

AD-A072 877

NAVAL RESEARCH LAB WASHINGTON DC  
A RADIOACTIVE SOURCE ACCOUNTABILITY AND MANAGEMENT SYSTEM - REV--ETC(U)

F/G 6/18

MAR 79 C BRYANT

UNCLASSIFIED

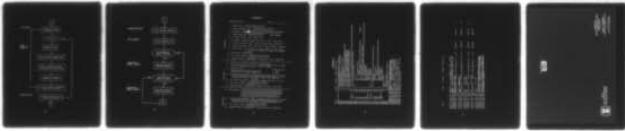
NRL-MR-3961

SBIE-AD-E000 306

NL

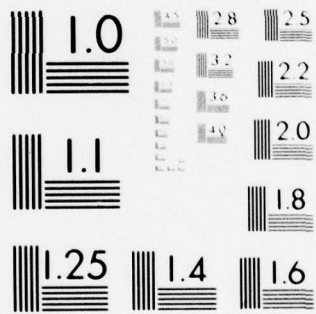
| OF |

AD  
A072877



END  
DATE  
FILMED  
9-79

DDC



MICROCOPY RESOLUTION TEST CHART  
 NATIONAL BUREAU OF STANDARDS-1963-A

**LEVEL**

AD 668698 (12) ADE 000 306  
NRL Memorandum Report 3961

ADA072877

# A Radioactive Source Accountability and Management System - Revised Version

CAROLYN BRYANT

*Research Computation Center  
for  
Radiological Protection Staff*

March 21, 1979

DDC  
RECEIVED  
AUG 20 1979  
A

DDC FILE COPY



79 04 30 007

NAVAL RESEARCH LABORATORY  
Washington, D.C.

Approved for public release; distribution unlimited.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NRL Memorandum Report 3961	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A RADIOACTIVE SOURCE ACCOUNTABILITY AND MANAGEMENT SYSTEM - REVISED VERSION	5. TYPE OF REPORT & PERIOD COVERED Interim report on a continuing NRL project.	
	6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s) Carolyn Bryant	8. CONTRACT OR GRANT NUMBER(s)	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Research Laboratory Washington, DC 20375	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 76082-7201	
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE March 21, 1979	
	13. NUMBER OF PAGES 16	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) UNCLASSIFIED	
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES  This research was supported by the Radiological Protection Staff.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  Accountability and management system Computer programs Radiological safety		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  An accountability and management system has been designed to aid its user by providing information necessary for the safe and prudent management of large groups of sources of ionizing radiation. This revised system is automated by computer programs written in FORTRAN for NRL's Texas Instruments Advanced Scientific Computer. It has been designed to furnish necessary accountability information on a timely and economical basis. In addition, it provides an efficient and relatively simple device for the management of essential, routine, applied radiological safety surveillance functions. ✕		

79 04 03 007

## TABLE OF CONTENTS

I. Background . . . . .	1
II. System Operation . . . . .	1
III. The Source Information File . . . . .	3
IV. The Computer Programs . . . . .	3
V. User's Manual . . . . .	4
A. Setting up the job deck for PRISM . . . . .	4
B. Setting up the data deck for PRISM . . . . .	5
C. Interpreting PRISM runs . . . . .	6
D. Utilizing program PRINIT . . . . .	7
E. Utilizing program PRIPUN . . . . .	8
Appendix A. Flow chart for PRISM . . . . .	9
Appendix B. Source data sheet . . . . .	12
Appendix C. Sample job activity file . . . . .	13

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
DOC TAB	
Unannounced	
Justification	
By _____	
Distribution/	
Availability Codes	
Dist.	Avail and/or special
A	

## A RADIOACTIVE SOURCE ACCOUNTABILITY AND MANAGEMENT SYSTEM -- REVISED VERSION

### I. Background

As described in NRL Memorandum Report 1861 (April 1968) a radioactive source accountability and management system was designed to aid the Radiological Protection Staff by providing information necessary for the safe and prudent management of large groups of sources of ionizing radiation. The system originally consisted of six computer programs with associated subroutines written in Fortran for NRL's CDC 3800. These programs provided for: generating information files, modifying these files, recovering any lost files and generating accountability and management reports. (See the NRL Memo Report, pages 4-8, for a more complete description of the programs.)

