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National Water Research Institute

Institut National de Recherche sur les Eaux

Summary Report - IRQC Studies No. 80 to 81 Extractable Trace Metals Methods by Direct Aspiration Technique

V. Cheam

TECHNICAL REPORT 17-AMD-T-61-81-VC

Summary Report - IRQC Studies No. 80 to 81 Extractable Trace Metals Methods by Direct Aspiration Technique

V. Cheam

Inter-regional Q.C. report

EXECUTIVE SUMMARY

This interlaboratory study helps to ensure comparability of routine data produced by Water Quality Branch laboratories and it also forms part of Phase II of the continuing specification program. It generates additional specification data on fourteen (14) analytical methods for trace metals by direct aspiration technique. Specification statements permit meaningful interpretation of historical, present and future data produced by laboratories using IWD analytical methods.

Three concentration levels of trace metals were studied in addition to those previously reported in Phase I. A few deviant analytical results were identified and brought to the attention of concerned managers and analysts.

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

TO / A: A.S.Y. Chau
Head, QAMS

FROM / DE: V. Cheam
Quality Assurance and Methods Section
Analytical Methods Division
NWRI/Burlington

SECURITY - CLASSIFICATION - DE SÉCURITÉ	
OUR FILE/NOTRE RÉFÉRENCE	
YOUR FILE/VOTRE RÉFÉRENCE	
DATE	October 23, 1981

SUBJECT / OBJET: Capsule Comments on IRQC Studies No. 80 to 81

Enclosed please find the final summary of IR 80 to 81. The following are capsule comments:

1. The study provides additional specification data (Phase II) on the direct aspiration methods for 14 trace metals at 3 more concentration levels.

2. The method for Molybdenum has been frequently detected to produce imprecise and inaccurate data in IR studies including this one.

3. BURLINGTON lab has several deviant results, in particular V, Co, Cu and Mo. CALGARY lab also has some such as Sr, Mo and Ba.

4. MONCTON lab seems to have improved, lately, their performance on trace metals analysis. This lab and VANCOUVER lab did well on all metals.

V. Cheam

cc. Chief, Lab Operations Division, WQB, HQ
Chief, AMD, NWRI/Burlington

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

TO / À: Distribution

FROM / DE:
V. Cheam
Quality Assurance and Methods Section
Analytical Methods Division
NWRI/Burlington

SECURITY - CLASSIFICATION - DE SÉCURITÉ
OUR FILE/NOTRE RÉFÉRENCE
YOUR FILE/VOTRE RÉFÉRENCE
DATE: October 23, 1981

SUBJECT / OBJET: Summary Report on IRQC Studies No. 80 to 81 — Resume final des etudes IRCQ No. 80 et 81

Enclosed please find the final summary of IR 80 to 81.

Vous troverez le resume final etudes IR No. 80 et 81.

V. Cheam

Head, Analytical Services
Pacific Region Water Quality Branch

Head, Analytical Services Section
Ontario Region Water Quality Branch

Head, Analytical Services Section
Quebec Region Water Quality Laboratory

Head, Analytical Services Section
Atlantic Region Water Quality Branch

Head, Analytical Services Section
Western Region Water Quality Laboratory

cc: Chief, Laboratory Operations Division, WQB, HQ
Head, QAMS, AMD, NWRI/Burlington
Chief, AMD, NWRI/Burlington

SUMMARY REPORT

IRQC STUDIES NOS. 80 to 81 - EXTRACTABLE TRACE METAL METHODS BY DIRECT ASPIRATION TECHNIQUE

by

V. Cheam

SUMMARY REPORT

IRQC STUDIES NOS. 80 to 81 - EXTRACTABLE TRACE METAL METHODS BY DIRECT ASPIRATION TECHNIQUE

V. Cheam

This study is another part of the continuing specification program to provide demonstrated levels of confidence for interpretation of historical, present and future NAQUADAT data. The study supplements IRQC studies Nos. 51 to 54, which specified all the solvent extraction and direct aspiration trace metal methods at three concentration levels (low, medium and high) within the dynamic range.

