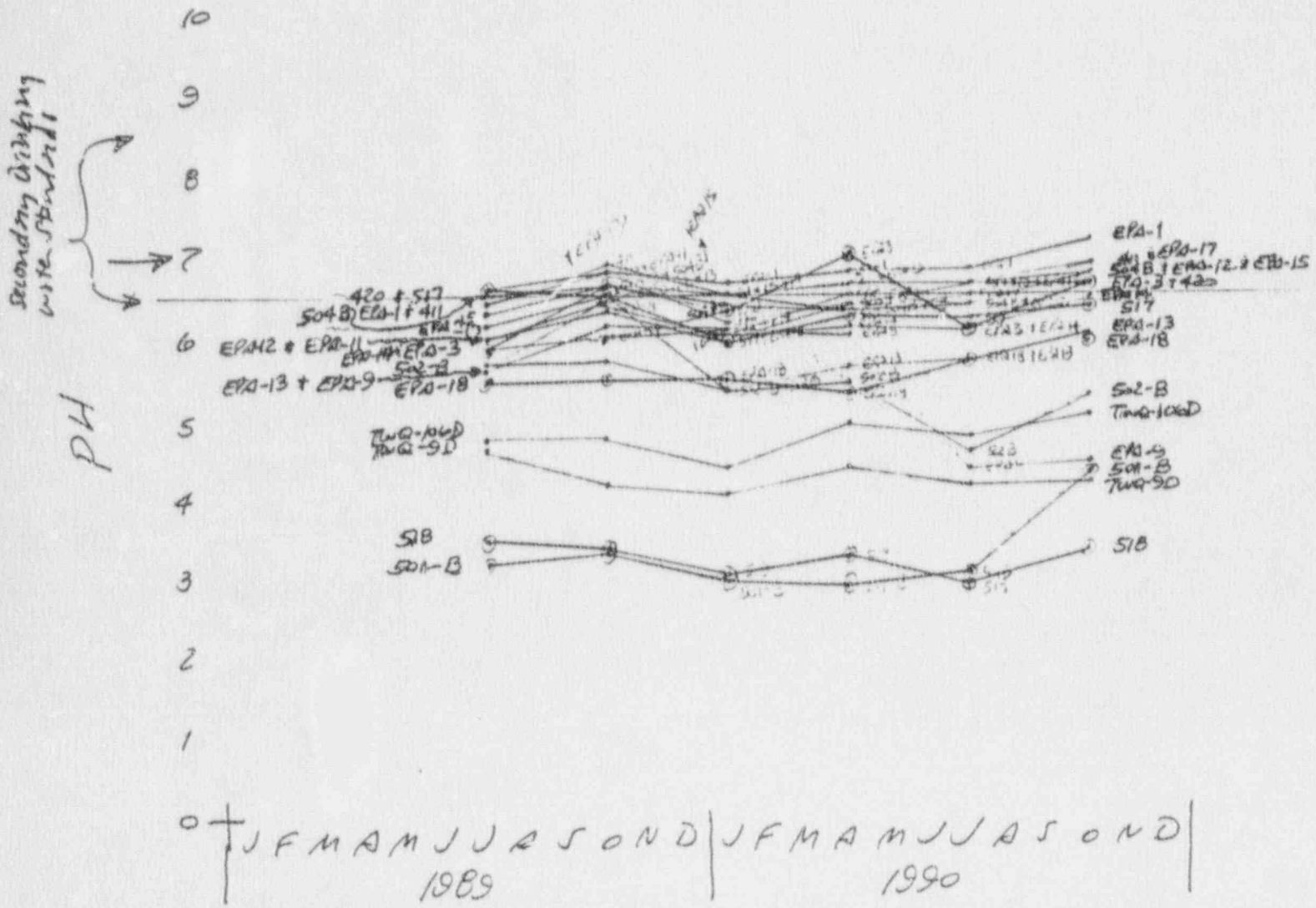
BY RH CHKD. _____

UNC-1990 Ann Rev . . .

