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RADIOISOTOPE INVENTORY PROGRAM

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NUCLEAR MEDICINE IS UNIQUE IN THAT THE PHARMACEUTICALS STOCKED IN THE LABORATORY'S INVENTORY ARE CONSTANTLY BEING DEPLETED BY RADIOISOTOPE DECAY WHETHER ANY OF THE MATERIAL IS USED OR NOT. THIS PRESENTS AN UNUSUAL PROBLEM IN INVENTORY CONTROL, AND ONE PARTICULARLY SUITED FOR THE USE OF A DIGITAL COMPUTER. WE HAVE DEVELOPED A SET OF PROGRAMS FOR A PROCESS CONTROL COMPUTER WHICH COMPLETELY CONTROL A GROUPS RADIOISOTOPE INVENTORY. THIS COMPUTER OPERATES IN THE 'MULTIPROGRAMMING' MODE, ALLOWING SEVERAL PROGRAMS TO BE EXECUTED CONCURRENTLY.

THE PROGRAMS ARE LOGICALLY DIVIDED INTO FOUR SECTIONS. THE FIRST LISTS ALL OF THE SHIPMENTS CURRENTLY IN THE INVENTORY WITH BOTH THE INITIAL AND CURRENT ACTIVITY AND VOLUME. CURRENT DATA IS REPORTED TO THE PRESENT DAY AND HOUR. THIS ALLOWS THE TECHNICIAN TO QUICKLY NOTE ISOTOPES FOR WHICH THE TOTAL ACTIVITY AVAILABLE REQUIRES REORDERING AND IT ALLOWS EASY ANALYSIS SINCE ALL INFORMATION IS PRESENTED ON A SINGLE PAGE.

THE SECOND PROGRAM ALLOWS THE TECHNICIAN TO LOG SHIPMENTS IN AND OUT OF THE INVENTORY SYSTEM. WHEN A SHIPMENT IS LOGGED OUT, THE COMPUTER PRODUCES A LISTING OF EACH PATIENT THAT RECEIVED A PORTION OF THE ISOTOPE SHIPMENT AND THE DATE AND ACTIVITY RECEIVED. THIS INFORMATION MAY THEN BE PERMANENTLY FILED BOTH IN THE PATIENT'S CHART AND THE ISOTOPE RECORD'S FILE.

TO CALCULATE A DOSE, THE TECHNICIAN NEED ONLY ENTER THE ISOTOPE AND THE DOSE REQUIRED AND THE PATIENT'S WEIGHT AND HOSPITAL NUMBER. THE PROGRAM FIRST DETERMINES IF THERE IS ENOUGH ISOTOPE AVAILABLE. IF NOT, THE TOTAL AMOUNT AVAILABLE IS PRINTED. IF THE TOTAL DOSE IS AVAILABLE, THE COMPUTER INFORMS THE TECHNICIAN OF THE SHIPMENT AND VOLUME TO USE. THE PHYSICIAN NEED ONLY CHECK THAT THE DOSE REQUESTED IS CORRECT. AFTER THE DOSE IS DRAWN AND GIVEN, THE TECHNICIAN USES THE FOURTH PROGRAM TO INFORM THE COMPUTER THAT THE LAST DOSE CALCULATED HAS BEEN USED. THE INVENTORY FILES ARE THEN AUTOMATICALLY UPDATED. **C E N T E R**

THIS SYSTEM OF RADIOISOTOPE INVENTORY CONTROL ALLEVIATES THE NEED OF THE TECHNICIAN MAKING AND RECORDING REPETITIVE DECAY CALCULATIONS AND INSURES THAT THE CALCULATIONS WILL BE ERROR FREE. ADDITIONALLY, RECORDS OF EACH CALCULATION AND THE ISOTOPE USAGE ARE MAINTAINED IN PRINTED FORM

A. MINIMUM MACHINE CONFIGURATION REQUIRED

1. IBM 1130 COMPUTING SYSTEM

8K IBM 1131 WITH DISK, 1442 CARD READER.

2. IBM 1800 DATA ACQUISITION AND CONTROL SYSTEM

16 K IBM 1802, 1442 CARD READ PUNCH, 1810 DISK DRIVE, 1816 PRINTER
KEYBOARD.

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B. PROGRAM OPERATION

THE RADIOISOTOPE INVENTORY PROGRAM (RIP) IS LOGICALLY DIVIDED INTO FOUR PARTS, EACH OF WHICH IS CALLED AS REQUIRED BY A CONTROL DRIVER PROGRAM.

