EUR 531.e

EUROPEAN ATOMIC ENERGY COMMUNITY - EURATOM

COMPUTER PROGRAM SYSTEM FOR A QUANTITATIVE ANALYSIS BY NEUTRON ACTIVATION AND GAMMA-RAY SPECTROMETRY

by

A. BORELLA and G. GUZZI

1964

Joint Nuclear Research Center
Ispra Establishment - Italy

Nuclear Chemistry Service and Scientific Data Processing Center

LEGAL NOTICE

The authors' names are listed in alphabetical order.

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CONTENTS

COMPUTER PROGRAM SYSTEM FOR
A QUANTITATIVE ANALYSIS BY NEUTRON ACTIVATION
AND GAMMA-RAY SPECTROMETRY

1. IDENTIFICATION

a) Computer Program System for a Quantitative Analysis by Neutron Activation and Gamma Ray Spectrometry.

b) G. GUZZI, A. BORELLA - June 1963 -

c) EURATOM C.C.R. ISPRA: Nuclear Chemistry Laboratory
C.E.T.I.S.

d) 256 Channels NaI(Tl) scintillation spectrometer (LABEN Milano) with the output of data on tapes punched by a High Speed Tape Punch (TELETYPE Corp.)
IBM 1620
IBM 7090

e) FORTRAN II

2. AIM OF THE WORK

Although there exist already many programs allowing a complete analysis of gamma spectra of the radioisotopes produced by neutron activation (see references), in order to overcome as quickly as possible the numerous requests of analysis of a wide range of samples, coming at our laboratory, we have preferred for the moment, to set up a simple and flexible program, limited to the quantitative analysis of gamma spectra of those radioisotopes commonly determined by us and whose photopeaks could be easily identified by the analysts.

Most of the elements irradiated in a reactor during an irradiation time T and after a decay time t, have an activity represented by the following general formula :

$$(1) \qquad A = \frac{\sigma \theta \Phi N_A W (1-e^{-\lambda T})\ e^{-\lambda t}}{M}$$

where :
- σ activation cross section
- θ isotopic abundance
- Φ neutron flux
- W weight of the irradiated element
- λ decay constant
- $1-e^{-\lambda T}$ saturation factor
- $e^{-\lambda t}$ decay factor
- N_A Avogrado's number
- M atomic weight of the element

from the relation (1) it is evident that the activity is proportional to the weight of the element.

If a known amount of an element is irradiated together with an unknown quantity of the same element it is possible to write the following relationship :

$$(2) \qquad \frac{A_i}{A_s} = \frac{W_i}{W_s}$$

If the unknown sample is measured in conditions different from those of the standard, from the (1)

(3) $$\frac{A_i}{A_s} = \frac{W_i}{W_s}\,\frac{1-e^{-\lambda T_i}}{1-e^{-\lambda T_s}}\,\frac{e^{-\lambda t_i}}{e^{-\lambda t_s}}\,\frac{\Phi_i}{\Phi_s}$$

where :

(4) $$W_i = W_s\,\frac{A_i}{A_s}\,\frac{1-e^{-\lambda T_s}}{1-e^{-\lambda T_i}}\,\frac{e^{-\lambda t_s}}{e^{-\lambda t_i}}\,\frac{\Phi_s}{\Phi_i}$$

If :

(5) $$a = \frac{W_s \Phi_s\,(1-e^{-\lambda T_s})\,e^{-\lambda t_s}}{A_s}$$

the relation (4) is written :

(6) $$W_i = \frac{a \cdot A_i}{(1-e^{-\lambda T_i})\,e^{-\lambda t_i}\,\Phi_i}$$

A certain number of values of a have been obtained experimentally for each of the isotopes commonly determined in our laboratory, using different irradiation times and facilities and samples in different physical and chemical states.
In order to compare the activities measured for the standards and those of the unknown samples a standard counting geometry is adopted.
By using the relation (6) it is possible to eliminate the irradiation of standards and it is also possible to determine elements whose existence in the samples was not expected.
For every irradiation, although, a flux monitor is introduced in the capsule.
This flux monitor is a wire, weighing 21.1 ± 0.2 mg, of an aluminium-cobalt alloy, containing 1% of cobalt.
The calculation of the neutron flux is then made by comparing the activity of this monitor with the activity of a standard having the same weight and previously calibrated in order to know exactly its absolute activity.
From the relation (1)

(7) $$\Phi_i = \frac{M}{\sigma \theta N_A W_i}\;\frac{A_o}{(1-e^{-\lambda T_i})\,e^{-\lambda t_i}}$$

where A_o is the absolute activity of the irradiated aluminium-cobalt wire.

(8) $$A_o = \frac{A_{os}}{A_{ms}} \cdot A_{mi}$$

where : A_{os} absolute activity of the standard

A_{ms} counting rate of the standard

A_{mi} counting rate of the irradiated monitor

The half life of the cobalt 60 being very long (2.3 years), for short-time irradiations

$$1-e^{-\lambda T_i} \simeq T_i \qquad \text{(in hours)}$$

The decay factor $e^{-\lambda t_i}$ is considered equal to 1 when the counting of the flux monitor is done some hours after the end of the irradiation.

Knowing the nuclear constants of cobalt and the weight of the irradiated wire, we have from the relation (7) :

(9) $$\Phi_i = 1.39.10^7 \frac{A_o}{T_i}$$

The value of the neutron flux so obtained makes it possible to calculate W_i from the relation (6).

3. METHOD

With the identification data NIRR, IDENT, VNOME, NSP all the other related data are chosen; it is then possible to evaluate the photopeak areas as follows:
the library gives the interval within which are the photopeaks of the unknown samples.
With the SDEV the limits of those intervals are corrected, if necessary, in order to recalibrate the spectrometer. The higher value of the interval is found in an interval narrower than those generally used for the evaluation of the photopeak area. If SDEV = 0, does not occur any change in the limits of the interval within which the higher value is researched.
If the higher value falls on one of the limits of the interval the same interval is decreased by one channel and so on until the higher value is internal to the two limits.
The higher value of the interval is considered as the maximum of the photopeak only when its value plus those immediately at right and at left are higher than the sum of the other three values at the right, and the sum of the other three values at the left.
In the case that a maximum is not found there is a write-out:
HAS NOT A PEAK IN THE INTERVAL
In the case that two or more equal maxima are found, the maximum is assumed as the value of the central channel. Also the values of the channels at the right and left but falling in the square root of the maximum, are considered as maxima.
The values of the remaining channels are averaged (the channel at the right with the corresponding channel at the left) until the last averaged value falls on the limits of the considered interval.
The areas are calculated for each value falling in the 1.5 times the square root of the minimum until the first value do not correspond to this condition.
For each area so obtained is subtracted the value of the last channel multiplied by the number of channels considered.

The final area is then represented by the mean of these areas.
The area of the photopeak in c.p.m. is calculated finally from the mean divided by the counting time.
Taking into account the decay factor $e^{-\lambda t}$ the AREAO is evaluated.
The weight of the unknown sample is then obtained from the formula (6). From this the PPM are calculated.

When the spectra of cobalt are red, the neutron flux is evaluated from the relation (9).

The statistical error in the evaluation of the photopeak area, considering a 68.3% confidence level, is calculated from the following relationship :

$$\sigma = \frac{1}{TCON} * \sqrt{\frac{\Sigma AREAP + VNUCA^2 * VMED/2}{VNUAR}}$$

where :

AREAP	partial area (photopeak area + background)
VNUCA	number of channels occurring in the evaluation of AREAP
VMED	the value of the last channel falling in the 1.5 times the square root of the minimum
VNUAR	number of AREAP
TCON	counting time

A percentage error is also calculated.

REFERENCES

(1) W.E. Kuykendall jr., R.E. Wainerdi and al.: An Investigation on Automated Activation Analysis. Off. of Isotopes Develop. USAEC (1960)

(2) L. Salmom: Analysis of gamma-ray Scintillation spectra by the method of least squares; AERE - R3640 (1961)

(3) L.E.Fite, D. Gibbons. R.E. Wainerdi and al.: Computer coupled automatic Activation Analysis. Report TEES - 2671 - 1 UC - 23 (May 1961)

(4) Proceedings of International Conference: Modern trends in Activation Analysis - College Station, Texas Dec. 15 - 16, 1961

(5) R.L. Heath: Digital Analysis of pulse-high Spectra. Nucleonics Vol. 20 n° 5 (1962)

(6) Proceedings of the Symposium: Applications of Computers to Nuclear and Radiochemistry. Galtimburg - Tennessee Oct. 17 - 19, 1962

(7) I.F. Croall: CODA a Least Square Fitting Program for Radioactive Decay Curves. AERE - R4227 (1963)

I. RESTRICTIONS

a) The standard IBM 1620 and its monitor is needed

b) The standard IBM 7090 and its monitor is needed

c) For the IBM 1620 it is necessary to put in the tape reader the punched tape coming from the High Speed Tape Punch of the 256 channels analyser. The 1620 computer transfers the gamma spectra from the tape to punched cards.

II. USE OF THE PROGRAM

INPUT consists of :

1 - One card for the computation of the decay times of the radioisotopes after the irradiation in the reactor.

FORMAT (12I6)

2 - One card with the number of elements in library, the number of channels of the analyzer, the lower limit and the upper limit of this portion of gamma spectrum containing the 1.17 MeV photopeak of Co^{60} used as flux monitor, the correction factor depending on the calibration of the gamma spectrometer and the number of channels used to find the recalibration photopeak.