JOB NO _____

UNC Church rock site
Zone 3
pH

- POC MW
- other MW



DATE Wed 16 Jun 91

SUBJECT

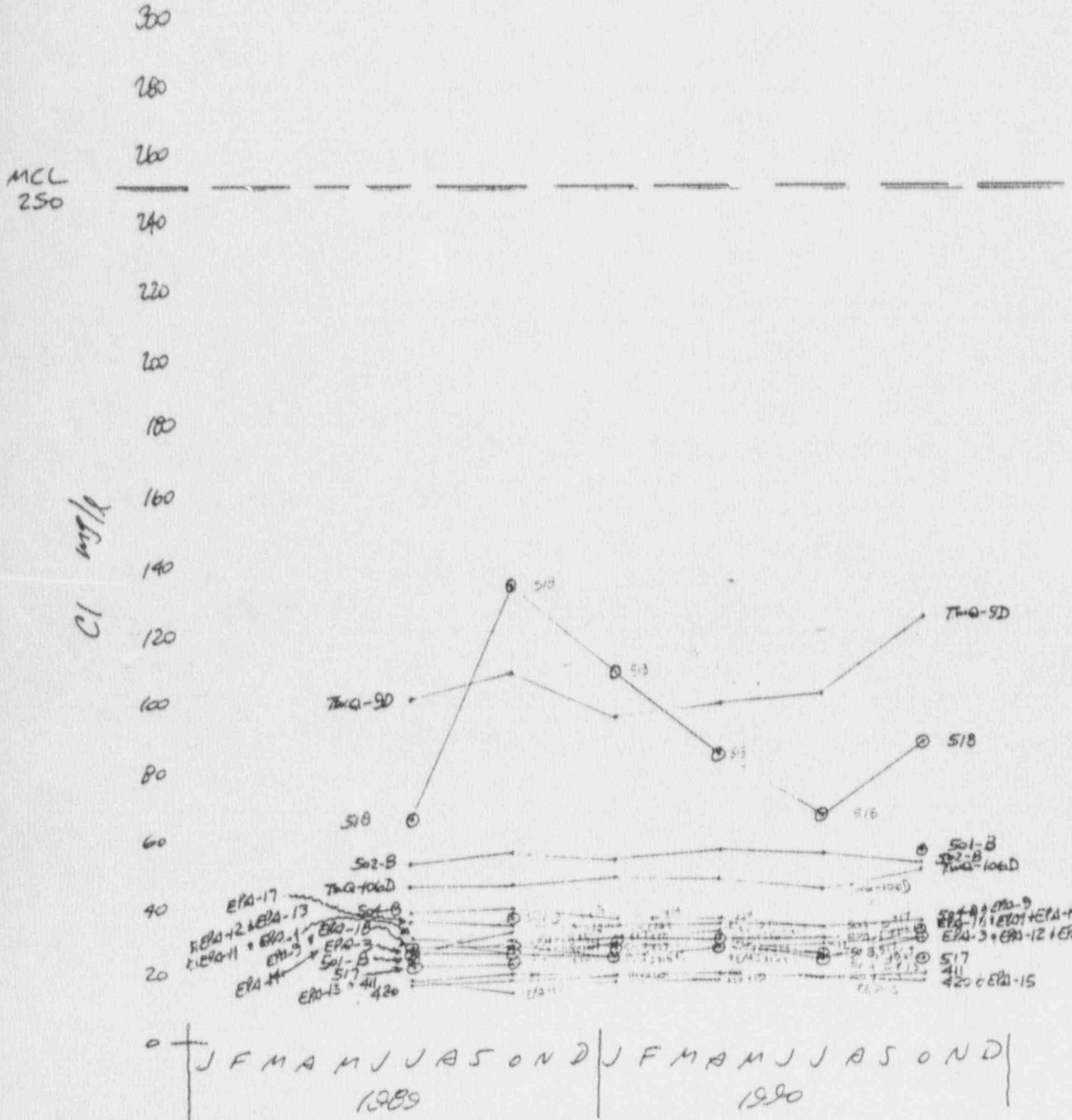
SHEET NO. _____

BY RHL CHKD. _____ VNC-1990 Ann Rev

JOB NO. _____

VNC Churchrock site
Zone 3
Chloride (Cl)

© FOC MW
• OTHER MW



DATE Wed 16 Jan 91

SUBJECT

BY RJH CHKD. _____ VNC - 1390 Ann Rev ...