1. RIP

THIS CONTROL PROGRAM, WHEN CALLED, READS THE ISOTOPE LIBRARY TO DETERMINE THE HALF-LIFE VALUES OF ALL CURRENTLY CATALOGUED ISOTOPES. NEXT THE SHIPMENT LIBRARY IS READ AND THE INPUT/OUTPUT UNITS DEFINED. THEN A MESSAGE IS TYPED REQUESTING THE PROGRAM SEGMENT DESIRED. AFTER THE REQUESTER ENTERS THIS DATA, THE CORRECT PROGRAM SEGMENT IS LOADED. IF THE REQUEST IS INVALID A *CALL EXIT* IS EXECUTED.

THERE ARE ALSO THREE ADDITIONAL FUNCTIONS THAT *RIP* IS CAPABLE OF PERFORMING.

THE FIRST UTILITY IS TO INITIALIZE ALL FILES WHEN THE PROGRAM IS INITIALLY LOADED. THIS IS DONE BY TYPING THE SYMBOL '='. THE PROGRAM THEN RESPONDS BY TYPING 'IF INITIALIZATION IS TO BE ACCOMPLISHED, REENTER THE LAST CHARACTER'. IF THE SYMBOL '=' IS ENTERED A SECOND TIME, INITIALIZATION WILL OCCUR.

THE SECOND UTILITY FUNCTION IS TO ADD ADDITIONAL ISOTOPES TO THE ISOTOPE LIBRARY. THIS IS ACCOMPLISHED BY ENTERING THE CHARACTER '/'. A MESSAGE IS TYPED REQUESTING THE ISOTOPE HALF-LIFE IN HOURS AND THE ISOTOPE DESCRIPTION. FOLLOWING ENTRY, THE ISOTOPE LIBRARY IS LISTED.

THE THIRD UTILITY FUNCTION IS TO LIST WITHOUT ADDITION THE ISOTOPE LIBRARY. THIS IS ACCOMPLISHED BY ENTERING THE COMMAND 'ISOTOPE'.

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2. LIST

THIS PROGRAM ALLOWS LISTING ANY OR ALL OF THE SHIPMENTS CURRENTLY IN THE INVENTORY. IT ALSO CONTAINS A UTILITY FOR CHANGING THE JULIAN DATE AT THE END OF THE YEAR.

A. LISTING OF ONE SHIPMENT.

THE PROGRAM REQUESTS ENTRY OF THE PRESENT JULIAN DATE, THE HOUR IN HOURS AND HUNDREDTHS (ADD 12 TO ALL HOURS AFTER THE NOON HOUR - FIFTEEN MINUTES AFTER ONE IS TO BE ENTERED AS 1325) AND THE SHIPMENT NUMBER (2 DIGIT BETWEEN 01 AND 32).

B. LISTING OF ALL CURRENT SHIPMENTS.

THE PROCEEDURE IS THE SAME AS ABOVE EXCEPT ENTER THE SHIPMENT NUMBER '00'.

C. UPDATING THE FILES FOR A NEW YEAR.

FIRST, GET A LISTING AT ANY HOUR FOR THE LAST DAY OF THE YEAR OF ALL SHIPMENTS. NEXT, REQUEST A LISTING OF SHIPMENT 99 (DAY AND HOUR ARE IGNORED).

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3. SHIP

THIS PROGRAM LOGS RADIOISOTOPE SHIPMENTS IN AND OUT OF THE INVENTORY. IT ALSO ALLOWS LISTING OF ALL DATA ON ANY INDIVIDUAL SHIPMENT OR ALL OF THE SHIPMENTS.

A. LOG A SHIPMENT INTO INVENTORY.

AFTER THE PROGRAM REQUESTS THE FUNCTION TO BE PERFORMED, TYPE 'IN'. THE NEXT AVAILABLE SHIPMENT WILL THEN BE PRINTED. THIS NUMBER SHOULD BE MARKED ON THE ISOTOPE CONTAINER TO ALLOW USAGE LATER. NEXT, THE PROGRAM REQUESTS ALL PERTINENT INFORMATION ON THE SHIPMENT TO BE ENTERED. AFTER THIS INFORMATION HAS BEEN ENTERED AND STORED, THE REQUESTER HAS AN OPPORTUNITY TO MAKE ADDITIONAL CHANGES TO THE INVENTORY. IF NO MORE CHANGES ARE DESIRED, THE PROGRAM TERMINATES.