FORMAT (12I6/4I6/3F6.3)

3 - One card for each element in the library. This card contains:

ELEM Name of the element

LINE channel in which falls the theoretical maximum of its photopeak

LSUP number of channels corresponding to the half of the interval in which the photopeak falls

XLAM decay constant of the isotope in minutes

AS the experimental value of a obtained from the relation (5).

FORMAT (A6,2I6,2E12.8)

4 - One card for each irradiation, where :

NIRR1 Irradiation number

TIRR irradiation duration in minutes

IRRORA end of the irradiation stating its hour, minute, day and month

AA absolute activity of the Co^{60} standard used in the calculation of the neutron flux

FINE after the last card there is a card with this word punched fom 57 to 60.

FORMAT (I6,F12.3,4I6,E12.8.A6)

5 - One card for each irradiated sample to analyse, where:

NIRR2 Irradiation number

IDENT2 identification number of the sample

PESOC weight of the sample in grams

FINE see point 4

FORMAT (I6,6X,I6,6X,F9.6,21X,A6)

6 - One card for each measurement made with the gamma ray spectrometer :

NIRR3 Irradiation number

IDENT3 Identification number of the sample

MISORA hour, minute, day and month of the counting

TCON counting time

VNOME the name of the isotope to be analyzed

NSP number of the gamma spectrum punched by the High Speed Tape Punch of the spectrometer

FINE see point 4

SDEV recalibration factor

FORMAT(6I6,F6.3,A6,I6,A6,F6.0)

7 - A set of 26 cards for each spectrum punched by the 1620 computer. Each set is characterized by the number of the spectrum (NSP) and by the number of each card in the set.

FORMAT (10F6.0,I6)

OUTPUT consists of:

1) All the input data.
2) Since the first number of each spectra represents the prefixed counting time of the spectrometer, that is 64 seconds or one of its multiples, we introduced a control in order to know if the spectrometer counted for the prefixed time.
   If that does not occur we have the following write out near the spectrum:
   THE ANALYZER NOT COUNTED FOR THE PREFIXED TIME
   All the calculations are also done, but before the results one asterisk is printed out to caution that those results could be erroneous.
3) If the isotope to be analized has not the corresponding name in the library:
   IS NOT IN LIBRARY
   is printed out.

4) If there does not exist the spectrum related to the researched isotope, there is the following write out:
THE SPECTRUM DOES NOT EXIST

5) If all the input elements are right, a line is written out containing:
   a) Identification number of the sample
   b) the name of the isotope to be analyzed
   c) PPM
   d) percentage error
   e) number of the spectrum
   f) number of the channel in which the maximum falls and the difference between this number and the number of channel in which the maximum could theoretically fall
   g) photopeak area
   h) statistical error in the photopeak area
   i) AREAO
   j) Weight of the element

III. COMPOSITION OF THE PROGRAM

The program is composed of a deck of Fortran cards and its listing is shown in Appendix 1.

MAIN PROGRAM : Reading and printing of the data, coordination of the subroutines, calculation of the weights of the researched elements and of the PPM.

SUBROUTINE AREPIC Evaluation of the photopeak areas as described in chapter 3, calculation of the standard deviations and of the percentage errors.

SUBROUTINE FLUSS Calculation of the neutron flux as described in chapter 2.

FUNCTION TDEC Evaluation of the decay times.

SUBROUTINE CORR Calculation of the recalibration factor as follows: the gamma-ray energy of a photopeak of one isotope whose existence is recognized during the counting is divided by a factor depending on the previous calibration of the spectrometer. This is done in order to find the channel in which the maximum of this photopeak could fall; the number of the channel on which the maximum really falls is then divided by the number previously found.
The final result is the correction factor with which to multiply the limits of the interval of the spectrum to be analyzed.
The new two limits are written out near the spectrum.

SUBROUTINE STAMPA It prints all the final results as shown in Appendix 2.

IV. CONTROLS

If requested it is possible to print the partial results of all the calculations.

AKNOWLEDGEMENTS

The suggestions and criticisms of Dr. F. Girardi are gratefully aknowledged.

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C     COMPUTER  PROGRAM  SYSTEM  FOR  A
C     QUANTITATIVE  ANALYSIS  BY  NEUTRON  ACTIVATION
C     AND  GAMMA - RAY  SPECTROMETRY


      DIMENSION ELEM(100),LINE(100),LSUP(100),XLAM(100),AS(100)
      DIMENSION NIRR1(100),TIRR(100),IRRORA(4,100),AA(100),NIRR2(500),ID
     1ENT2(500),PESOC(500),NIRR3(1000),IDENT3(1000),MISORA(4,1000),TCON(
     21000),VNOME(1000),NSP(1000),IME(12),FLUSSO(100),SP(300),AREA(1000)
     3,AREAO(1000),PESO(1000),PPM(1000),SDEV(1000),CANALI(300),SDEV1(100
     4),SDEV2(100),NO(1000),AST(1000)
      DIMENSION INTEM(1000),INAM(100)
      COMMON INTEM,K1,K2
      COMMON ELEM,XLAM,AS,NIRR1,TIRR,IRRORA,AA,NIRR2,IDENT2,PESOC,NIRR3,
     1IDENT3,MISORA,TCON,VNOME,NSP,FLUSSO,SP,AREA,AREAO,PESO,PPM,SDEV,IE
     2,ISP,SDEV1,SDEV2,NO,IR,JCAMP,KES,KJ,AST
      COMMON LINE,LSUP
      EQUIVALENCE(SP,CANALI)
B     FIN=606026314525
      READ INPUT TAPE 5,101,IME,IE,ISP,K1,K2,SP(300),SP(299),SP(298)
  101 FORMAT (12I6/4I6/3F6.3)
      READ INPUT TAPE 5,102,(ELEM(I),LINE(I),LSUP(I),XLAM(I),AS(I),I=1,I
     1E)
  102 FORMAT (A6,2I6,2E12.8)
      WRITE OUTPUT TAPE 6,500,(ELEM(I),LINE(I),LSUP(I),XLAM(I),AS(I),I=1
     1,IE)
      DO 1 I=1,100
      READ INPUT TAPE 5,103,NIRR1(I),TIRR(I),(IRRORA(K,I),K=1,4),AA(I),F
     1INE
  103 FORMAT (I6,F12.3,4I6,E12.8,A6)
B     IF ((FINE+FIN)*(-(FINE*FIN))) 2,3,2
    2 IR=I
    1 CONTINUE
    3 CONTINUE
      WRITE OUTPUT TAPE 6,501, (NIRR1(I),TIRR(I),(IRRORA(K,I),K=1,4),AA(
     1I) ,I=1,IR)
      DO 4 J=1,500
      READ INPUT TAPE 5,104,NIRR2(J),IDENT2(J),PESOC(J),FINE
  104 FORMAT (I6,6X,I6,6X,F9.6,21X,A6)
B     IF ((FINE+FIN)*(-(FINE*FIN))) 5,6,5
    5 JCAMP=J
    4 CONTINUE
    6 CONTINUE
      WRITE OUTPUT TAPE 6,502,(NIRR2(J),IDENT2(J),PESOC(J),J=1,JCAMP)
      DO 7 K=1,1000
      READ INPUT TAPE 5,105,NIRR3(K),IDENT3(K),(MISORA(I,K),I=1,4),TCON(
     1K),VNOME(K),NSP(K),FINE,SDEV(K)
  105 FORMAT (6I6,F6.3,A6,I6,A6,F6.0)
B     IF ((FINE+FIN)*(-(FINE*FIN))) 8,9,8
    8 KES=K
    7 CONTINUE
    9 CONTINUE
```

```
      WRITE OUTPUT TAPE 6,503,(NIRR3(K),IDENT3(K),(MISORA(I,K),I=1,4),TC
     1ON(K),VNOME(K),NSP(K),SDEV(K),K=1,KES)
  300 READ INPUT TAPE 5,106,(SP(I),I=1,10),NSPE
  106 FORMAT (10F6.0,I6)
      NSPE=NSPE
      IF (NSPE) 10,100,10
   10 CONTINUE
      READ INPUT TAPE 5,107,(SP(I),I=11,ISP)
  107 FORMAT (10F6.0)
      WRITE OUTPUT TAPE 6,504,(SP(L),L=1,10),NSPE
  504 FORMAT (1H1///1H0,10F6.0,I6)
      WRITE OUTPUT TAPE 6,507,(SP(L),L=11,ISP)
  507 FORMAT (1H0,10F6.0)
      DO 600 IKL=1,6
      ILK=SP(IKL)+0.5
      IF(ILK-(ILK/64)*64)600,602,600
  600 CONTINUE
B     AST(NSPE)=606060546060
      WRITE OUTPUT TAPE 6,603
      GO TO 555
  602 CONTINUE
B     AST(NSPE)=606060606060
  555 DO 400 KJ=1,KES
      KJ=KJ
      IF (NSP(KJ)-NSPE) 400,15,400
   15 DO 11 I1=1,IE
      I=I1
      IF (ELEM(I)-VNOME(KJ )) 11,12,11
   11 CONTINUE
B     COB=234622214363
B     IF ((VNOME(KJ)+COB)*(-(VNOME(KJ)*COB))) 13,14,13
   14 CALL FLUSS
      GO TO 300
   13 NO (KJ)=2
      GO TO 400
   12 NO(KJ)=0
      LINA=LINE(I)-LSUP(I)
      LSUA=LINE(I)+LSUP(I)
      CALL AREPIC(LINA,LSUA,AREA1)
      AREA(KJ)=AREA1/TCON(KJ)
      DO 401 N=1,IR
      IRR=N
      IF (NIRR3(KJ)-NIRR1(N)) 401,402,401
  401 CONTINUE
  402 AREAO(KJ)=AREA(KJ)/EXPF(-XLAM(I)*TDEC(MISCRA(1,KJ),IRRORA(1,IRR),I
     1ME))
      PESO(KJ)=(AS(I)*AREAO(KJ))/(1.-EXPF(-XLAM(I)*TIRR(IRR)))
  400 CONTINUE
      GO TO 300
  100 CONTINUE
      DO 200 K=1,KES
      DO 201 L=1,IR
      L1=L
      IF (NIRR3(K)-NIRR1(L)) 202,203,202
  202 CONTINUE
  201 CONTINUE
```