SHEET NO. _____
JOB NO. _____

7000
CNC Churchrock Site
Zone 3 S18
Sulfate (SO4)

6000

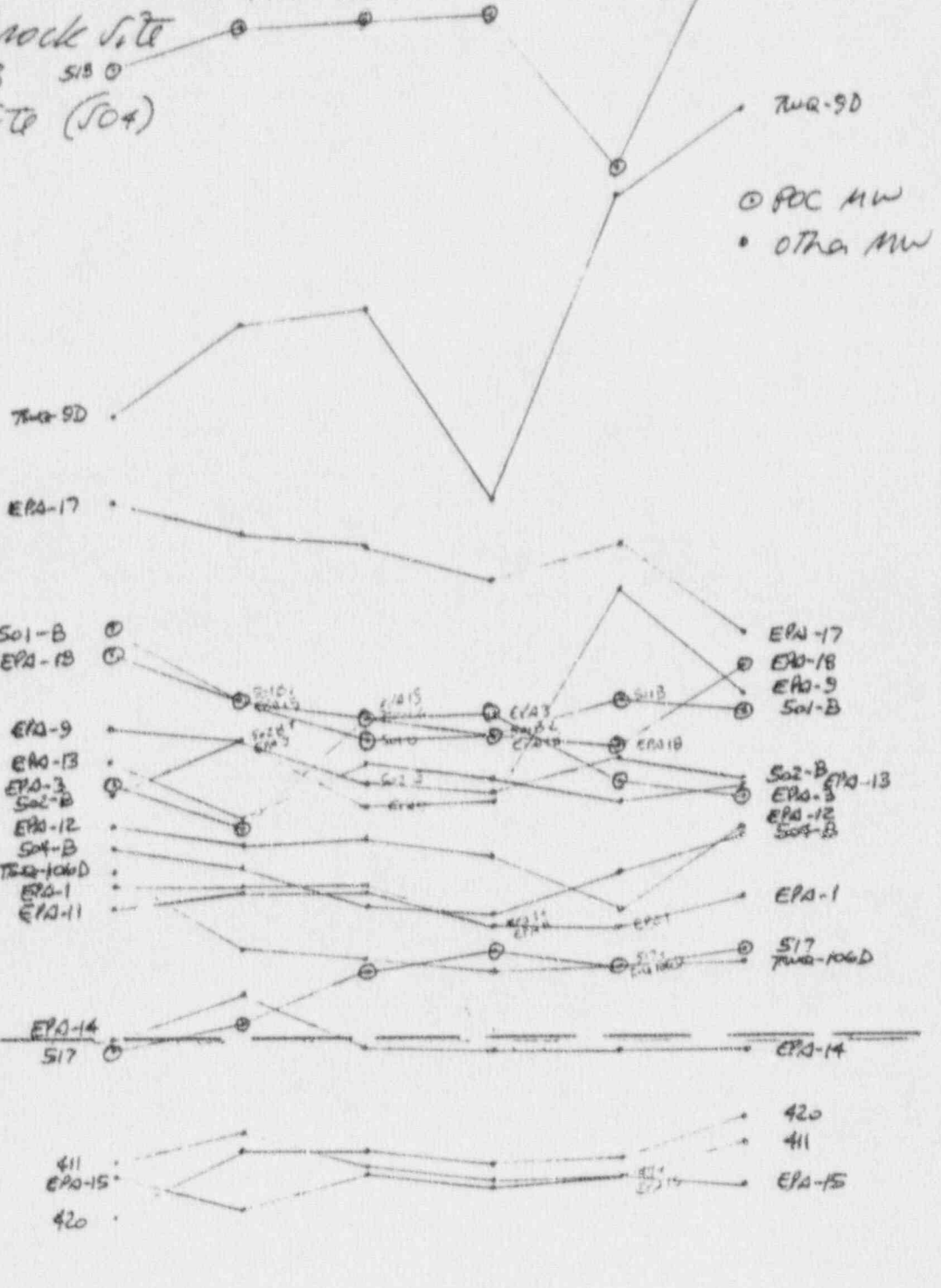
5000

4000

3000

1000

mg/lp
504



EPA-ARAR
2160 2000

° | J F M A M J J A S O N D | J F M A M J J A S O N D |
1989 1990

DATE Wed 23 Jan 91

SUBJECT

SHEET NO. _____

BY HTH CHKD. _____

VOC - 1990 Ann Rev ...