In 1976 it was decided that a number of the reports were no longer necessary, that some should be revised, and that greater flexibility in editing data in the master source information file was necessary. These revisions were undertaken at the same time that the system was being converted to run on the TI-ASC. A revised, converted, version was completed in 1976. This system consisted of one main program (PRISM) plus associated subroutines, which provided for: modifying the existing source information file (with greater ease than in the CDC system), and generating certain accountability and management reports.

An error in the program structure was discovered during the 7/1/77 run, when the entire source information file was destroyed. To regenerate the file a separate initialization program, PRINIT, was written. Corrections were made to the program structure to ensure that the source information file would thereafter remain intact, several changes in the report formats were incorporated, and a minor error in calculating a radioactive amount was corrected. The following paragraphs describe the radioactive source accountability and management system as of January 1978.

### II. System Operation

At the present writing, the maintenance and reports programs are run quarterly by the Radiological Protection Staff. At this time, new sources are added to the source information file, information about existing sources is updated (e.g., if a source has been moved from one

Note: Manuscript submitted January 15, 1979.

location to another, or has been assigned to a new custodian), and deleted sources are removed from the file. These updates are performed by using "edit" cards, which are input to the PRISM program (see User's Manual for instructions about producing edit cards and setting up a run deck). PRISM also recalculates the current activity of each source, and prints the following reports needed by the Radiological Protection Staff.

(1) Master Source Listing

Lists all current information on every source. Sources are ordered by location (building and room number). This report is used as a general reference by the Radiological Protection Staff.

(2) Sources Deleted from the Master File

Lists the Radiological Protection serial number of sources that were deleted from the master file during this run.

(3) Authority Reports

(a) Lists sources by the licensing authority under which they are held. Also prints totals of activity, by isotope, for each authority.

(b) Prints a list of all radium sources, plus totals of activity by isotope.

(c) Prints a list of all radiation producing machines.

(4) Decayed Source Disposal List

Lists any source whose activity fell below .005  $\mu\text{Ci}$  as of this run. These sources need no longer to be accounted for and are dropped from the Master Source Listing.

(5) Custodian Reports (optional)

One report is produced for each custodian, listing basic information on each source he is responsible for.

(6) Leak Test Reports (optional)

Two reports are printed, one listing all sources that must be leak tested semi-annually, one listing sources to be tested quarterly.

### III. The Source Information File

The data base for the radioactive source accounting and maintenance system is the source information file, which consists of a record for each source of ionizing radiation for which the Lab is accountable. Each record contains all the necessary information for that source: isotopic name, location, custodian, date acquired, halflife, original amount of source when acquired, current amount, a short description, and several indicators that specify other characteristics of the source (such as when leak tests are to be made).

The source information file is maintained as a catalogued file on magnetic tape. The current version of the source information file plus the three previous versions (i.e., a year's worth of data) are saved. The original source information file (as created for the ASC version, October 1976) also exists on IBM punched cards. This card deck provides an extra back-up in case of need to regenerate the source information file. An up-to-date card deck may be punched from the current master file by using program PRIPUN.

### IV. The Computer Programs

Following is a brief description of program PRISM and its subroutines, and programs PRINT and PRIPUN. For a more detailed description of PRISM, see Appendix A.

PRISM: Controls the generation of the updated source information file and the printing of various reports. Calls subroutines to process the edit cards. Prints the Master Source Listing, along with the Source Disposal List. Calls subroutines to produce other reports. (See User's Manual sections A-C for instructions for utilizing PRISM.)

Subroutine EDIT: Processes edit cards to make changes/corrections to existing information, add new sources, and delete sources from the master file. Prints a list of sources that have been deleted during this run.

Subroutine DBDMOD: Used in calculating the current amount of activity for sources that decay. Calculates the number of days between the date of acquisition of the source and the date of this report.

Subroutine PRINT: Prints the Authority Reports -- one report for each licensing authority -- plus a list of Radium Sources and a list of Machines.

Subroutine CPRINT: Prints the Custodian Reports -- one report for each custodian of radioactive materials. This report is optional and must be asked for on an input card.