```
 203 CONTINUE
     PESO(K)=PESO(K)/FLUSSO(L1)
     DO 204 J=1,JCAMP
     J1=J
     IF(NIRR2(J)-NIRR3(K))204,206,204
 206 IF (IDENT2(J)-IDENT3(K)) 204,205,204
 204 CONTINUE
 205 PPM(K)=PESO(K)/PESOC(J1)
 200 CONTINUE
     CALL STAMPA
     CALL EXIT
 500 FORMAT (1H1,8HLIBRARY /////1X,8HELEMENT ,5X,4HMAX.,7X,6HINTERV,11X
    1,10HDEC.CONST.,13X,6HA VAL.///(1H ,A6,4X,I6,5X,I6,6X,1P2E20.7))
 501 FORMAT (1H1,13HIRRADIATIONS /////4X,6HIRR.N.,7X,10HIRR. TIME ,5X,2
    14H*  END OF IRRADIATION  *,8X,13HSTANDARD COB.///(I8,0PF17.3,5X,4I
    26,1PE25.7))
 502 FORMAT (1H1,19HIRRADIATED SAMPLES /////4X,6HIRR.N.,5X,6HSAMPLE,7X,
    113HWEIGHT IN GR ///(I10,I11,F20.6))
 503 FORMAT (1H1,15H      COUNTINGS/////4X,6HIRR.N.,5X,6HSAMPLE,5X,24H*
    1   TIME OF COUNTING   *,3X,6HCOUNT ,4X,14HRESEARCH.ELEM.,4X,9HSPEC
    2T.N. ,5X,6HCALIB.///(I8,I11,5X,4I6,F11.3,8X,A6,I16,F11.0))
 603 FORMAT (54X,50H THE ANALYZER NOT COUNTED FOR THE PREFIXED TIME
    1/////)
     END(1,0,0,0,0,0,1,0,0,0,0,0,0,0,0)
```

```
      SUBROUTINE AREPIC(LIN,LSU,AREA)
      DIMENSION ELEM(100),LINE(100),LSUP(100),XLAM(100),AS(100)
      DIMENSION NIRR1(100),TIRR(100),IRRORA(4,100),AA(100),NIRR2(500),ID
     1ENT2(500),PESOC(500),NIRR3(1000),IDENT3(1000),MISORA(4,1000),TCON(
     21000),VNOME(1000),NSP(1000),IME(12),FLUSSO(100),SP(300),AREA(1000)
     3,AREAO(1000),PESO(1000),PPM(1000),SDEV(1000),CANALI(300),SDEV1(100
     4),SDEV2(100),NO(1000),AST(1000)
      DIMENSION INTEM(1000),INAM(100)
      COMMON INTEM,K1,K2
      COMMON ELEM,XLAM,AS,NIRR1,TIRR,IRRORA,AA,NIRR2,IDENT2,PESOC,NIRR3,
     1IDENT3,MISORA,TCON,VNOME,NSP,FLUSSO,SP,AREA,AREAO,PESO,PPM,SDEV,IE
     2,ISP,SDEV1,SDEV2,NO,IR,JCAMP,KES,KJ,AST
      EQUIVALENCE(SP,CANALI)
      DIMENSION VMED(300)
      ERR=0
      LINE=LIN
      LSUP=LSU
      CALL CORR(LINE,LSUP,SDEV(KJ),CANALI,LAP)
      INTERV=(LSUP-LINE+1)/2
      LAP=LAP
      GO TO(111,100),LAP
  111 LINE=LINE+6
      LSUP=LSUP-6
  100 CONTINUE
      IF(LSUP-LINE)200,200,201
  200 NO(KJ)=-1
      GO TO 500
  201 CONTINUE
      DO 119 I=1,ISP
  119 VMED(I)=0.
      IPMPR=0
      VALM=0.
      DO 1 I=LINE,LSUP
      IF(VALM-CANALI(I))2,4,3
    2 CONTINUE
      SC=CANALI(I)+CANALI(I-1)+CANALI(I+1)
      SM=CANALI(I-2)+CANALI(I-3)+CANALI(I-4)
      SP=CANALI(I+2)+CANALI(I+3)+CANALI(I+4)
      IF(SC-SM)3,3,21
   21 IF(SC-SP)3,3,20
   20 VALM=CANALI(I)
      IPMPR=I
      IPMSE=0
      GO TO 3
    4 IPMSE=I
    3 CONTINUE
    1 CONTINUE
      IF(VALM)22,200,22
   22 CONTINUE
      IF(IPMPR-LINE)300,301,300
  301 LINE=LINE+1
      GO TO 100
  300 IF(IPMPR-LSUP)302,303,302
  302 IF(IPMSE-LSUP)304,303,304
  303 LSUP=LSUP-1
```

```
      GO TO 100
  304 CONTINUE
      IF(IPMSE)5,5,6
    6 NMAS=IPMSE-IPMPR+1
      ICM=(NMAS-1)/2+IPMPR
      IF(NMAS-((NMAS/2)*2))12,12,13
    5 ICM=IPMPR
      RMAS=VALM-SQRTF(VALM)
      IF(CANALI(IPMPR+1)-RMAS)10,11,11
   11 IF(CANALI(IPMPR-1)-RMAS)12,13,13
   10 IF(CANALI(IPMPR-1)-RMAS)13,14,14
   12 IPA=2
      VALM=(VALM+CANALI(ICM+1))/2.
      I2=ICM+1
      GO TO 15
   14 VALM=(VALM+CANALI(ICM-1))/2.
      I2=ICM
      ICM=ICM-1
      IPA=2
      GO TO 15
   13 I2=ICM
      VALM=CANALI(ICM)
      IPA=1
   15 CONTINUE
      INTEM(KJ)=(ICM+I2)/2
      DO 19 I=1,INTERV
      ICM=ICM-1
      I2=I2+1
      VMED(I)=(CANALI(ICM)+CANALI(I2))/2.
   19 CONTINUE
      VCONT=0.
      VMM=0.
      VMIN=1.E+38
      DO 32 I=1,ISP
      IF(VMED(I))30,30,31
   31 IF(VMIN-VMED(I))32,32,33
   33 VMIN=VMED(I)
      MIN=I
   32 CONTINUE
   30 CONTINUE
      RVMIN=SQRTF(VMIN)*1.5+VMIN
      VNUAR=1.
      VIPA=IPA
      AREAS=VALM*VIPA
      DO 40 K=1,MIN
   40 AREAS=AREAS+VMED(K)*2.
      VNUCA=MIN*2 +IPA
      AREA=AREAS-VMIN*VNUCA
      ERR=AREAS+VNUCA**2*VMIN/2.

      IMIN=0.
      MINS=MIN
      MIND=MIN
      AREAD=AREAS
      VNUCP=VNUCA
   39 AREAS=AREAS-VMED(MINS)*2.
```

```
      MIND=MIND+1
      AREAD=AREAD+VMED(MIND)*2.
      VNUCA=VNUCA-2.
      VNUCP=VNUCP+2.
      MINS=MINS-1
      IF(RVMIN-VMED(MINS))41,42,42
   42 AREA=AREA+AREAS-VMED(MINS)*VNUCA
      ERR=ERR+AREAS+VNUCA**2*VMED(MINS)/2.
      VNUAR=VNUAR+1.
      GO TO 43
   41 IMIN=IMIN+1
   43 IF(VMED(MIND))37,36,37
   37 IF(RVMIN-VMED(MIND))36,45,45
   45 AREA=AREA+AREAD-VMED(MIND)*VNUCP
      ERR=ERR+AREAD+VNUCP**2*VMED(MIND)/2.
      VNUAR=VNUAR+1.
      IF(IMIN)39,36,39
   36 CONTINUE

      AREA=AREA/VNUAR
      SDEV(KJ)=SQRTF(ERR/VNUAR)/TCON(KJ)
   50 CONTINUE
  500 CONTINUE
      RETURN
      END(1,0,0,0,0,0,1,0,0,0,0,0,0,0,0)
```