JOB NO. _____

VOC - Churchville site

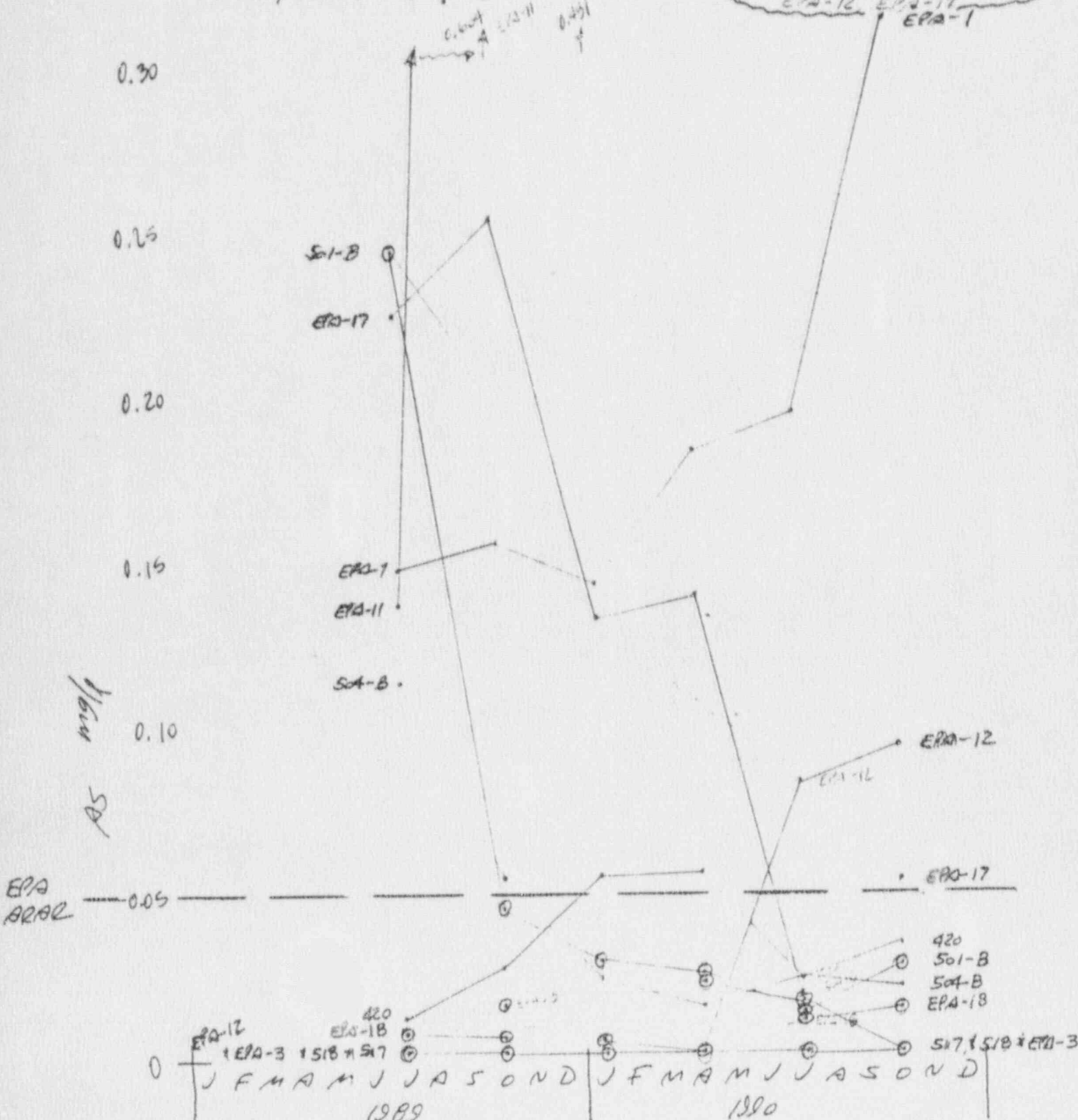
Zone 3

Aromatic (AS)