The three supplementary levels investigated in this study lie between the high-medium and the medium-low levels. The background matrix is Lake Ontario water. This is the final summary report. The preliminary data summaries were sent to the labs on September 15 and October 2, 1981, as we received additional data.

Strontium Analysis

CALGARY lab tends to produce low results of strontium, which subsequently resulted in low recoveries in samples 3 and 4 (see printouts). Furthermore, significant imprecision was observed in samples 1 and 2 between the strontium results of day 1 and day 2. For

this reason, Mr. Merl Korchinski had the 2 samples reanalyzed, reported results for day 3, and asked us to comment upon the apparent disagreement.

A close examination of their results, those by Burlington lab, previously reported data for Lake Ontario water (for example in IRQC studies Nos. 51 to 54, where the mean was 0.18 ± 0.01 PPM SR), and the present spike and background values of 0.1987 PPM and 0.175 PPM in sample 2, strongly suggests that their day 1 results are biased low. A quick calculation indeed indicates that their day 1 results are low by about 72.5% in both cases. This may well mean that their standards were too high at the time of analysis. The induction is at least partially supported by their consistent low day 1 results in all 4 samples as compared to their day 2 and day 3 results.

Molybdenum Analysis

CALGARY lab observed very poor precision between day 1 and day 2 of molybdenum results for sample 2, namely 0.80 PPM and 0.59 PPM. Subsequently, they reanalysed the sample for day 3 and day 4, and obtained 0.44 PPM and 0.45 PPM, which basically agree with the spiked amount of 0.497 PPM, but disagree with their first 2 days results. Mr. Korchinski naturally was concerned about this imprecision. To complicate this matter further, we have BURLINGTON

lab reporting results of 0.78 PPM and 0.70 PPM. So which is the most accurate result?

It would be a much clearer cut answer if this water sample were a certified standard reference material, SRM. But it's not, unfortunately. (This once again examplifies another instance where SRM's can give the needed "black or white" answer). Our spike value, which was confirmed before sample distribution, seems to indicate that the day 3 and day 4 results are most accurate. The next obvious question is why the first 2 results of CALGARY differ from each other and from the last 2 results.

The question of sample instability is irrelevant because 0.2% HNO_3 is known to ensure much longer holding time than this study requires. The question of standards is not as obvious as in the case of strontium discussed above. So perhaps it is the methodology itself because we have before observed this poor interlaboratory precision and recovery data, such as in IRQC studies Nos. 51 to 54 or Nos. 76 to 77 for the molybdenum analysis by direct aspiration technique. Thus, it may be that the present method is inadequate and needs further examination.

Other Trace Metals

Overall, the interlaboratory analytical data are comparable and result in respectable % CV and % recovery. MONCTON and VANCOUVER labs did well in all metals. BURLINGTON and CALGARY have some suspect results, which are circled (see Tables).

Two positive results in sample 1 (Zn and Ba by BURLINGTON lab) are not used in calculations and are flagged "R" based on judgement call only as it is impossible to treat them statistically among the many less than values.

SUMMARY

INTER REGIONAL QUALITY CONTROL PROGRAM

STUDY NO. 80-81 DATE: 01/03/81 DATE DISTRIBUTED 250281
SOURCE OF SAMPLE SPIKED SAMPLES ADDITIONAL SPE.DATA ON D/A METHODS