```
      SUBROUTINE FLUSS
      DIMENSION ELEM(100),LINE(100),LSUP(100),XLAM(100),AS(100)
      DIMENSION NIRR1(100),TIRR(100),IRRORA(4,100),AA(100),NIRR2(500),ID
     1ENT2(500),PESOC(500),NIRR3(1000),IDENT3(1000),MISORA(4,1000),TCON(
     21000),VNOME(1000),NSP(1000),IME(12),FLUSSO(100),SP(300),AREA(1000)
     3,AREAO(1000),PESO(1000),PPM(1000),SDEV(1000),CANALI(300),SDEV1(100
     4),SDEV2(100),NO(1000),AST(1000)
      DIMENSION INTEM(1000),INAM(100)
      COMMON INTEM,K1,K2
      COMMON ELEM,XLAM,AS,NIRR1,TIRR,IRRORA,AA,NIRR2,IDENT2,PESOC,NIRR3,
     1IDENT3,MISORA,TCON,VNOME,NSP,FLUSSO,SP,AREA,AREAO,PESO,PPM,SDEV,IE
     2,ISP,SDEV1,SDEV2,NO,IR,JCAMP,KES,KJ,AST
      EQUIVALENCE(SP,CANALI)
      DO 1 I=1,IR
      II=I
      IF (NIRR3(KJ)-NIRR1(I)) 1,2,1
    1 CONTINUE
    2 CONTINUE
      WRITE OUTPUT TAPE 6,505
  505  FORMAT (1H0///60X,9H STANDARD)
  507 FORMAT(1H0,10F6.0)
      CALL AREPIC(K1,K2,ARST)
      SDEV1(II)=ARST
      SDEV(KJ)=0.
      READ INPUT TAPE 5,107,(SP(I),I=1,ISP)
  107 FORMAT (10F6.0)
      WRITE OUTPUT TAPE 6,506
  506 FORMAT (1H1///60X,8H  COBALT)
      WRITE OUTPUT TAPE 6,507,(SP(I),I=1,ISP)
      CALL AREPIC(K1,K2,ARIR)
      SDEV2(II)=ARIR
      SDEV(KJ)=0.
      AK=AA(II)*ARIR/ARST
      FLUSSO(II)=1.39E7*AK/(TIRR(II)*.01667)
   10 CONTINUE
      RETURN
      END(1,0,0,0,0,0,1,0,0,0,0,0,0,0,0)
```

```
      FUNCTION TDEC(MO,IO,IME)
      DIMENSION MO(4),IO(4),IME(12)
      I1=MO(4)
      I2=IO(4)
      TDEC=((IME(I1)-IME(I2)+MO(3)-IO(3))*24+MC(1)-IO(1))*60+MO(2)-IO(2)
      RETURN
      END(1,0,0,0,0,0,1,0,0,0,0,0,0,0,0)
```

```
      SUBROUTINE CORR(LI,LS,CO,SP,L)
      DIMENSION SP(300)
      IF(CO)9,10,9
    9 CONTINUE
      L=1
      CO=CO/SP(300)
      ICO=CO-SP(299)
      NCO=CO+SP(298)
      VAX=0.
      DO 2 I=ICO,NCO
      IF(VAX-SP(I))3,2,2
    3 II=I
      VAX=SP(II)
    2 CONTINUE
      X=FLOATF(II)/CO
      LI=X*FLOATF(LI)
      LS=X*FLOATF(LS)
      WRITE OUTPUT TAPE 6,100,II,LI,LS
  100 FORMAT (60X,3I10)
      GO TO 15
   10 L=2
   15 RETURN
      END(1,0,0,0,0,0,1,0,0,0,0,0,0,0,0)
```

```
      SUBROUTINE STAMPA
      DIMENSION ELEM(100),LINE(100),LSUP(100),XLAM(100),AS(100)
      DIMENSION NIRR1(100),TIRR(100),IRRORA(4,100),AA(100),NIRR2(500),ID
     1ENT2(500),PESOC(500),NIRR3(1000),IDENT3(1000),MISORA(4,1000),TCON(
     21000),VNOME(1000),NSP(1000),IME(12),FLUSSO(100),SP(300),AREA(1000)
     3,AREAO(1000),PESO(1000),PPM(1000),SDEV(1000),CANALI(300),SDEV1(100
     4),SDEV2(100),NO(1000),AST(1000)
      DIMENSION INTEM(1000),INAM(100)
      COMMON INTEM,K1,K2
      COMMON ELEM,XLAM,AS,NIRR1,TIRR,IRRORA,AA,NIRR2,IDENT2,PESOC,NIRR3,
     1IDENT3,MISORA,TCON,VNOME,NSP,FLUSSO,SP,AREA,AREAO,PESO,PPM,SDEV,IE
     2,ISP,SDEV1,SDEV2,NO,IR,JCAMP,KES,KJ,AST
      COMMON LINE,LSUP
      EQUIVALENCE(SP,CANALI)
      DO 201 K=1,KES
      DO 200 I=1,IE
B     IF((VNOME(K)+ELEM(I))*(-(VNOME(K)*ELEM(I))))200,199,200
  199 INAM(K)=LINE(I)
      GO TO 201
  200 CONTINUE
      INAM(K)=INTEM(K)
  201 CONTINUE
      DO 1 I=1,IR
      WRITE OUTPUT TAPE 6,100,NIRR1(I),FLUSSO(I),SDEV1(I),SDEV2(I)
      DO 2 J=1,JCAMP
      IF (NIRR2(J)-NIRR1(I)) 2,4,2
    4 DO 3 K=1,KES
      IDI=INTEM(K)-INAM(K)
      IF (NIRR3(K)-NIRR1(I)) 3,5,3
    5 IF (IDENT3(K)-IDENT2(J)) 3,6,3
    6 CONTINUE
      IF(NO(K))9,7,8
    9 WRITE OUTPUT TAPE 6,103,IDENT3(K),VNOME(K),NSP(K)
      GO TO 3
    8 WRITE OUTPUT TAPE 6,102,IDENT3(K),VNOME(K),NSP(K)
      GO TO 3
    7 CONTINUE
      IF(INTEM(K))10,11,10
   11 WRITE OUTPUT TAPE 6,104,IDENT3(K),VNOME(K),NSP(K)
      GO TO 3
   10 CONTINUE
      PERC=100.*SDEV(K)/AREA(K)
      K1=NSP(K)
      WRITE OUTPUT TAPE 6,101,AST(K1),IDENT3(K),VNOME(K),PPM(K),PERC,NSP
     1(K),INTEM(K),IDI ,AREA(K),SDEV(K),AREAO(K),PESO(K)
    3 CONTINUE
    2 CONTINUE
    1 CONTINUE
      RETURN
  101 FORMAT(1H0,A6,I6,5X,A6,F15.3,F10.2,I6,2I5,1PE15.3,0PF10.2,1P2E15.3
     1)
  100 FORMAT (1H1,16HIRRADIATION N.  ,I6,10X,6HFLUX   ,1PE15.3,10X,6HAREA
     1 1,1PE15.3,10X,6HAREA 2,1PE15.3/////
     26X,19HSAMPLE      ELEMENT ,6X,3HPPM,10X,3H0/0,5X,3HNSP,3X,7HMAXIMUM
     3,6X,4HAREA,9X,4HS.D.,9X,5HAREAO,9X,6HWEIGHT///)
```