ABC Ann

Other MWL Excdg MCLs

420, 501-B, EPA-1, EPA-11, EPA-12, EPA-17, EPA-1



DATE Wed 23 Jun 91

SUBJECT

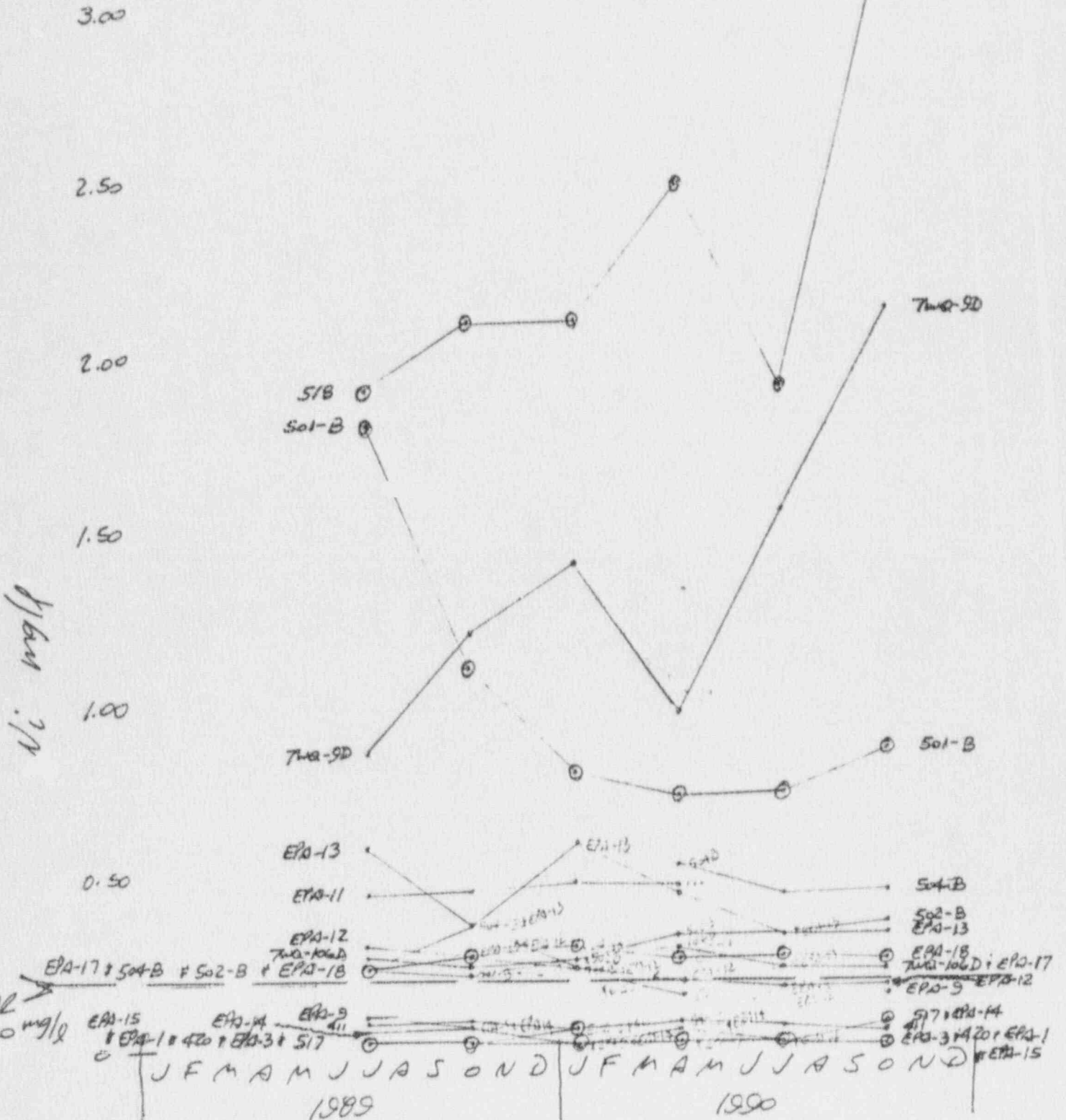
SHEET NO. _____

BY RAH CHKD. _____ UNC-1990 Ann RW

JOB NO. _____

UNC Churchrock Site
Zone 3
Nickel (Ni)

○ POC MW
• other MW



DATE Wed 23, Jan 91

SUBJECT

SHEET NO. _____

BY RLL CHKD. _____ UNC - 1990 Ann Rev ...