TM(0.2%HNO3) D/A MET HODS	*	N/A	MONCTON	BURLINGTON	CALGARY	VANCOUVER	LONGEUIL	*	MEAN	STDEV	RELAT STDEV	SPIKE	BGD	%REC
SAMPLE 1=LAKE WATER														
13302 AL EXTRBL UF D/A MG/L	*	N/A	.1000L	.1000L	.0500L	N/A	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
13302 AL EXTRBL UF D/A MG/L	*	N/A	.1000L	.1000L	.0500L	N/A	N/A	*						
23301 V EXTRBL UF D/A MG/L	*	N/A	N/A	.050L	.050L	N/A	N/A	*	0.000	0.000	0.0	N/A	N/A	0.0
23301 V EXTRBL UF D/A MG/L	*	N/A	N/A	.050L	.050L	N/A	N/A	*						
24302 CR EXTRBL UF D/A MG/L	*	N/A	N/A	.0100L	.0080L	N/A	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
24302 CR EXTRBL UF D/A MG/L	*	N/A	N/A	.0100L	.0080L	N/A	N/A	*						
25304 MN EXTRBL UF D/A MG/L	*	N/A	.0100L	.0100L	.0100L	.0100L	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
25304 MN EXTRBL UF D/A MG/L	*	N/A	.0100L	.0100L	.0100L	.0100L	N/A	*						
26304 FE EXTRBL UF D/A MG/L	*	N/A	.0500L	.0300L	.0200L	.0500L	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
26304 FE EXTRBL UF D/A MG/L	*	N/A	.0500L	.0300L	.0200L	.0500L	N/A	*						
27301 CO EXTRBL UF D/A MG/L	*	N/A	.0200L	.0300L	.0200L	.0200L	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
27301 CO EXTRBL UF D/A MG/L	*	N/A	.0200L	.0300L	.0200L	.0200L	N/A	*						
28301 NI EXTRBL UF D/A MG/L	*	N/A	.0200L	.0300L	.0400L	.0200L	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
28301 NI EXTRBL UF D/A MG/L	*	N/A	.0200L	.0300L	.0400L	.0200L	N/A	*						
29306 CU EXTRBL UF D/A MG/L	*	N/A	.0200L	.0100L	.0100L	.0100L	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
29306 CU EXTRBL UF D/A MG/L	*	N/A	.0200L	.0100L	.0100L	.0100L	N/A	*						
30304 ZN EXTRBL UF D/A MG/L	*	N/A	.0100L	.0140R	.0100L	.0100L	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
30304 ZN EXTRBL UF D/A MG/L	*	N/A	.0100L	.0200L	.0100L	.0100L	N/A	*						
38301 SR EXTRBL UF D/A MG/L	*	N/A	N/A	.2000	.1300	N/A	N/A	*	.1760	.0270	15.4	N/A	N/A	0.0
38301 SR EXTRBL UF D/A MG/L	*	N/A	N/A	.1900	.1800	N/A	N/A	*						
38301 SR EXTRBL UF D/A MG/L	*	N/A	N/A	N/A	.1800	N/A	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
42301 MO EXTRBL UF D/A MG/L	*	N/A	N/A	.0500L	.1000L	N/A	N/A	*						
42301 MO EXTRBL UF D/A MG/L	*	N/A	N/A	.0500L	.1000L	N/A	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
48301 CD EXTRBL UF D/A MG/L	*	N/A	.0100L	.0100L	.0100L	.0100L	N/A	*						
48301 CD EXTRBL UF D/A MG/L	*	N/A	.0100L	.0100L	.0100L	.0100L	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
56301 BA EXTRBL UF D/A MG/L	*	N/A	N/A	.1200R	.0500L	N/A	N/A	*						
56301 BA EXTRBL UF D/A MG/L	*	N/A	N/A	.1000L	.0500L	N/A	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0
82301 PB EXTRBL UF D/A MG/L	*	N/A	.0500L	.0500L	.0300L	.0500L	N/A	*						
82301 PB EXTRBL UF D/A MG/L	*	N/A	.0500L	.0500L	.0300L	.0500L	N/A	*	0.0000	0.0000	0.0	N/A	N/A	0.0

N/A = NOT APPLICABLE

NOT ANALYSED

L = LESS THAN

SUMMARY

INTER REGIONAL QUALITY CONTROL PROGRAM

STUDY NO. 80-81 DATE: 01/03/81 DATE DISTRIBUTED 250281
SOURCE OF SAMPLE SPIKED SAMPLES ADDITIONAL SPE.DATA ON D/A METHODS