```
 102 FORMAT (1H0,6X,I6,5X,A6,25X,I6,4X,17HIS NOT IN LIBRARY)
 103 FORMAT (1H0,6X,I6,5X,A6,25X,I6,4X,31HHAS NCT A PEAK IN THE INTERVA
    1L )
 104 FORMAT (1H0,6X,I6,5X,A6,25X,I6,4X,27HTHE SPECTRUM DOES NOT EXIST)
     END(1,0,0,0,0,0,1,0,0,0,0,0,0,0,0)
```

IRRADIATED SAMPLES

IRR.N.	SAMPLE	WEIGHT IN GR
1658	1	0.478800
1658	10	0.403500
1658	20	0.383100
1658	103	0.120100
1671	20	0.039241
1672	22	0.030471
1673	42	0.036696

COUNTINGS

IRR.N.	SAMPLE	*	TIME OF COUNTING		*	COUNT	RESEARCH.ELEM.	SPECT.N.	CALIB.
1658	1	15	27	18	9	1.067	CL1B	1	-0.
1671	20	14	20	26	9	1.067	CR1A	2	-0.
1658	20	15	31	18	9	1.067	CL1B	23	-0.
1658	103	15	32	18	9	1.067	CL1B	4	-0.
1658	1	15	34	18	9	1.067	MG1B	5	-0.
1658	10	15	35	18	9	1.067	CL1B	6	164.
1658	20	15	37	18	9	1.067	CL1B	7	-0.
1658	103	15	39	18	9	1.067	CL1B	8	-0.
1673	42	14	33	26	9	2.134	CR1A	9	64.
1672	22	14	35	26	9	2.134	CR1A	10	-0.
1671	-0	-0	-0	-0	-0	-0.	COBALT	11	-0.
1672	-0	-0	-0	-0	-0	-0.	COBALT	13	-0.
1673	-0	-0	-0	-0	-0	-0.	COBALT	15	-0.
1658	-0	-0	-0	-0	-0	-0.	COBALT	17	-0.

64.	0.	2.	1202.	2888.	2994.	2700.	2488.	2286.	2218.
2010.	2045.	1899.	1819.	1729.	1804.	1819.	1814.	1754.	1716.
1608.	1665.	1584.	1525.	1469.	1411.	1444.	1319.	1373.	1255.
1289.	1263.	1249.	1232.	1239.	1181.	1171.	1200.	1263.	1351.
1238.	1172.	1208.	1115.	1110.	1091.	1131.	1078.	1165.	1100.
1096.	1057.	1064.	1010.	1016.	1012.	1074.	1003.	1065.	1044.
995.	984.	1038.	1025.	1130.	1175.	1331.	1378.	1331.	1224.
1143.	978.	994.	992.	977.	1002.	976.	1049.	978.	1044.
982.	1021.	1057.	963.	1013.	988.	953.	1023.	1115.	1255.
1269.	1301.	1291.	1306.	1188.	1178.	1146.	1144.	1128.	1179.
1118.	1161.	1279.	1289.	1330.	1353.	1327.	1257.	1273.	1239.
1142.	1089.	1097.	979.	931.	864.	832.	769.	711.	731.
673.	672.	739.	720.	692.	861.	1015.	1306.	1804.	2344.
2878.	3324.	3514.	3405.	2937.	2437.	1792.	1391.	1098.	952.
825.	808.	766.	740.	765.	774.	750.	753.	730.	733.
712.	734.	699.	616.	576.	557.	450.	438.	390.	319.
286.	293.	274.	243.	266.	293.	346.	471.	693.	946.
1257.	1704.	2199.	2401.	2531.	2456.	2120.	1624.	1274.	888.
561.	396.	290.	193.	134.	102.	102.	85.	88.	113.
100.	93.	93.	100.	85.	98.	76.	97.	90.	90.
81.	79.	89.	73.	81.	84.	61.	65.	74.	60.
79.	58.	70.	64.	55.	64.	73.	67.	56.	61.
66.	62.	65.	84.	55.	70.	55.	63.	59.	47.
57.	48.	50.	47.	54.	44.	66.	54.	46.	43.
59.	44.	53.	51.	52.	62.	69.	32.	61.	46.
48.	47.	51.	39.	38.	36.				

64.	662.	1138.	1076.	972.	986.	1008.	879.	875.	755.
713.	747.	666.	694.	673.	668.	629.	647.	670.	700.
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
296.	375.	329.	344.	327.	350.	365.	451.	508.	560.
601.	630.	758.	782.	959.	1024.	1164.	1226.	1369.	1296.
1265.	1094.	978.	942.	772.	674.	541.	505.	441.	430.
398.	355.	392.	372.	358.	398.	369.	365.	364.	383.
390.	335.	374.	342.	333.	322.	343.	314.	308.	308.
289.	280.	274.	289.	251.	266.	268.	248.	281.	232.
272.	231.	256.	249.	230.	220.	242.	231.	221.	205.
186.	209.	176.	178.	156.	176.	146.	158.	159.	157.
142.	168.	160.	142.	159.	133.	132.	153.	192.	193.
214.	252.	300.	309.	373.	443.	495.	544.	558.	635.
708.	691.	745.	764.	729.	742.	679.	669.	607.	556.
460.	433.	372.	303.	294.	223.	212.	197.	177.	175.
168.	176.	210.	233.	245.	310.	313.	337.	406.	422.
460.	476.	488.	472.	482.	502.	459.	432.	403.	332.
320.	319.	240.	217.	193.	180.	131.	108.	99.	100.
80.	65.	66.	52.	60.	39.	42.	44.	48.	35.
48.	38.	40.	40.	32.	31.	27.	43.	30.	24.
27.	20.	20.	17.	20.	18.	16.	18.	29.	29.
20.	22.	18.	14.	8.	23.				

64.	0.	8.	920.	1761.	1716.	1530.	1402.	1353.	1275.
1220.	1137.	1045.	1054.	1089.	1019.	1056.	1010.	978.	951.
904.	882.	934.	802.	861.	815.	790.	761.	744.	746.
678.	798.	703.	663.	719.	709.	688.	670.	714.	755.
693.	670.	665.	632.	610.	596.	658.	694.	667.	651.
599.	550.	539.	581.	550.	547.	562.	561.	565.	490.
536.	482.	561.	621.	658.	672.	747.	791.	656.	640.
528.	549.	578.	521.	506.	528.	561.	513.	525.	555.
536.	525.	561.	507.	587.	534.	561.	598.	643.	670.
686.	677.	659.	608.	613.	577.	541.	632.	581.	638.
662.	636.	753.	646.	714.	719.	704.	732.	727.	685.
671.	631.	551.	472.	468.	463.	438.	396.	420.	403.
353.	370.	415.	431.	464.	507.	746.	958.	1345.	1593.
1828.	1998.	1745.	1572.	1235.	955.	712.	599.	489.	400.
360.	407.	407.	403.	413.	408.	435.	404.	401.	422.
396.	352.	361.	334.	295.	245.	210.	193.	175.	143.
124.	164.	139.	135.	181.	207.	302.	427.	593.	770.
1002.	1216.	1357.	1333.	1301.	1027.	902.	638.	434.	246.
204.	166.	97.	79.	61.	69.	84.	46.	51.	52.
59.	52.	57.	58.	44.	71.	43.	55.	51.	50.
53.	44.	44.	55.	47.	34.	50.	28.	28.	48.
44.	37.	46.	46.	53.	57.	62.	53.	63.	74.
61.	59.	63.	54.	54.	41.	33.	30.	32.	35.
39.	28.	29.	30.	25.	32.	28.	30.	33.	33.
24.	34.	30.	28.	26.	35.	33.	34.	27.	22.
25.	26.	31.	27.	19.	23.				

64.	0.	4.	1016.	2487.	2525.	2450.	2116.	1915.	1881.	4
1777.	1720.	1563.	1570.	1572.	1523.	1572.	1563.	1527.	1439.	
1405.	1475.	1550.	1488.	1523.	1371.	1219.	1209.	1179.	1119.	
1230.	1178.	1255.	1152.	1093.	1083.	1113.	1037.	1140.	1100.	
1149.	1074.	1033.	994.	1025.	950.	942.	1055.	1004.	994.	
963.	987.	911.	899.	885.	842.	924.	857.	863.	835.	
841.	859.	848.	904.	983.	1122.	1286.	1307.	1346.	1223.	
1031.	983.	922.	851.	869.	883.	890.	877.	945.	935.	
850.	923.	876.	901.	917.	897.	876.	936.	944.	1007.	
1080.	1086.	997.	961.	945.	861.	855.	846.	867.	869.	
889.	983.	1039.	1113.	1210.	1212.	1309.	1504.	1635.	1722.	
1720.	1522.	1355.	1027.	875.	759.	642.	589.	604.	569.	
616.	540.	611.	565.	638.	701.	748.	980.	1372.	1694.	
1976.	2396.	2269.	2255.	2004.	1590.	1282.	991.	819.	684.	
632.	625.	643.	674.	620.	667.	672.	643.	651.	587.	
565.	532.	500.	526.	517.	450.	400.	402.	357.	344.	
335.	303.	304.	316.	287.	331.	374.	407.	555.	775.	
1083.	1314.	1530.	1722.	1766.	1636.	1433.	1198.	970.	730.	
563.	468.	378.	322.	270.	255.	201.	210.	193.	205.	
201.	199.	214.	198.	199.	218.	185.	190.	199.	171.	
186.	189.	153.	187.	176.	169.	167.	166.	161.	152.	
131.	151.	145.	192.	187.	210.	269.	331.	309.	374.	
378.	374.	399.	316.	296.	219.	167.	144.	116.	92.	
99.	63.	69.	80.	59.	50.	80.	76.	67.	103.	
119.	151.	149.	158.	170.	165.	162.	145.	151.	109.	