JOB NO. _____

35 UNC-Cherokee Site

Zone 3 Sol-B

Radium 226-228 combined

⊙ POC MW
• Other MWs and 9 MCLs

S04-B

30

25

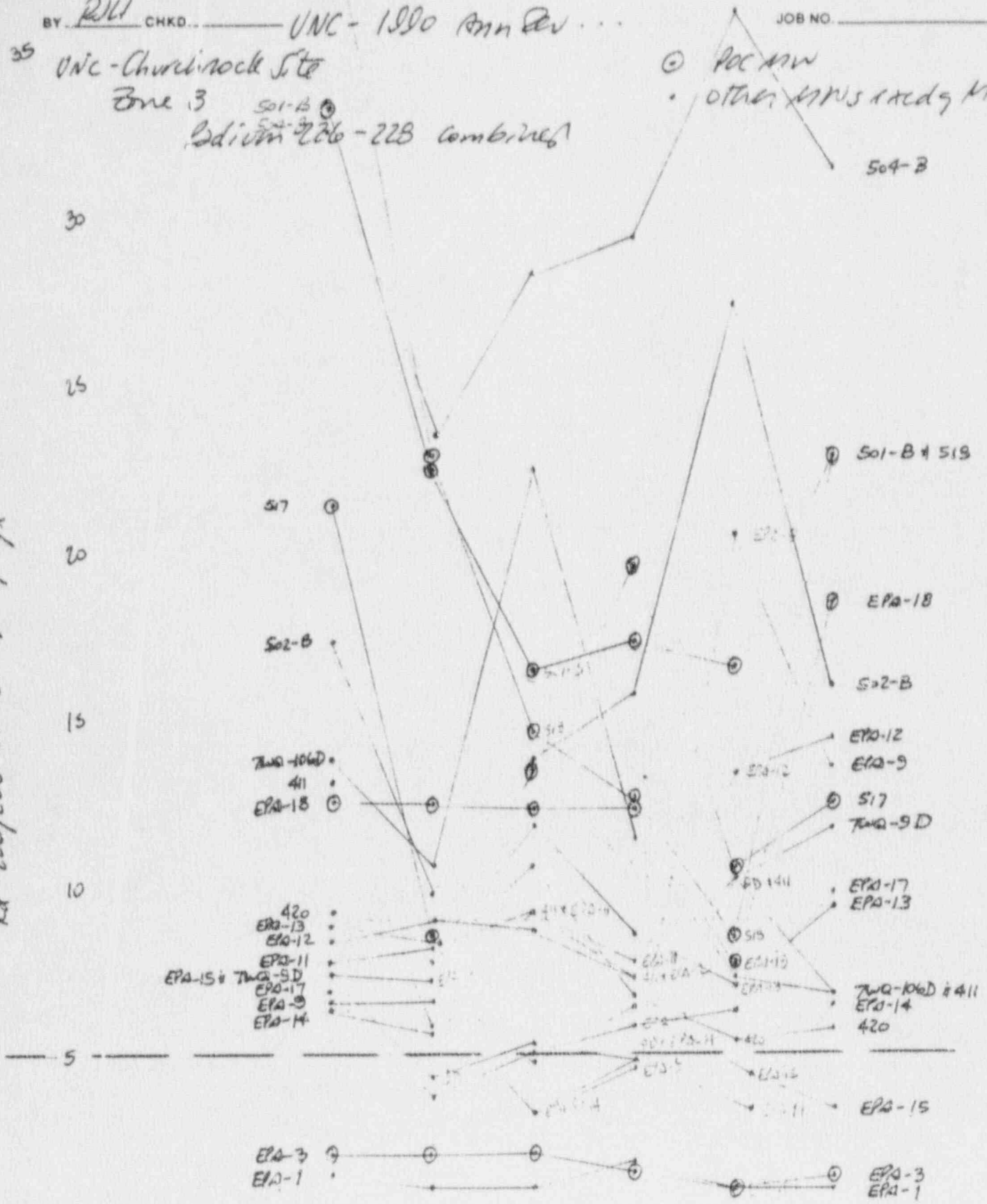
20

15

10

5

Ra-226/228 combined pCi/l



0 | J F M A M J J A S O N D | J F M A M J J A S O N D |

DATE Jan 25 1991

SUBJECT

SHEET NO _____

BY [Signature] CHKD _____ UNC - 1990 Ann Rev ...

JOB NO _____

Zone 1 :

Concentration vs Time Graphs

- pH
- NO3
- Cl
- SO4

See Table 2.9 and Performance Monitoring Data in Volume II, UNC, 1989 and 1990.

DATE Thu 24 Jan 91

SUBJECT

SHEET NO. _____

BY PH CHKD. _____

UNC - 1990 Annual Rev...