Subroutine PRINTS: Prints the Semi-annual and Quarterly Leak Test Reports. This report is optional and must be asked for on an input card.

Subroutine ASORT (with entry-points ASORT, CSORT, SORTL, and SORTED): Sorts the master file according to various specified fields (depending on entry-point). Uses external subroutines EXINP and EXOUTP.

Subroutines EXINP and EXOUTP: Used by Sort subroutine to input and output the master file.

Program PRINIT: Serves as an initialization program for PRISM. Reads in the original deck of source information cards to recreate the original source tape. To bring the recreated tape up to date, each successive deck of change cards must then be read and processed by the PRISM program. (See User's Manual section D. for instructions for utilizing PRINIT.)

Program PRIPUN: Punches a back-up card deck from the current master file. This program should probably be run once every 2 or 3 years, to keep a fairly current card deck available in the unlikely event that all the tape files are destroyed. (See User's Manual section E. for instructions for utilizing PRIPUN.)

## V. User's Manual

### A. Setting Up the Job Deck for PRISM

The job deck for the usual execution of the program is set up as follows:

```
/ JOB STONE,607201$JNS,STONJ1,OPT=(R)
/ LIMIT BAND=50,MIN=5
/ PD STONE,USERCAT/D60/B70/STONJ1/MSTRFILE
/ ASG FT15F001,STONE,USE=SHR
/ CATV USERCAT/D60/B70/STONJ1/MBACKUP,ACNM=FT15F001,DTYP=TAPE
/ FD FT16F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FD FT17F001,LREC=119,BKSZ=4760,RCFM=FB,BAND=2/10/2
/ FD FT18F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FD FT19F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ NEWFILE FT16F001
```

```

/ ASG OBJECT,USERCAT/D60/B70/STONJ1/OBJECT,USE=SHR
/ LNK
  LIBRARY OBJECT
  INCLUDE PRISM
/ FXQT RTP=(20000,1500),ADDMEM=25K,CPTIME=100000,DATA=DATA
/ START ACNM=DATA
  [ insert data deck here ]
/ STOP
/ IF TERM.NE.0,END
/ CATV STONE,ACNM=FT16F001,DTYP=TAPE
/END EOJ

```

The only cards that need to be changed for each quarter's run are the data cards.

If an error is discovered after a run has been completed (e.g., incorrect input that did not, however, cause the program to fail), the source information file can be redone by using the following alternate job deck. This deck accesses the back-up file (i.e., the previous quarter's master file) as input, and writes over the incorrect source information file.

```

/ JOB STONE,607201$JNS,STONJ1,OPT=(R)
/ LIMIT BAND=50,MIN=5
/ PD BACK,USERCAT/D60/B70/STONJ1/MBACKUP
/ ASG FT15F001,BACK,USE=SHR
/ FD FT16F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FD FT17F001,LREC=119,BKSZ=4760,RCFM=FB,BAND=2/10/2
/ FD FT18F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FD FT19F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ NEWFILE FT16F001
/ ASG OBJECT,USERCAT/D60/B70/STONJ1/OBJECT,USE=SHR
/ LNK
  LIBRARY OBJECT
  INCLUDE PRISM
/ FXQT RTP=(20000,1500),ADDMEM=25K,CPTIME=100000,DATA=DATA
/ START ACNM=DATA
  [ insert data deck here ]
/ STOP
/ IF TERM.NE.0,END
/ RPLV STONE,ACNM=FT16F001,DTYP=TAPE
/END EOJ

```

#### B. Setting Up the Data Deck for PRISM

The data cards are placed in the job deck in between the card that reads: / START ACNM=DATA and the card that reads: / STOP. The data cards must be in the following order:

Isotope cards, in alphabetical order by isotope  
Blank card  
Date and option card  
Update cards, in numerical order by sequence number  
Blank card

Isotope card format is as follows:

Col. 1-8 Isotope name  
Col. 15-16 Units

Date and option card format is as follows:

Col. 1-6 Date (format MMDDYY)  
Col. 21 1 if Custodian Report is desired, blank if not  
Col. 22 1 if Leak Test Report is desired, blank if not

Update cards are of three types (see Appendix B. for complete format): a new source to be added, a change or correction to an existing source, or a source to be deleted. For each new source, a set of three cards must be input. For a change, only the card on which the change occurs is necessary. To delete a source, the only information necessary is a "4" in col. 49 and the sequence number of the first card of the set in col. 77-80.