96.	78.	73.	52.	59.	48.					

64.	0.	2.	1122.	2635.	2722.	2436.	2234.	2123.	2027.
1874.	1778.	1715.	1618.	1593.	1644.	1641.	1637.	1617.	1549.
1446.	1382.	1338.	1309.	1285.	1274.	1228.	1242.	1202.	1156.
1206.	1164.	1143.	1120.	1081.	1100.	1068.	1076.	1154.	1175.
1112.	1113.	1004.	1012.	957.	989.	1040.	1014.	1035.	996.
1004.	974.	928.	912.	919.	888.	911.	909.	867.	876.
900.	834.	932.	888.	1024.	1065.	1099.	1224.	1221.	1108.
964.	964.	930.	872.	920.	874.	885.	838.	848.	893.
864.	836.	835.	849.	931.	880.	901.	945.	955.	1045.
1152.	1235.	1258.	1193.	1116.	1097.	1063.	992.	1069.	1018.
1022.	1100.	1191.	1151.	1251.	1257.	1137.	1130.	1114.	1120.
1077.	985.	914.	845.	847.	776.	732.	692.	638.	605.
677.	629.	618.	670.	657.	706.	885.	1135.	1544.	2061.
2542.	2974.	3095.	3001.	2566.	2169.	1685.	1287.	988.	794.
730.	701.	685.	649.	672.	650.	691.	670.	709.	695.
679.	627.	627.	566.	529.	484.	410.	376.	344.	307.
271.	272.	240.	236.	227.	243.	273.	385.	509.	812.
1145.	1463.	1834.	2121.	2188.	2173.	1968.	1530.	1172.	872.
556.	370.	255.	180.	140.	107.	79.	105.	91.	72.
90.	76.	93.	71.	67.	93.	76.	69.	84.	70.
65.	91.	62.	76.	63.	57.	64.	69.	53.	47.
53.	54.	50.	60.	64.	62.	61.	65.	55.	42.
49.	51.	59.	53.	61.	47.	55.	50.	53.	51.
41.	50.	61.	51.	44.	50.	47.	36.	47.	53.
50.	44.	41.	55.	46.	46.	42.	45.	41.	38.
40.	51.	41.	36.	34.	37.				

6

64.	0.	14.	1040.	1797.	1776.	1648.	1513.	1444.	1390.
1258.	1214.	1153.	1187.	1129.	1167.	1152.	1147.	1157.	1036.
1024.	1009.	1021.	985.	965.	922.	855.	860.	891.	848.
858.	788.	854.	775.	808.	777.	843.	871.	862.	849.
847.	773.	735.	712.	615.	617.	662.	621.	568.	629.
578.	522.	592.	598.	672.	798.	965.	1269.	1497.	1742.
1833.	1554.	1199.	844.	642.	605.	628.	606.	588.	514.
497.	509.	459.	491.	436.	523.	475.	515.	444.	480.
476.	474.	477.	514.	481.	489.	510.	532.	570.	604.
661.	645.	611.	594.	559.	505.	561.	500.	567.	532.
589.	633.	582.	598.	597.	640.	605.	630.	638.	631.
591.	542.	551.	474.	397.	394.	364.	363.	335.	335.
364.	335.	317.	352.	392.	442.	581.	796.	1054.	1329.
1575.	1768.	1689.	1464.	1214.	933.	746.	502.	497.	380.
372.	378.	357.	363.	356.	352.	386.	353.	338.	309.
382.	326.	316.	299.	296.	238.	217.	181.	175.	141.
118.	111.	119.	118.	152.	172.	213.	269.	442.	617.
765.	1035.	1162.	1278.	1173.	1046.	885.	623.	478.	306.
207.	111.	104.	65.	66.	52.	53.	45.	41.	47.
42.	37.	39.	49.	46.	41.	44.	32.	34.	42.
37.	32.	26.	44.	28.	38.	24.	36.	21.	34.
22.	38.	32.	40.	39.	34.	40.	42.	46.	50.
57.	53.	38.	37.	31.	36.	32.	38.	28.	29.
24.	21.	24.	24.	30.	27.	34.	15.	15.	16.
32.	17.	23.	21.	26.	24.	17.	12.	20.	29.
22.	27.	20.	20.	18.	19.				

132 117 145

1050.	997.	997.	915.	883.	914.	964.	938.	861.	792.
64.	0.	11.	989.	1501.	1457.	1398.	1345.	1227.	1144.
787.	767.	723.	703.	698.	711.	691.	648.	649.	630.
604.	651.	624.	599.	560.	611.	578.	596.	602.	652.
601.	592.	531.	553.	515.	501.	533.	568.	593.	524.
553.	553.	493.	466.	484.	494.	510.	469.	484.	488.
487.	491.	510.	526.	563.	619.	654.	696.	625.	532.
546.	473.	487.	450.	501.	465.	441.	443.	491.	442.
437.	473.	476.	471.	505.	499.	530.	543.	549.	574.
631.	626.	586.	611.	518.	516.	496.	532.	552.	527.
552.	594.	627.	634.	657.	615.	645.	676.	636.	589.
629.	535.	509.	465.	413.	395.	356.	331.	341.	317.
323.	298.	318.	343.	428.	486.	545.	779.	1066.	1315.
1571.	1726.	1566.	1490.	1201.	904.	615.	536.	425.	396.
397.	359.	338.	399.	345.	365.	347.	395.	352.	329.
347.	305.	329.	274.	280.	231.	189.	184.	179.	149.
103.	98.	121.	111.	125.	137.	216.	312.	487.	617.
812.	1030.	1177.	1157.	1070.	939.	823.	604.	427.	300.
183.	128.	84.	62.	81.	60.	58.	49.	47.	46.
59.	44.	48.	46.	51.	46.	41.	43.	49.	53.
38.	50.	34.	38.	30.	31.	34.	31.	31.	30.
36.	27.	42.	42.	43.	44.	73.	64.	73.	65.
71.	69.	55.	58.	31.	40.	38.	32.	26.	21.
35.	32.	36.	17.	21.	32.	23.	29.	29.	24.
29.	30.	24.	17.	26.	26.	17.	25.	27.	28.
35.	19.	25.	23.	12.	20.				

THE ANALYZER NOT COUNTED FOR THE PREFIXED TIME

64.	0.	5.	1028.	2245.	2328.	2193.	1963.	1834.	1747.	8
1629.	1584.	1526.	1464.	1413.	1415.	1513.	1453.	1388.	1331.	
1318.	1304.	1288.	1337.	1316.	1155.	1144.	1071.	1080.	1027.	
1104.	1079.	985.	1071.	918.	1025.	973.	979.	1034.	1090.	
1004.	977.	891.	935.	901.	834.	911.	883.	923.	922.	
938.	875.	859.	789.	862.	821.	880.	807.	843.	808.	
803.	822.	827.	871.	976.	1060.	1171.	1267.	1226.	1087.	
1009.	877.	834.	805.	827.	801.	849.	803.	843.	809.	
833.	834.	810.	824.	809.	863.	883.	840.	898.	892.	
1000.	973.	916.	868.	849.	785.	768.	787.	807.	829.	
854.	878.	898.	1002.	1028.	1134.	1209.	1365.	1528.	1617.	
1616.	1422.	1262.	1034.	854.	695.	623.	557.	527.	530.	
532.	551.	534.	558.	546.	645.	742.	919.	1237.	1513.	
1853.	2128.	2134.	2000.	1817.	1477.	1125.	960.	766.	639.	
593.	597.	574.	590.	546.	562.	572.	563.	567.	567.	
554.	518.	487.	505.	492.	406.	402.	357.	342.	252.	
299.	261.	273.	280.	269.	317.	360.	409.	550.	735.	
905.	1215.	1399.	1545.	1573.	1545.	1302.	1134.	867.	656.	
488.	447.	367.	297.	262.	251.	209.	209.	193.	211.	
212.	157.	197.	157.	158.	168.	170.	172.	161.	163.	
156.	151.	145.	153.	143.	138.	136.	118.	134.	130.	
122.	129.	122.	154.	172.	206.	275.	298.	308.	359.	
365.	388.	359.	318.	254.	200.	189.	146.	107.	91.	
81.	74.	58.	68.	68.	64.	53.	66.	70.	80.	
82.	73.	102.	99.	114.	113.	109.	130.	100.	99.	
67.	79.	80.	62.	39.	47.					

128.	779.	2128.	2281.	2358.	2473.	3295.	4927.	6004.	4887.	9
3661.	2635.	2298.	2204.	2373.	2371.	2470.	2894.	3946.	5273.
5814.	5536.	4562.	3333.	2698.	2350.	2398.	2568.	2820.	2877.
3184.	3179.	3316.	3203.	3010.	2716.	2405.	2266.	2150.	2101.
2060.	1971.	2054.	2046.	2017.	2042.	2185.	2303.	2561.	2706.
2825.	2756.	2551.	2261.	2077.	1941.	1802.	1729.	1604.	1639.
1588.	1541.	1524.	1520.	1521.	1479.	1494.	1473.	1503.	1536.
1546.	1576.	1670.	1737.	1761.	1831.	1935.	1982.	2021.	2004.
2112.	2095.	2208.	2244.	2333.	2436.	2465.	2590.	2590.	2548.
2547.	2537.	2579.	2423.	2595.	2443.	2699.	2755.	2821.	2850.
2756.	2790.	2871.	3028.	3079.	3188.	3511.	3686.	3703.	3746.
3832.	3785.	3414.	3086.	2741.	2331.	2021.	1762.	1551.	1451.
1311.	1119.	1046.	1118.	1078.	984.	1019.	925.	910.	824.