TM(0.2%HNO3) D/A MET HODS	*	N/A	MONCTON	BURLINGTON	CALGARY	VANCOUVER	LONGEUIL	*	MEAN	STDEV	RELAT STDEV	SPIKE	BGD	%REC
SAMPLE 2=SPK LAKE WATER														
13302 AL EXTR8L UF D/A MG/L	*	N/A	1.0000	.9600	.9000	N/A	N/A	*						
13302 AL EXTR8L UF D/A MG/L	*	N/A	1.0000	.9900	.9000	N/A	N/A	*	.9567	.0463	4.8	.9834	0.0000	97.3
23301 V EXTR8L UF D/A MG/L	*	N/A	N/A	1.100	1.060	N/A	N/A	*						
23301 V EXTR8L UF D/A MG/L	*	N/A	N/A	.990	1.010	N/A	N/A	*	1.040	.050	4.8	.994	0.000	104.7
24302 CR EXTR8L UF D/A MG/L	*	N/A	N/A	.0900	.8800RT	N/A	N/A	*						
24302 CR EXTR8L UF D/A MG/L	*	N/A	N/A	.0850	.9100RT	N/A	N/A	*						
24302 CR EXTR8L UF D/A MG/L	*	N/A	N/A	N/A	.0880C	N/A	N/A	*						
24302 CR EXTR8L UF D/A MG/L	*	N/A	N/A	N/A	.0910C	N/A	N/A	*						
25304 MN EXTR8L UF D/A MG/L	*	N/A	.1000	.0930	.1200	.1000	N/A	*	.0885	.0026	3.0	.0916	0.0000	96.6
25304 MN EXTR8L UF D/A MG/L	*	N/A	.1000	.0940	.0900	.1000	N/A	*						
26304 FE EXTR8L UF D/A MG/L	*	N/A	.4800	.4700	.4500	.4600	N/A	*	.0996	.0091	9.2	.0994	0.0000	100.2
26304 FE EXTR8L UF D/A MG/L	*	N/A	.4900	.4600	.4400	.4600	N/A	*						
27301 CO EXTR8L UF D/A MG/L	*	N/A	.3000	.2300	.2800	.3000	N/A	*	.4638	.0160	3.4	.4660	0.0000	99.5
27301 CO EXTR8L UF D/A MG/L	*	N/A	.3000	.2500R	.2800	.3000	N/A	*						
28301 NI EXTR8L UF D/A MG/L	*	N/A	.5000	.4200	.4700	.4500	N/A	*	.2929	.0095	3.2	.2981	0.0000	98.2
28301 NI EXTR8L UF D/A MG/L	*	N/A	.4700	.4300	.4900	.4800	N/A	*						
29306 CU EXTR8L UF D/A MG/L	*	N/A	.1100	.0780	.0900	.1000	N/A	*	.4638	.0283	6.1	.4677	0.0000	99.2
29306 CU EXTR8L UF D/A MG/L	*	N/A	.1200	.0820	.1000	.1000	N/A	*						
30304 ZN EXTR8L UF D/A MG/L	*	N/A	.1800	.1300	.2000	.2000	N/A	*	.0975	.0139	14.3	.0994	0.0000	98.1
30304 ZN EXTR8L UF D/A MG/L	*	N/A	.1900	.2000	.2000	.1900	N/A	*						
38301 SR EXTR8L UF D/A MG/L	*	N/A	N/A	.4400	.2300	N/A	N/A	*	.1925	.0089	4.6	.1988	0.0000	96.8
38301 SR EXTR8L UF D/A MG/L	*	N/A	N/A	.4600	.4000	N/A	N/A	*						
42301 MO EXTR8L UF D/A MG/L	*	N/A	N/A	N/A	.3800	N/A	N/A	*	.3340	.0662	16.8	.1987	.1750	105.4
42301 MO EXTR8L UF D/A MG/L	*	N/A	N/A	.7800	.2000	N/A	N/A	*						
42301 MO EXTR8L UF D/A MG/L	*	N/A	N/A	.7000	.5900	N/A	N/A	*						
42301 MO EXTR8L UF D/A MG/L	*	N/A	N/A	N/A	.4400	N/A	N/A	*						
48301 CD EXTR8L UF D/A MG/L	*	N/A	N/A	N/A	.4500	N/A	N/A	*	.6267	.1590	25.4	.4967	0.0000	126.2
48301 CD EXTR8L UF D/A MG/L	*	N/A	.0800	.0930	.1000	.1000	N/A	*						
56301 BA EXTR8L UF D/A MG/L	*	N/A	.0900	.0810	.1000	.0900	N/A	*	.0918	.0082	8.9	.0923	0.0000	99.4
56301 BA EXTR8L UF D/A MG/L	*	N/A	N/A	.9500	.9300	N/A	N/A	*						
82301 PB EXTR8L UF D/A MG/L	*	N/A	N/A	.9200	.9400	N/A	N/A	*	.9350	.0129	1.4	.9935	0.0000	94.1
82301 PB EXTR8L UF D/A MG/L	*	N/A	.5000	.4700	.4600	.5000	N/A	*						
	*	N/A	.5000	.4900	.4800	.5000	N/A	*	.4875	.0158	3.2	.4968	0.0000	98.1