#### C. Interpreting PRISM runs

With the safeguards that have been added to the system, it may pretty well be assumed that as long as all the proper reports were output (i.e., Master Source Listing, Authority Reports, Custodian Reports (if requested), and Leak Test Reports (if requested)) PRISM ran normally.

However, it is also a good idea to read through the job activity file (JATF), which is printed before the program output. Appendix C is a sample JATF from a successful run, with the pertinent statements underlined. There are three main things to look for:

(1) The TERM code should always be equal to 0. A statement reading "TERM = 4." (or any other value than 0.) indicates a possible error, even though the statement says "TERMINATED NORMALLY". If this ever occurs, the program and output should probably be examined by a programming consultant. "TERM = 9." probably indicates that the job stopped while in the EDIT subroutine.

(2) Depending on how many reports were requested, there will be up to four "SORT HAS STARTED / SORT HAS ENDED" pairs. Failure

in a sort (such as happened in 7/1/77) is indicated by a statement such as "ERROR - USER HAS EXCEEDED DISC RESERVATION FOR FILE \$SORTIN" coming after "SORT HAS STARTED". This would probably mean that the run time parameters, presently specified as RTP=(20000,1500), on the FXQT statement need to be enlarged.

(3) Finally, the statement "FILE FT16F001 WAS CATALOGUED AS VERSION #0" (or VERSION # 1, 2, or 3) indicates that the updated source information file has been saved on tape. An error message such as "ACCESS NAME NOT FOUND" or "USER DOES NOT HAVE OWN ATTRIBUTE" would indicate that no file had been saved.

In the reports printed out by PRISM there are several possible error messages.

(1) The EDIT subroutine checks the sequence numbers (col. 77-80) on change and delete cards to be sure they are in ascending order. If not, it prints the message "A CARD IS OUT OF ORDER" and gives the last sequence number read. The routine then stops before printing out any reports.

(2) As PRISM calculates the new amount of radiation for items that decay, it checks to make sure any item measured in grams has a halflife of 0.0. If not, an error message ("SOURCE \_\_\_ ON FILE IS MEASURED IN GRAMS BUT HAS NON-ZERO HALFLIFE") is printed out just before the listing of that source in the Master Source Listing. The program then continues.

(3) As the Authority Reports are printed out, each item is checked against the isotope list. If the isotope name is not found, or if the unit does not match that in the isotope list, the following message is printed in the Authority List: "THE ISOTOPE \_\_\_ IN \_\_\_ FOR SERIAL NUMBER \_\_\_ IS NOT IN THE ISOTOPE LIST". The program then continues. This message could indicate a spelling error in the isotope name or unit, or it might be the result of a set of cards for a new item being input in scrambled order. (The EDIT subroutine, which reads in cards for new items does not check either the information or the order). Any time an error message is noticed in an Authority Report, that item should be checked in the Master Source Listing. A new item that was input incorrectly could be fixed by change card(s) in the next run.

#### D. Utilizing Program PRINIT

The job deck for executing the program is set up as follows:

```
/ JOB PRISMINIT,607201$JNS,STONJ1,OPT=(R)
/ LIMIT BAND=65
```

```

/ FD FT06F001,BAND=4/12/2
/ FD FT15F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FTN FTVERS=FX,FTNOPT=(M,X)
  [ program deck goes here ]
/ LNK
/ FXQT
  [ data deck goes here ]
/ IF TERM.NE.0,END
/ CATV USERCAT/D60/B70/STONJ1/MSTRFILE,ACNM=FT15F001,DTYP=TAPE
/END EOJ

```

The data deck consists of a date card followed by the master file cards. Format for the date card is as follows:

Col. 1-8 date of the master file (e.g. 070176)

The master file cards formats are given in Appendix B.

Output will be a tape containing the master file and a complete print out of the master file.