829.	735.	696.	696.	661.	630.	668.	615.	586.	620.
570.	590.	520.	511.	459.	530.	471.	491.	478.	471.
415.	452.	394.	402.	390.	386.	371.	385.	412.	430.
424.	453.	595.	639.	725.	753.	916.	1030.	1149.	1243.
1294.	1390.	1516.	1572.	1655.	1610.	1636.	1603.	1605.	1471.
1374.	1398.	1267.	1221.	1140.	1048.	985.	954.	926.	838.
827.	709.	729.	682.	727.	711.	751.	789.	854.	943.
985.	1070.	1156.	1233.	1246.	1216.	1344.	1333.	1226.	1224.
1256.	1131.	1006.	1000.	884.	790.	703.	699.	561.	479.
431.	372.	324.	333.	273.	244.	225.	214.	179.	195.
175.	154.	160.	168.	162.	153.	119.	130.	145.	141.
114.	137.	151.	113.	110.	126.	118.	114.	104.	127.
113.	108.	105.	103.	104.	106.				

51 38 62

10

128.	639.	1090.	1123.	1027.	995.	978.	1006.	1056.	1003.
875.	866.	917.	964.	974.	946.	1020.	1159.	1801.	3089.
3855.	3530.	2476.	1582.	1113.	897.	949.	1090.	1265.	1177.
1111.	1069.	993.	949.	949.	878.	861.	794.	871.	749.
794.	746.	776.	795.	785.	729.	802.	792.	832.	839.
803.	798.	766.	812.	744.	732.	735.	628.	673.	645.
664.	656.	609.	583.	607.	617.	648.	611.	603.	567.
593.	584.	653.	632.	623.	683.	624.	686.	694.	719.
742.	769.	889.	824.	865.	894.	937.	991.	1034.	1030.
975.	982.	954.	872.	823.	800.	729.	721.	747.	679.
678.	681.	688.	740.	734.	684.	682.	667.	658.	631.
707.	694.	715.	669.	608.	622.	633.	616.	611.	619.
620.	586.	587.	603.	580.	587.	539.	562.	581.	497.
583.	570.	499.	489.	505.	491.	532.	472.	515.	482.
462.	499.	495.	450.	393.	420.	394.	429.	390.	368.
373.	362.	337.	398.	334.	331.	332.	347.	332.	347.
403.	425.	487.	499.	596.	668.	733.	892.	933.	1059.
1183.	1261.	1331.	1302.	1401.	1372.	1372.	1346.	1392.	1271.
1230.	1164.	1167.	1063.	1079.	1012.	993.	854.	861.	774.
691.	717.	683.	648.	694.	677.	722.	757.	828.	834.
933.	935.	1067.	1088.	1119.	1129.	1171.	1183.	1166.	1095.
1051.	1044.	958.	794.	798.	693.	666.	526.	476.	427.
362.	334.	274.	262.	227.	192.	182.	181.	165.	171.
164.	150.	138.	161.	145.	130.	136.	136.	126.	122.
127.	120.	128.	121.	111.	132.	97.	111.	108.	113.
114.	98.	115.	114.	103.	96.				

128.	1036.	1706.	1675.	1626.	1540.	1473.	1545.	1568.	1549.	11
1571.	1515.	1490.	1601.	1814.	1964.	1931.	1797.	1715.	1709.	
1621.	1685.	1631.	1539.	1528.	1419.	1474.	1425.	1419.	1370.	
1370.	1330.	1296.	1255.	1210.	1296.	1253.	1239.	1207.	1229.	
1237.	1251.	1188.	1212.	1180.	1174.	1118.	1208.	1232.	1249.	
1207.	1223.	1136.	1206.	1239.	1233.	1219.	1267.	1211.	1277.	
1270.	1250.	1287.	1290.	1294.	1256.	1363.	1364.	1325.	1435.	
1384.	1313.	1365.	1333.	1238.	1134.	1074.	943.	887.	849.	
896.	876.	881.	932.	861.	790.	862.	1007.	1451.	2150.	
3177.	4083.	4479.	4247.	3281.	2236.	1358.	671.	476.	534.	
793.	1314.	2072.	2885.	3542.	3635.	3315.	2408.	1744.	952.	
531.	238.	177.	127.	90.	93.	92.	90.	94.	92.	
109.	91.	77.	82.	76.	88.	87.	90.	59.	81.	
76.	68.	71.	92.	63.	69.	67.	74.	62.	67.	
72.	70.	46.	78.	63.	46.	53.	60.	50.	58.	
52.	53.	52.	55.	58.	51.	67.	47.	40.	48.	
62.	60.	46.	47.	65.	51.	41.	45.	50.	45.	
65.	43.	51.	68.	52.	56.	60.	59.	58.	43.	
57.	35.	36.	25.	27.	31.	22.	20.	16.	7.	
13.	13.	20.	26.	32.	51.	50.	69.	84.	106.	
105.	85.	92.	55.	38.	29.	21.	9.	4.	2.	
2.	0.	0.	1.	0.	0.	0.	2.	0.	1.	
0.	0.	1.	2.	0.	1.	1.	0.	0.	0.	
0.	1.	0.	0.	0.	0.	0.	1.	0.	1.	
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	2.					

STANDARD

COBALT

128.	565.	628.	615.	621.	500.	512.	538.	538.	472.
527.	521.	529.	526.	624.	626.	602.	603.	549.	530.
539.	557.	471.	523.	474.	487.	476.	474.	460.	441.
427.	456.	411.	414.	426.	399.	395.	434.	432.	410.
392.	388.	392.	402.	391.	380.	394.	395.	420.	403.
365.	359.	409.	343.	350.	389.	363.	375.	404.	412.
402.	417.	387.	387.	433.	431.	415.	491.	433.	397.
413.	430.	425.	378.	379.	335.	320.	330.	295.	242.
269.	297.	269.	261.	280.	243.	291.	342.	501.	791.
1041.	1335.	1355.	1201.	957.	602.	350.	189.	129.	192.
277.	482.	758.	956.	1109.	1110.	987.	722.	488.	262.
137.	82.	56.	33.	44.	19.	23.	29.	23.	30.
29.	30.	22.	26.	21.	39.	24.	16.	24.	34.
22.	22.	28.	27.	28.	29.	26.	20.	22.	20.
23.	21.	21.	24.	21.	16.	20.	17.	12.	20.
19.	17.	14.	20.	12.	22.	16.	23.	24.	20.
12.	12.	18.	16.	19.	20.	17.	20.	11.	16.
15.	19.	19.	16.	22.	24.	14.	14.	18.	15.
13.	13.	12.	10.	15.	3.	6.	8.	4.	5.
4.	4.	12.	14.	9.	22.	20.	18.	35.	40.
29.	28.	25.	12.	17.	9.	9.	3.	0.	0.
0.	3.	0.	1.	2.	2.	4.	5.	3.	1.
1.	1.	0.	2.	0.	1.	1.	1.	0.	1.
1.	0.	1.	1.	1.	0.	0.	0.	0.	0.
0.	0.	1.	0.	0.	0.	0.	1.	1.	0.
1.	0.	0.	0.	0.	0.				

128.	1025.	1690.	1650.	1748.	1581.	1531.	1541.	1619.	1560.
1518.	1533.	1587.	1673.	1833.	1954.	1988.	1898.	1797.	1778.
1662.	1652.	1605.	1562.	1527.	1473.	1403.	1386.	1436.	1330.
1297.	1325.	1313.	1314.	1274.	1236.	1236.	1227.	1295.	1249.
1275.	1251.	1156.	1233.	1167.	1208.	1242.	1132.	1245.	1220.
1221.	1247.	1230.	1192.	1187.	1144.	1253.	1203.	1226.	1221.
1272.	1278.	1238.	1307.	1307.	1310.	1363.	1358.	1313.	1322.
1395.	1321.	1373.	1333.	1233.	1093.	1033.	922.	946.	910.
833.	889.	927.	852.	877.	855.	848.	1039.	1347.	2014.
3007.	3931.	4548.	4311.	3509.	2381.	1464.	819.	499.	506.
627.	1148.	1843.	2667.	3424.	3628.	3430.	2748.	1911.	1165.
643.	356.	155.	121.	88.	107.	96.	97.	74.	64.
94.	100.	91.	93.	98.	71.	85.	82.	82.	81.
68.	66.	55.	73.	79.	61.	55.	64.	67.	72.
65.	65.	52.	46.	67.	77.	56.	59.	61.	60.
55.	50.	55.	59.	62.	49.	67.	62.	63.	44.
38.	59.	56.	57.	60.	40.	39.	46.	45.	45.
48.	60.	38.	64.	57.	53.	56.	54.	42.	55.
51.	44.	37.	46.	27.	19.	23.	21.	12.	12.
14.	13.	15.	33.	24.	32.	56.	71.	99.	117.
108.	107.	83.	68.	43.	28.	31.	15.	7.	4.
5.	0.	1.	1.	1.	1.	1.	0.	0.	1.
1.	1.	0.	0.	0.	1.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	0.	0.	0.
0.	0.	1.	0.	0.	0.	0.	1.	0.	0.
2.	0.	0.	2.	0.	1.				

STANDARD

COBALT

128.	838.	882.	777.	755.	639.	573.	568.	559.	547.
522.	541.	571.	555.	612.	617.	655.	611.	593.	516.
539.	533.	533.	533.	492.	492.	480.	469.	426.	447.
417.	452.	389.	436.	408.	420.	402.	463.	419.	471.
429.	413.	411.	353.	369.	391.	384.	369.	411.	372.
399.	354.	390.	381.	357.	366.	386.	380.	391.	406.
406.	410.	399.	432.	452.	437.	429.	469.	406.	411.
412.	402.	412.	380.	351.	344.	320.	313.	313.	299.
276.	247.	285.	269.	281.	266.	299.	350.	485.	736.