B. LOG A SHIPMENT OUT OF INVENTORY.

A SHIPMENT MAY BE REMOVED FROM INVENTORY BY ENTERING THE CODE 'OUT'. THE PROGRAM WILL THEN REQUEST THE 2 DIGIT SHIPMENT NUMBER (BETWEEN 01 AND 32) WHICH SHOULD BE ENTERED. THE PROGRAM WILL PRINT THE INFORMATION ABOUT THE SHIPMENT AND THE DATA ON EACH DOSAGE USED FROM THAT SHIPMENT. THE SHIPMENT IS THEN REMOVED FROM THE INVENTORY.

C. LOG ALL SHIPMENTS OUT OF INVENTORY.

SAME AS ABOVE EXCEPT ENTER A SHIPMENT NUMBER OF '00'.

D. LIST A SHIPMENT IN INVENTORY.

THE INSTRUCTIONS ARE THE SAME AS B. ABOVE EXCEPT THAT THE INITIAL CODE IS 'LIST'.

E. LIST ALL SHIPMENTS IN INVENTORY.

THE INSTRUCTIONS ARE THE SAME AS C. ABOVE EXCEPT THAT THE INITIAL CODE IS 'LIST'.

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4. DOSE

THE DOSE PROGRAM IS CALLED ANY TIME THE REQUESTER DESIRES TO CALCULATE A RADIOISOTOPE DOSAGE. SINCE THERE IS NO UPDATING OF THE SHIPMENT FILE INFORMATION, THIS ROUTINE MAY BE USED INDEPENDENTLY OF THE INVENTORY (AS LONG AS THERE IS A SHIPMENT OF THE SPECIFIC ISOTOPE WITH SUFFICIENT ACTIVITY PRESENT IN THE INVENTORY).

UPON ENTRY, THE PROGRAM ASKS THE REQUESTER FOR SPECIFIC INFORMATION ABOUT THE DOSE TO BE CALCULATED. IT THEN CALCULATES THE DOSAGE AND SEARCHES THE INVENTORY FOR ALL SHIPMENTS OF THE ISOTOPE DESIRED, STARTING WITH THE OLDEST FIRST. IF THE SHIPMENT DOESN'T HAVE ENOUGH ACTIVITY, A MESSAGE TO THAT EFFECT IS PRINTED AND THE SEARCH IS CONTINUED. IF THE SHIPMENT DOES HAVE ENOUGH ACTIVITY, THE VOLUME REQUIRED FOR THE REQUESTED DOSAGE IS PRINTED, AND THE DOSAGE INFORMATION IS STORED IN A TEMPORARY FILE.

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5. USE

THIS PROGRAM ALLOWS UPDATING OF THE SHIPMENT FILE. WHEN ENTERED, THE PROGRAM ASKS THE REQUESTER IF THE LAST DOSAGE CALCULATED BY THE PROGRAM *DOSE* IS TO BE USED. IF THE ANSWER IS YES, THE DATA STORED IN THE TEMPORARY FILE IS USED TO UPDATE THE SHIPMENT FILE. IF THE LAST DOSAGE CALCULATED HAS ALREADY BEEN USED, THE REQUESTER IS SO INFORMED AND NO FILES UPDATE TAKES PLACE. IF THE ANSWER IS NO, THE PROGRAM REQUESTS THE PERTINENT DATA ABOUT THE DOSAGE TO BE USED AND UPDATES THE SHIPMENT FILE.

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INITIAL PROGRAM LOADING *****

THE PROGRAM IS BEING DISTRIBUTED FOR DIRECT LOADING ON AN IBM 1130 COMPUTING SYSTEM. IT HAS BEEN TESTED ON AN 8K, ONE DISK SYSTEM USING VERSION 2, MODIFICATION LEVEL 6 OF THE DISK MONITOR SYSTEM. FOR THOSE INSTALLATIONS USING AN IBM 1800, MODIFICATIONS MUST BE MADE TO THE MONITOR CONTROL CARDS. THE PROGRAMS HAVE BEEN SUCCESSFULLY RUN IN A 2.5K CORE LOAD AREA UNDER THE MPX OPERATING SYSTEM.

THE CARD DECK SHOULD BE RUN AS RECEIVED. IF LISTINGS ARE NOT DESIRED, THE *LIST SOURCE PROGRAM CARDS SHOULD BE REMOVED.

AFTER ALL CORE LOADS HAVE BEEN BUILT, THE INITIAL TESTING PROCEEDURE SHOULD BE FOLLOWED.