RT = VALUES ORIGINALLY REPORTED BY LABS, BUT LATER CHANGED TO VALUES FLAGGED WITH C.
RT'S ARE NOT TAKEN INTO CALCNS,
C'S ARE USED

SUMMARY

INTER REGIONAL QUALITY CONTROL PROGRAM

STUDY NO. 80-81 DATE: 01/03/81 DATE DISTRIBUTED 250281
SOURCE OF SAMPLE SPIKED SAMPLES ADDITIONAL SPE.DATA ON D/A METHODS

TM(0.2%HNO3) D/A METHODS	*	N/A	MONCTON	BURLINGTON	CALGARY	VANCOUVER	LONGEUIL	*	MEAN	STDEV	RELAT STDEV	SPIKE	BGD	%RE
SAMPLE 3=SPK LAKE WATER														
13302 AL EXTRBL UF D/A MG/L	*	N/A	10.0000	10.0000	9.9000	N/A	N/A	*						
13302 AL EXTRBL UF D/A MG/L	*	N/A	10.0000	11.0000	10.0000	N/A	N/A	*	10.1500	.4183	4.1	10.1420	0.0000	100.1
23301 V EXTRBL UF D/A MG/L	*	N/A	N/A	44.480	32.000	N/A	N/A	*						
23301 V EXTRBL UF D/A MG/L	*	N/A	N/A	37.000	34.000	N/A	N/A	*	35.870	3.697	10.3	36.425	0.000	98.5
24302 CR EXTRBL UF D/A MG/L	*	N/A	N/A	.9000	.9600	N/A	N/A	*						
24302 CR EXTRBL UF D/A MG/L	*	N/A	N/A	.9000	.9500	N/A	N/A	*	.9275	.0320	3.5	.9400	0.0000	98.7
25304 MN EXTRBL UF D/A MG/L	*	N/A	.6300	.6000	.6500	.6400	N/A	*						
25304 MN EXTRBL UF D/A MG/L	*	N/A	.6100	.6000	.6300	.6300	N/A	*	.6238	.0185	3.0	.6160	0.0000	101.3
26304 FE EXTRBL UF D/A MG/L	*	N/A	2.0000	2.0000	1.9000	2.0000	N/A	*						
26304 FE EXTRBL UF D/A MG/L	*	N/A	2.0000	2.0000	1.9000	2.0000	N/A	*	1.9750	.0463	2.3	2.0550	0.0000	96.1
27301 CO EXTRBL UF D/A MG/L	*	N/A	1.0300	.9600	.9900	1.1000	N/A	*						
27301 CO EXTRBL UF D/A MG/L	*	N/A	1.0300	1.0000	1.0000	1.0000	N/A	*	1.0138	.0414	4.1	1.0270	0.0000	98.7
28301 NI EXTRBL UF D/A MG/L	*	N/A	1.2600	1.1000	1.2000	1.2000	N/A	*						