JOB NO. _____

UNC Churchrock site
Zone 1
PH

© JOC MWS
• other MWR



DATE Thu 24 Jan 91

SUBJECT

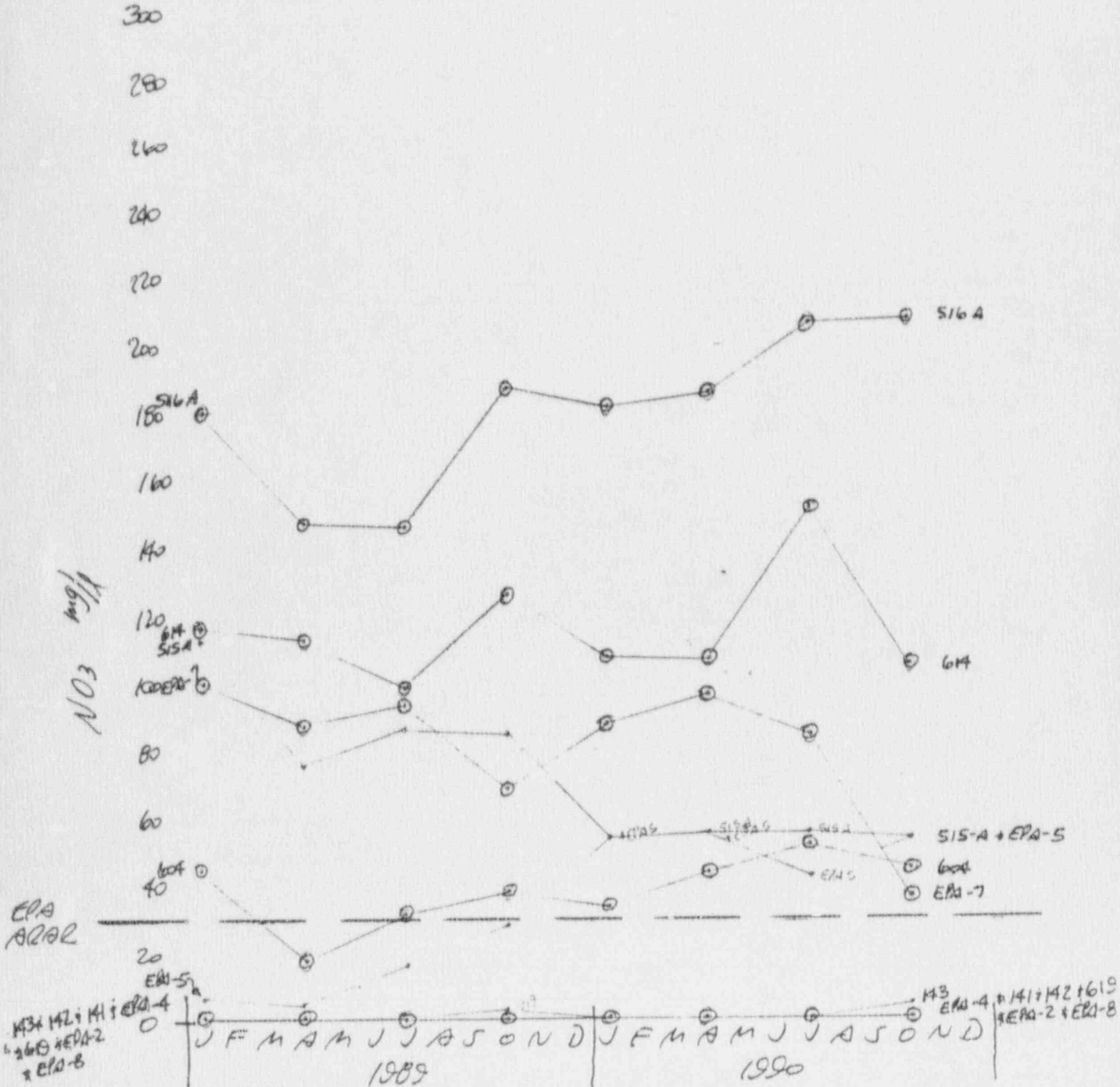
SHEET NO. _____

BY [Signature] CHKD. _____ UNC - 1990 Ann Rev

JOB NO. _____

UNC - Churchrock Site
Zone 1
Nitrate (NO₃)₂N

- POC MW
- Other MWS



DATE May 24 1991

SUBJECT

SHEET NO. _____

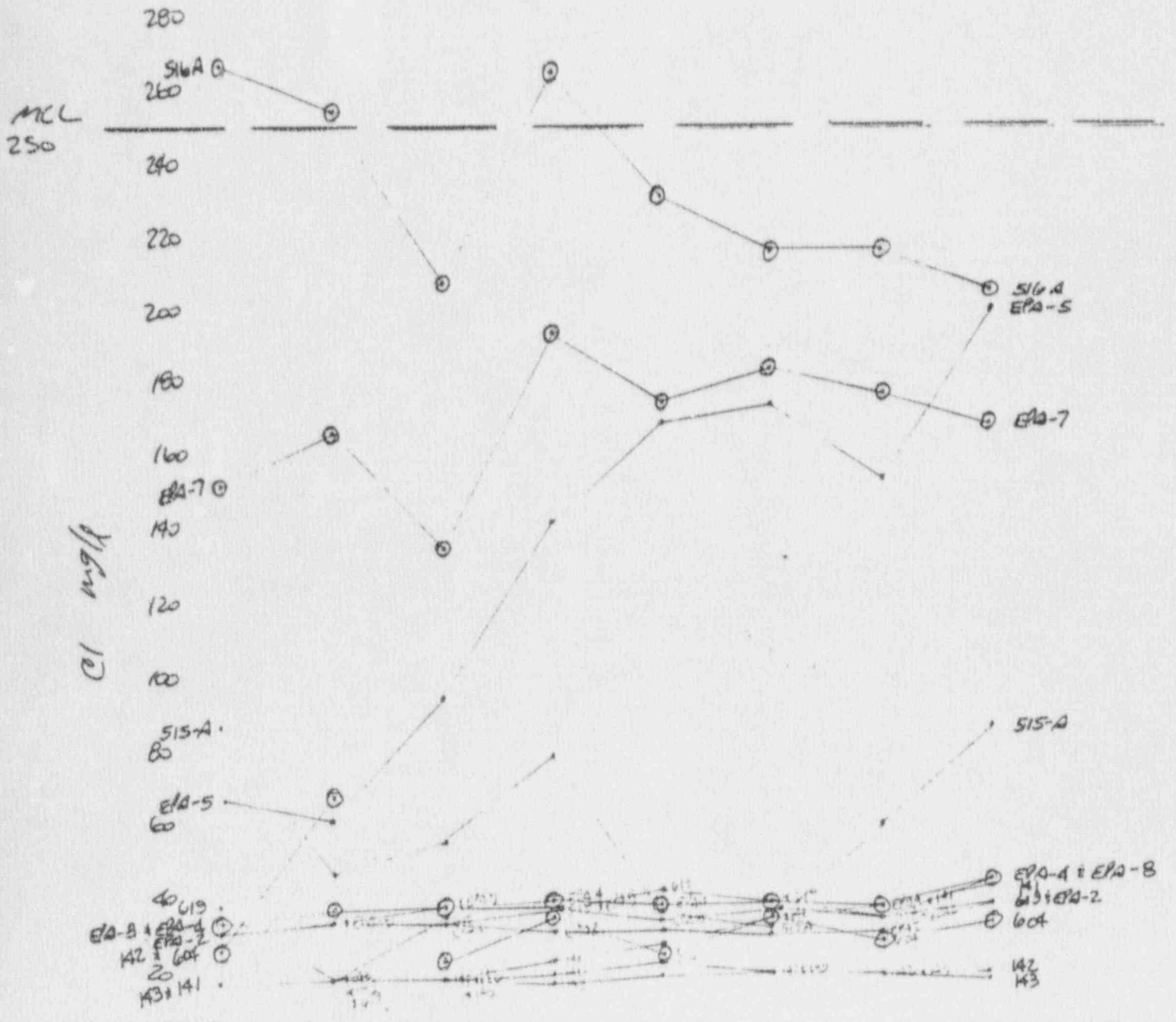
BY RJW CHKD. _____

UNC - 1990 Ann Rev

JOB NO. _____

UNC Churchrock Site
Zone 1
Chloride (Cl)

⊙ POC MW
• Other MW