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1. NAME - LIBIN (LIBRARY OF SHIPMENTS)
NUMBER OF SECTORS - 1
NUMBER OF RECORDS - 32
WORDS PER RECORD - 10
RECORD STRUCTURE -

WORD(S)	DESCRIPTION	FORMAT
1	ISOTOPE CODE	INTEGER
2	JULIAN SHIPMENT DATE	INTEGER
3-4	SHIPMENT DATE ACTIVITY(MILLICURIES)	REAL
5	SHIPMENT DATE VOLUME(CC*100)	INTEGER
6	CURRENT ACTIVITY JULIAN DATE	INTEGER
7	CURRENT ACTIVITY HOUR	INTEGER
8-9	CURRENT ACTIVITY(MILLICURIES)	REAL
10	CURRENT VOLUME(CC*100)	INTEGER

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2. NAME - SHPIN (SHIPMENT DOSAGE RECORDS)
 NUMBER OF SECTORS - 11
 NUMBER OF RECORDS - 32
 WORDS PER RECORD - 105
 RECORD STRUCTURE - 1 SUB-RECORD OF 1 WORD LENGTH, 13 SUB-RECORDS
 8 WORD LENGTH.

SUB-RECORD 1

WORD(S)	DESCRIPTION	FORMAT
1	NUMBER OF NEXT SUB-RECORD -1 TO BE USED FOR SHIPMENT DOSAGES	INTEGER

SUB-RECORDS 2-14

WORD(S)	DESCRIPTION	FORMAT
1	JULIAN DOSAGE DATE	INTEGER
2	DOSAGE HOUR	INTEGER
3	HIGH ORDER 3 DIGIT PATIENT ID	INTEGER
4	LOW ORDER 3 DIGIT PATIENT ID	INTEGER
5-6	DOSAGE ACTIVITY (MILLICURIES)	REAL
7	DOSAGE VOLUME (CC*100)	INTEGER
8	NOT USED

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3. NAME

- ISOIN (DOSE CALCULATION RECORD AND ISOTOPE
LIBRARY.)

NUMBER OF SECTORS - 1
NUMBER OF RECORDS - 32
WORDS PER RECORD - 10
RECORD STRUCTURE -

RECORD 1 (DOSE CALCULATION RECORD)

WORD(S)	DESCRIPTION	FORMAT
1	SHIPMENT NUMBER	INTEGER
2	ISOTOPE CODE	INTEGER
3	JULIAN DOSAGE DAY	INTEGER
4	DOSAGE HOUR	INTEGER
5-6	DOSAGE ACTIVITY (MILLICURIES)	REAL
7	DOSAGE VOLUME (CC*100)	INTEGER
8	HIGH ORDER 3 DIGIT PATIENT ID	INTEGER
9	LOW ORDER 3 DIGIT PATIENT ID	INTEGER
10	CODE (=1, NOT USED, OTHERWISE, USED)	INTEGER

RECORDS 2-32 (ISOTOPE RECORDS)

WORD(S)	DESCRIPTION	FORMAT
1-2	ISOTOPE HALF LIFE (DAYS)	INTEGER
3-10	ISOTOPE DESCRIPTION	ALPHA

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INITIAL TESTING PROCEDURE * * * * *

1. LOAD THE PROGRAMS AS DESCRIBED UNDER INITIAL PROGRAM LOADING.
2. CHANGE THE PRINCIPAL INPUT DEVICE TO THE CONSOLE KEYBOARD BY USING A *//_TYP*_MONITOR_CONTROL_CARD.
3. MAKE INPUT ENTRIES IDENTICAL TO THOSE SHOWN ON THE NEXT PAGES (INPUT IS UNDERLINED). THE OUTPUT SHOULD BE THE SAME.
4. AFTER VERIFYING THE OUTPUT, INITIALIZE THE FILES AS DESCRIBED UNDER GENERAL DESCRIPTION, PROGRAM OPERATION, RIP.
5. ENTER THE ISOTOPE LIBRARY AS DESIRED.
6. ENTER ALL CURRENT ISOTOPE SHIPMENTS.
7. THE RADIOISOTOPE INVENTORY PROGRAM IS NOW READY FOR ROUTINE USAGE.

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// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

LIST

DATE, HOUR, SHIPMENT NUMBER(00 WILL LIST ALL)

DDHHHHSS

12103000

R A D I O I S O T O P E I N V E N T O R Y . . .

DAY = 112 HOUR= 1030

SHIP. NUMBER	ISOTOPE CODE	SHIP. DATE	INITIAL ACTIVITY	INITIAL VOLUME	CURRENT ACTIVITY	CURRENT VOLUME
1	1	110	2.0885	25.00	1.6921	25.00
2	3	111	22.9726	15.00	2.1318	15.00

ACTIVITY IN MILLICURIES, VOLUME IN CC.