28301 NI EXTRBL UF D/A MG/L	*	N/A	1.2300	1.2000	1.4000	1.2000	N/A	*	1.2238	.0845	6.9	1.2330	0.0000	99.2
29306 CU EXTRBL UF D/A MG/L	*	N/A	1.0400	1.0000	1.0000	1.0000	N/A	*						
29306 CU EXTRBL UF D/A MG/L	*	N/A	1.0800	1.1000	1.0000	1.0000	N/A	*	1.0275	.0413	4.0	1.0270	0.0000	100.0
30304 ZN EXTRBL UF D/A MG/L	*	N/A	.5000	.4800	.5200	.5000	N/A	*						
30304 ZN EXTRBL UF D/A MG/L	*	N/A	.5000	.5000	.5200	.5000	N/A	*	.5025	.0128	2.6	.5140	0.0000	97.8
38301 SR EXTRBL UF D/A MG/L	*	N/A	N/A	1.2000	.9500	N/A	N/A	*						
38301 SR EXTRBL UF D/A MG/L	*	N/A	N/A	1.2000	1.0400	N/A	N/A	*	1.0975	.1239	11.3	1.0270	.1620	92.3
42301 MO EXTRBL UF D/A MG/L	*	N/A	N/A	9.1000	11.0000	N/A	N/A	*						
42301 MO EXTRBL UF D/A MG/L	*	N/A	N/A	10.0000	13.0000	N/A	N/A	*	10.7750	1.6741	15.5	12.0600	0.0000	89.3
48301 CD EXTRBL UF D/A MG/L	*	N/A	.4300	.3800	.4000	.4200	N/A	*						
48301 CD EXTRBL UF D/A MG/L	*	N/A	.4200	.3800	.4100	.4200	N/A	*	.4075	.0191	4.7	.4100	0.0000	99.4
56301 BA EXTRBL UF D/A MG/L	*	N/A	N/A	6.4000	5.0000	N/A	N/A	*						
56301 BA EXTRBL UF D/A MG/L	*	N/A	N/A	6.2000	4.9000	N/A	N/A	*	5.6250	.7848	14.0	5.3400	0.0000	105.3
82301 PB EXTRBL UF D/A MG/L	*	N/A	4.3000	4.5000	4.3000	.4400RT	N/A	*						
82301 PB EXTRBL UF D/A MG/L	*	N/A	4.4000	4.2000	4.4000	.4300RT	N/A	*						
82301 PB EXTRBL UF D/A MG/L	*	N/A	N/A	N/A	N/A	4.4000C	N/A	*						
82301 PB EXTRBL UF D/A MG/L	*	N/A	N/A	N/A	N/A	4.3000C	N/A	*	4.3500	.0926	2.1	4.3150	0.0000	100.8

SUMMARY

INTER REGIONAL QUALITY CONTROL PROGRAM

STUDY NO. 80-81 DATE: 01/03/81 DATE DISTRIBUTED 250281
SOURCE OF SAMPLE SPIKED SAMPLES ADDITIONAL SPE.DATA ON D/A METHODS