0 | J F M A M J J A S O N D | J F M A M J J A S O N D |
1989 | 1990

Cl mg/l

MCL
250

320

300

280

260

240

220

200

180

160

140

120

100

80

60

40

20

0

0

0

0

0

111 11 11

DATE Nov 24 1991

SUBJECT

BY RHH CHKD. VNC-1990 Ann Rev

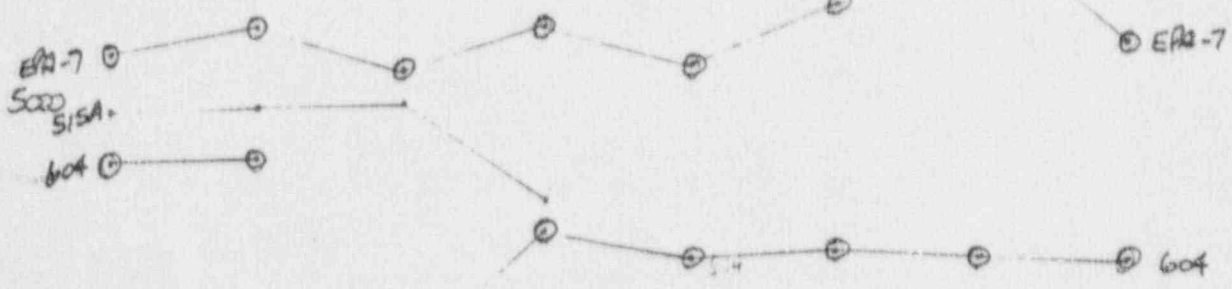
SHEET NO. _____

JOB NO. _____

⊙ POC MW
• OTHER MW

7000 VNC - Churchvale Site
Zone 1
Sulfate (SO4)

6000



4000

019

3000

2000

1000

M2:
M3:

M2+M3
M4

0 | J F M A M J J A S O N D | J F M A M J J A S O N D |
1989 | 1990