1035.	1359.	1459.	1294.	967.	623.	346.	188.	141.	165.
272.	439.	727.	933.	1079.	1099.	984.	749.	443.	276.
167.	55.	50.	31.	32.	24.	25.	26.	34.	36.
29.	19.	23.	28.	22.	27.	23.	20.	30.	32.
26.	28.	25.	27.	21.	15.	12.	24.	22.	29.
18.	18.	19.	14.	15.	22.	20.	18.	25.	21.
17.	25.	19.	22.	15.	17.	14.	14.	22.	22.
21.	16.	18.	19.	15.	13.	14.	14.	12.	16.
16.	23.	20.	17.	24.	18.	17.	17.	14.	21.
19.	14.	11.	9.	5.	7.	5.	4.	7.	2.
3.	0.	4.	12.	18.	15.	22.	24.	26.	32.
32.	15.	27.	18.	9.	2.	5.	3.	2.	0.
0.	1.	1.	1.	3.	3.	2.	1.	2.	1.
0.	2.	1.	0.	1.	0.	0.	0.	0.	3.
1.	0.	1.	0.	1.	1.	0.	1.	0.	0.
1.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.				

128.	1015.	1594.	1600.	1581.	1543.	1591.	1518.	1570.	1586.
1510.	1566.	1593.	1708.	1845.	1980.	1907.	1813.	1812.	1714.
1759.	1620.	1572.	1541.	1529.	1463.	1374.	1468.	1385.	1428.
1361.	1313.	1264.	1233.	1319.	1297.	1208.	1254.	1251.	1188.
1285.	1192.	1208.	1222.	1200.	1165.	1223.	1128.	1182.	1212.
1177.	1218.	1230.	1248.	1153.	1125.	1244.	1275.	1242.	1269.
1230.	1263.	1251.	1249.	1285.	1287.	1384.	1390.	1319.	1390.
1447.	1430.	1353.	1307.	1239.	1190.	1047.	997.	1008.	878.
927.	838.	850.	841.	834.	876.	924.	1026.	1297.	2047.
2969.	3944.	4467.	4217.	3653.	2562.	1601.	906.	527.	457.
667.	1124.	1782.	2575.	3349.	3669.	3452.	2785.	2021.	1237.
610.	328.	199.	115.	86.	76.	99.	91.	102.	80.
93.	71.	86.	84.	99.	84.	94.	83.	83.	73.
67.	74.	69.	83.	83.	56.	81.	71.	58.	69.
64.	65.	71.	48.	55.	69.	72.	58.	51.	63.
47.	56.	49.	48.	62.	47.	62.	48.	52.	50.
51.	55.	43.	44.	52.	42.	51.	58.	61.	48.
49.	43.	49.	53.	60.	52.	47.	55.	60.	57.
46.	38.	34.	34.	34.	19.	22.	14.	9.	17.
12.	17.	14.	26.	22.	36.	51.	70.	108.	94.
130.	108.	94.	77.	53.	35.	23.	12.	9.	3.
4.	2.	0.	1.	1.	0.	2.	2.	2.	0.
1.	0.	1.	0.	0.	1.	0.	0.	0.	2.
0.	0.	1.	1.	0.	1.	0.	0.	0.	0.
0.	0.	0.	0.	2.	1.	0.	0.	1.	0.
0.	0.	0.	0.	0.	0.				

STANDARD

COBALT

128.	654.	665.	643.	634.	546.	483.	575.	545.	506.
511.	476.	553.	608.	635.	602.	606.	620.	628.	513.
494.	557.	515.	539.	497.	483.	452.	449.	449.	482.
442.	435.	460.	421.	450.	445.	408.	423.	420.	464.
426.	417.	390.	395.	367.	410.	376.	393.	398.	375.
411.	389.	394.	366.	361.	403.	384.	448.	406.	426.
406.	361.	417.	401.	409.	458.	421.	465.	460.	430.
439.	430.	443.	380.	390.	322.	307.	274.	288.	247.
270.	294.	304.	277.	272.	260.	319.	363.	525.	751.
1116.	1337.	1380.	1263.	1009.	650.	407.	224.	138.	176.
283.	476.	643.	887.	1089.	1147.	1017.	780.	517.	313.
156.	94.	57.	34.	36.	21.	22.	30.	18.	31.
31.	16.	17.	34.	21.	39.	25.	24.	29.	24.
27.	32.	26.	34.	25.	17.	18.	22.	29.	29.
13.	23.	19.	22.	20.	21.	15.	27.	27.	23.
22.	19.	25.	25.	15.	17.	26.	18.	19.	19.
18.	18.	19.	18.	17.	13.	16.	15.	14.	11.
12.	21.	11.	24.	21.	23.	15.	18.	22.	15.
17.	10.	13.	14.	5.	9.	6.	4.	4.	5.
4.	5.	3.	11.	4.	11.	25.	30.	40.	32.
46.	32.	25.	20.	17.	6.	4.	3.	0.	0.
1.	0.	0.	2.	5.	2.	2.	1.	1.	2.
3.	0.	0.	0.	0.	0.	0.	1.	0.	0.
0.	1.	0.	2.	1.	1.	1.	0.	0.	0.
0.	1.	0.	0.	1.	0.	1.	0.	0.	0.
1.	0.	0.	0.	0.	0.				

0.	71.	91.	97.	81.	88.	78.	100.	84.	82.
87.	77.	90.	75.	107.	124.	112.	105.	89.	88.
98.	85.	95.	86.	91.	76.	84.	92.	62.	57.
73.	64.	75.	68.	71.	61.	61.	70.	53.	60.
68.	68.	58.	63.	65.	59.	40.	81.	72.	57.
56.	55.	66.	53.	71.	58.	60.	65.	69.	71.
68.	76.	73.	68.	65.	79.	78.	79.	68.	78.
81.	73.	85.	67.	81.	60.	72.	48.	63.	56.
51.	46.	37.	42.	48.	45.	42.	52.	53.	74.
102.	144.	214.	240.	253.	231.	179.	90.	54.	31.
20.	44.	48.	78.	126.	169.	184.	234.	146.	132.
70.	40.	25.	14.	8.	8.	2.	5.	8.	3.
3.	7.	6.	6.	7.	5.	6.	6.	4.	3.
2.	9.	5.	5.	1.	5.	5.	3.	1.	3.
1.	3.	3.	2.	3.	6.	3.	3.	2.	4.
2.	3.	2.	4.	3.	2.	2.	3.	2.	4.
2.	7.	2.	5.	2.	1.	3.	3.	3.	2.
8.	1.	3.	1.	3.	2.	0.	2.	0.	4.
1.	3.	1.	1.	3.	2.	1.	1.	3.	0.
0.	0.	1.	0.	0.	4.	0.	4.	3.	5.
3.	6.	8.	9.	5.	6.	5.	2.	1.	1.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.				

17

STANDARD

COBALT

64.	370.	383.	391.	393.	332.	361.	361.	379.	318.
354.	322.	351.	380.	378.	388.	445.	373.	396.	356.
383.	344.	342.	329.	285.	296.	307.	332.	296.	280.
297.	280.	269.	246.	261.	237.	260.	337.	388.	415.
397.	328.	240.	245.	246.	223.	273.	268.	281.	314.
279.	248.	242.	214.	244.	205.	217.	222.	213.	236.
231.	218.	254.	312.	333.	354.	411.	399.	324.	309.
244.	234.	230.	214.	229.	199.	180.	175.	170.	165.
146.	154.	169.	150.	149.	150.	158.	153.	166.	204.
348.	465.	650.	681.	732.	575.	356.	222.	130.	80.
75.	108.	210.	293.	402.	523.	596.	542.	451.	341.
248.	119.	74.	53.	32.	26.	30.	27.	23.	31.
21.	28.	33.	31.	22.	22.	28.	27.	29.	33.
28.	22.	20.	22.	15.	28.	30.	19.	30.	28.
36.	29.	20.	24.	26.	27.	23.	22.	23.	19.
14.	11.	18.	16.	15.	18.	17.	13.	15.	20.
19.	11.	13.	15.	17.	18.	20.	15.	14.	24.
20.	19.	20.	15.	23.	22.	25.	20.	28.	23.
21.	15.	11.	13.	21.	13.	10.	5.	7.	11.
7.	11.	4.	10.	10.	7.	15.	15.	21.	16.
23.	24.	24.	16.	19.	14.	12.	9.	6.	2.
3.	3.	3.	12.	9.	9.	12.	15.	14.	13.
11.	14.	12.	3.	3.	1.	5.	1.	2.	3.
2.	2.	0.	1.	0.	1.	1.	0.	0.	0.
0.	0.	0.	3.	1.	2.	0.	3.	0.	0.
2.	1.	0.	0.	1.	1.				

APPENDIX 2

IRRADIATION N. 1658 FLUX 1.809E 14 AREA 1 1.176E 03 AREA 2 3.053E 03

SAMPLE	ELEMENT	PPM	0/0	NSP	MAXIMUM		AREA	S.D.	AREA0	WEIGHT
1	CL1B	3.270	2.39	1	133	2	1.934E 04	462.43	3.014E 04	1.566E 00
1	MG1B			5	IS NOT IN LIBRARY					
10	CL1B	2.106	2.95	6	132	1	9.053E 03	266.68	1.636E 04	8.499E-01
20	CL1B			23	THE SPECTRUM DOES NOT EXIST					
* 20	CL1B	2.346	3.16	7	132	1	9.226E 03	291.92	1.731E 04	8.988E-01
103	CL1B	9.106	2.98	4	132	1	1.231E 04	367.56	2.106E 04	1.094E 00
103	CL1B	9.370	3.87	8	132	1	1.113E 04	431.25	2.167E 04	1.125E 00

IRRADIATION N. 1671 FLUX 2.250E 13 AREA 1 2.083E 04 AREA 2 6.723E 03

SAMPLE	ELEMENT	PPM	0/0	NSP	MAXIMUM	AREA	S.D.	AREA0	WEIGHT
20	CR1A			2	HAS NOT A PEAK IN THE INTERVAL				

IRRADIATION N. 1672 FLUX 2.150E 13 AREA 1 2.092E 04 AREA 2 6.451E 03

SAMPLE	ELEMENT	PPM	0/0	NSP	MAXIMUM		AREA	S.D.	AREA0	WEIGHT
22	CR1A	1204.329	38.04	10	49	-2	4.464E 02	169.80	4.840E 02	3.670E 01

IRRADIATION N. 1673 FLUX 2.136E 13 AREA 1 2.148E 04 AREA 2 6.580E 03

SAMPLE	ELEMENT	PPM	0/0	NSP	MAXIMUM		AREA	S.D.	AREA0	WEIGHT
42	CR1A	6888.349	9.35	9	51	0	3.055E 03	285.75	3.311E 03	2.528E 02