TM(0.2%HNO3) D/A MET HODS		N/A	MONCTON	BURLINGTON	CALGARY	VANCOUVER	LONGEUIL	MEAN	STDEV	RELAT STDEV	SPIKE	BGD	%RE
SAMPLE 4=SPK LAKE WATER													
13302 AL EXTR8L UF D/A MG/L	*	N/A	25.5000	24.0000	25.0000	N/A	N/A						
13302 AL EXTR3L UF D/A MG/L	*	N/A	25.7000	25.0000	24.0000	N/A	N/A	24.8667	.7257	2.9	26.2600	0.0000	94.7
23301 V EXTR8L UF D/A MG/L	*	N/A	N/A	100.000	92.000	N/A	N/A						
23301 V EXTR8L UF D/A MG/L	*	N/A	N/A	103.000	95.000	N/A	N/A	97.500	4.933	5.1	88.300	0.000	110.4
24302 CR EXTR8L UF D/A MG/L	*	N/A	N/A	2.6000	2.5000	N/A	N/A						
24302 CR EXTR8L UF D/A MG/L	*	N/A	N/A	2.6000	2.6000	N/A	N/A	2.5750	.0500	1.9	2.7000	0.0000	95.4
25304 MN EXTR8L UF D/A MG/L	*	N/A	1.8000	1.7000	1.8000	1.9000	N/A						
25304 MN EXTR8L UF D/A MG/L	*	N/A	1.8000	1.8000	1.8000	1.9000	N/A	1.8125	.0641	3.5	1.8060	0.0000	100.4
26304 FE EXTR8L UF D/A MG/L	*	N/A	5.5000	5.5000	4.9000	5.0000	N/A						
26304 FE EXTR8L UF D/A MG/L	*	N/A	5.7000	5.6000	4.8000	5.2000	N/A	5.2875	.3271	6.2	5.2180	0.0000	101.3
27301 CO EXTR8L UF D/A MG/L	*	N/A	2.8600	2.6000	2.7000	2.9000	N/A						
27301 CO EXTR8L UF D/A MG/L	*	N/A	2.8700	2.7000	2.9000	2.8000	N/A	2.7913	.1121	4.0	2.8100	0.0000	99.3
28301 NI EXTR8L UF D/A MG/L	*	N/A	2.9700	2.2000	2.9000	2.7000	N/A						
28301 NI EXTR8L UF D/A MG/L	*	N/A	2.8900	2.7000	3.1000	2.9000	N/A	2.7950	.2743	9.8	2.8100	0.0000	99.5
29306 CU EXTR8L UF D/A MG/L	*	N/A	2.9500	3.3000	3.0000	3.0000	N/A						
29306 CU EXTR3L UF D/A MG/L	*	N/A	3.0300	3.2000	2.9000	3.0000	N/A	3.0475	.1338	4.4	3.0100	0.0000	101.2
30304 ZN EXTR8L UF D/A MG/L	*	N/A	1.1800	1.1000	1.2000	1.2000	N/A						
30304 ZN EXTR8L UF D/A MG/L	*	N/A	1.1600	1.2000	1.2000	1.1000	N/A	1.1675	.0440	3.8	1.2000	0.0000	97.3
38301 SR EXTR8L UF D/A MG/L	*	N/A	N/A	2.5000	1.9000	N/A	N/A						
38301 SR EXTR8L UF D/A MG/L	*	N/A	N/A	2.5000	2.1000	N/A	N/A	2.2500	.3000	13.3	2.4080	.1410	88.3
42301 MG EXTR8L UF D/A MG/L	*	N/A	N/A	31.0000	37.0000	N/A	N/A						
42301 MG EXTR8L UF D/A MG/L	*	N/A	N/A	33.0000	36.0000	N/A	N/A	34.2500	2.7538	8.0	34.1160	0.0000	100.4
48301 CD EXTR8L UF D/A MG/L	*	N/A	1.1700	1.2000	1.2000	1.2000	N/A						
48301 CD EXTR8L UF D/A MG/L	*	N/A	1.1700	1.2000	1.2000	1.2000	N/A	1.1925	.0139	1.2	1.2000	0.0000	99.4
56301 BA EXTR8L UF D/A MG/L	*	N/A	N/A	13.0000	13.0000	N/A	N/A						
56301 BA EXTR8L UF D/A MG/L	*	N/A	N/A	13.0000	10.0000R	N/A	N/A	13.0000	0.0000	0.0	13.2450	0.0000	98.2
82301 PB EXTR8L UF D/A MG/L	*	N/A	10.0000	11.0000	11.0000	11.5000	N/A						
82301 PB EXTR8L UF D/A MG/L	*	N/A	11.0000	11.0000	11.0000	11.5000	N/A	11.0000	.4629	4.2	11.0370	0.0000	99.7
RESULTS RECVD DYMOYR	*		11/06/81	31/07/81	12/05/81	22/09/81							