E. Utilizing program PRIPUN

The job deck for executing the program is set up as follows:

```

/ JOB PRISMPUNCH,6070201$JNS,STONJ1,OPT=(R)
/ ASG FT15F001,USERCAT/D60/B70/STONJ1/MSTRFILE,USE=SHR
/ FTN FTVERS=FX,FTNOPT=(M,D)
  [ program deck goes here ]
/ LNK
/ FD FT07F001,BAND=4/10/2
/ FXQT
/ FOSYS FT07F001,TYPE=PUNCH
/ EOJ

```

Output will be a deck of punched cards (about 1-2/3 boxes).

# APPENDIX A

## Radioactive Source Accountability and Management System (PRISM)

MAIN PROGRAM

Read in isotope  
table from cards

Read in card containing date of report  
and indicators telling whether custodian  
and/or leak test reports are desired

SUBROUTINE EDIT

Read in an  
update card

Last card? Yes

No

Read set of source information  
from master file (MF)

Sequence number match? Yes No

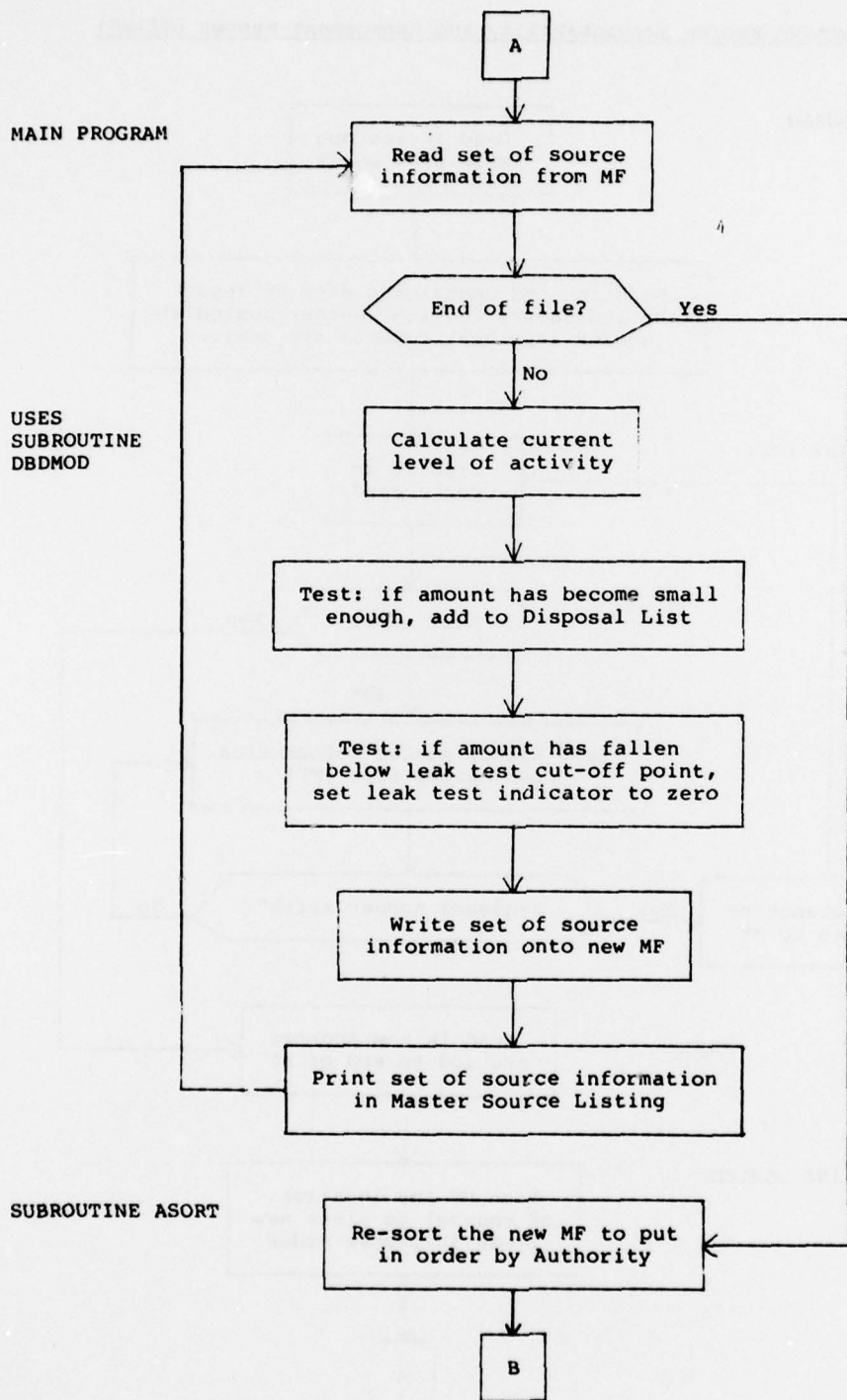
Make change or  
delete to MF

Read in new sources  
and add to end of MF

SUBROUTINE SORTED

Sort MF (by location  
of source) to place new  
items in proper order

A

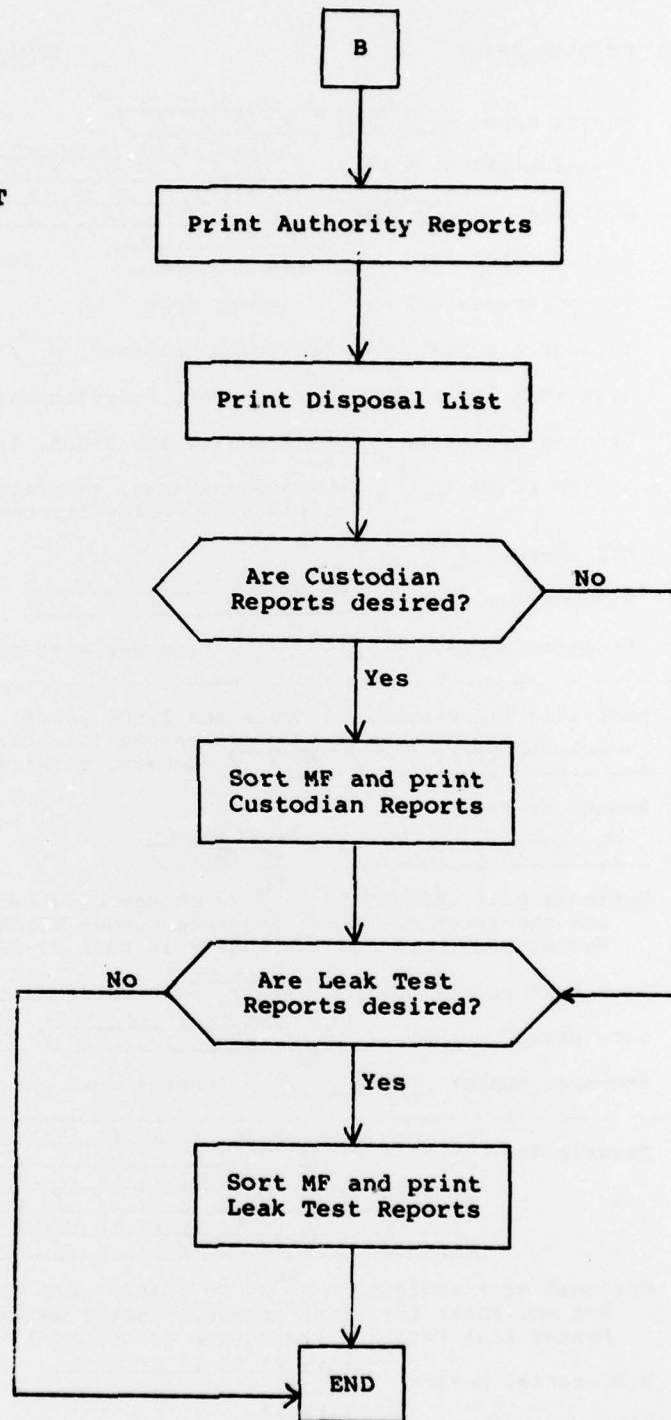


SUBROUTINE PRINT

MAIN PROGRAM

SUBROUTINES  
CSORT & CPRINT

SUBROUTINES  
SORTL & PRINTS



## APPENDIX B

SOURCE DATA SHEET

DATE \_\_\_\_\_

CARD 1

1. Source Name 

1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---
2. Location (Bldg. & Rm.) 

10	11	12	13	14	15	16	17
----	----	----	----	----	----	----	----
3. Custodian 

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
4. Source assay date 

38	39	40	41	42	43
----	----	----	----	----	----

 format MMDDYY
5. Is source sealed? 

45
----

 1=Yes, 0=No
6. Is source a radiation producing machine? 

46
----

 1=Yes, 0=No
7. Leak test indicator 

47
----

 0=None, 2=Semiannual, 4=Quarterly
8. License authority 

48
----

 1=BPM, 2=SM, 3=SNM, 4=Radium, 5=Machine
9. Action taken 

49
----

 1=Card one change, 4=Delete, 5=New source  
(See #15 & #20 below for card 2 or 3 changes)
10. RSR number 

57	58	59	60
----	----	----	----
11. H.P. serial number 

63	64	65	66	67	68	69	70
----	----	----	----	----	----	----	----
12. Sequence number 

77	78	79	80
----	----	----	----

 (number must end in column 80)

CARD 2

13. Half-life (if between 24 hours and 1,000 years)  

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

 column 10 contains unit of time:  
D=Days, Y=Years
14. Amount or rating (CI, GM, KV, MV)  

16	17	18	19	20	21	22	23	24	25	26	27	29	30
----	----	----	----	----	----	----	----	----	----	----	----	----	----
15. Optional edit indicator 

49
----

 To change card two, put "2" in this box and enter the first sequence number which appears in the Master List Data for the source in col. 77-80 (Item 18)
16. Leak test cutoff ( $\mu$ Ci) 

58	59	60
----	----	----

 (number must end in col. 60)
17. H.P. serial number 

63	64	65	66	67	68	69	70
----	----	----	----	----	----	----	----
18. Sequence number 

77	78	79	80
----	----	----	----

 (number must end in column 80)

CARD 3

19. Description 

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	
20. Optional edit indicator 

49
----

 To change card three, put "3" in this box and enter the first sequence number which appears in the Master List Data for the source in column 77-80 (Item 22)
21. H.P. serial number 

63	64	65	66	67	68	69	70
----	----	----	----	----	----	----	----
22. Sequence number 

77	78	79	80
----	----	----	----

 (number must end in column 80)



```

09:34:30 021A 0014 VERSION # 1 WAS ASSIGNED TO FILE EPFILE .
09:34:39 0442 0014 LKED TERMINATED NORMALLY. TERM = 0.
09:34:42 0000 0018 YZ= 0
09:35:02 0000 001C SORT HAS STARTED
09:35:23 0000 001C PR=12800,KB= 7169,G= 1024,M=20000, K= 6, N= 678,NM= 1500, D= 10
                    5600
09:35:24 0000 001C SORT HAS ENDED
09:35:51 0000 001C SORT HAS STARTED
09:36:03 0000 001C PR=13824,KB= 6144,G= 1024,M=20000, K= 5, N= 678,NM= 1500, D= 10
                    7648
09:36:03 0000 001C SSPT HAS ENDED
09:36:10 0000 001C SORT HAS STARTED
09:36:22 0000 001C SORT HAS ENDED
09:36:22 0000 001C PR=11776,KB= 8192,G= 1024,M=20000, K= 7, N= 678,NM= 1500, D= 11
                    5328
09:36:30 0000 001C SORT HAS STARTED
09:36:41 0000 001C RB=15872,KB= 4096,G= 1024,M=20000, K= 1, N= 678,NM= 1500, D= 6
                    7680
09:36:41 0000 001C SORT HAS ENDED
09:36:48 0000 001C STOP
09:36:48 0462 001C SYS L#30 TERMINATED NORMALLY. TERM = 0
09:36:51 0101 0021 MOUNT MY2 ,SCRATCH,L9, R,1600,JRIDE909.
09:37:29 0140 0021 FILE T16F001 IS FILE NO. 1 ON VSN 002098
09:37:29 0219 0021 FILE FT16F001 WAS CATALOGED AS VERSION # 0.
09:37:32 0338 FFFF JOB TERMINATED: NORMALLY
    
```

DEPARTMENT OF THE NAVY

NAVAL RESEARCH LABORATORY  
Washington, D.C. 20375

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, \$300  
Third Class Mail

POSTAGE AND FEES PAID  
DEPARTMENT OF THE NAVY  
D-o-D-316