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

DOSE

ISOTOPE CODE, DATE, HOURS, MILLICURIES PER KG, PAT. NO., WEIGHT

11DDDDHHHHMMM.MMMMPPPPPPWWW

011121100000.0010123456070

USE SHIPMENT 1. DOSE IS 1.03 CC, 0.0700 MILLICURIES.

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

USE

USE LAST DOSE CALCULATED - YES OR NO

YES

INVENTORY UPDATED.

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

DOSE

ISOTOPE CODE, DATE, HOURS, MILLICURIES PER KG, PAT. NO., WEIGHT

11DDDDHHHHMMM.MMMMPPPPPPWWW

011130800000.0800147852001

USE SHIPMENT 1. DOSE IS 1.27 CC, 0.0800 MILLICURIES.

██████████

██████████

██████████

██████████

██████████

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

E

USE LAST DOSE CALCULATED - YES OR NO

YES

INVENTORY UPDATED.

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

USE

USE LAST DOSE CALCULATED - YES OR NO

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

IF INITIALIZATION IS TO BE ACCOMPLISHED, REENTER LAST CHARACTER.

RADIOISOTOPE LIBRARY IS INITIALIZED.

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

ENTER ISOTOPE HALF LIFE IN HOURS, ISOTOPE DESCRIPTION

HHHHH.HHDDDDDDDDDDDDDDDDDD

00192.001-131 FORM 1

MORE ISOTOPE TO BE ENTERED - YES OR NO

YES

ENTER ISOTOPE HALF LIFE IN HOURS, ISOTOPE DESCRIPTION

HHHHH.HHDDDDDDDDDDDDDDDDDD

00192.001-131 FORM 2

MORE ISOTOPE TO BE ENTERED - YES OR NO

YES

ENTER ISOTOPE HALF LIFE IN HOURS, ISOTOPE DESCRIPTION

HHHHH.HHDDDDDDDDDDDDDDDDDD

00010.00ISOTOPE X

MORE ISOTOPE TO BE ENTERED - YES OR NO

NO

RADIOISOTOPE LIBRARY . . .

ISOTOPE CODE	HALF LIFE(HOURS)	DESCRIPTION
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1	192.00	I-131 FORM 1
2	192.00	I-131 FORM 2
3	10.00	ISOTOPE X

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

SHIP

IS SHIPMENT TO BE IN, OUT, OR LISTED.

IN

SHIPMENT NUMBER 1

ISOTOPE CODE, SHIPMENT DATE, HOURS, MILLICURIES ACTIVITY, CC VOLUME, PRESENT I

I1DDDHMMMM.MMMMCCDDDHMM

011101200002.00000251120800

ANY MORE SHIPMENTS - YES OR NO

YES

IS SHIPMENT TO BE IN, OUT, OR LISTED.

IN

SHIPMENT NUMBER 2

ISOTOPE CODE, SHIPMENT DATE, HOURS, MILLICURIES ACTIVITY, CC VOLUME, PRESENT I

I1DDDHMMMM.MMMMCCDDDHMM

031111200010.00000151120800

ANY MORE SHIPMENTS - YES OR NO

NO

LAST DOSE CALCULATED ALREADY USED

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -
LIST

DATE, HOUR, SHIPMENT NUMBER(00 WILL LIST ALL)

DDDDHHSS

13100000

R A D I O I S O T O P E I N V E N T O R Y . . .

DAY = 113 HOUR= 1000

SHIP. NUMBER	ISOTOPE CODE	SHIP. DATE	INITIAL ACTIVITY	INITIAL VOLUME	CURRENT ACTIVITY	CURRENT VOLUME
1	1	110	2.0885	25.00	1.4095	22.70
2	3	111	22.9726	15.00	0.4124	15.00

ACTIVITY IN MILLICURIES, VOLUME IN CC.

// XEQ RIP

INVENTORY PROGRAM REQUEST IS -

SHIP

IS SHIPMENT TO BE IN, OUT, OR LISTED.

LISTED

2 DIGIT SHIPMENT NUMBER

01

DAY = 113 HOUR= 1000

SHIP. NUMBER	ISOTOPE CODE	SHIP. DATE	INITIAL ACTIVITY	INITIAL VOLUME	CURRENT ACTIVITY	CURRENT VOLUME
1	1	110	2.0885	25.00	1.4095	22.70

SHIPMENT - PATIENT DATA.

DAY	HOUR	PATIENT	DOSE	VOLUME
-----	------	---------	------	--------

112	1100	123456	0.0700	1.03
-----	------	--------	--------	------

113	800	147852	0.0800	1.27
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DOSAGE IN MILLICURIES, VOLUME IN CC.

ANY MORE SHIPMENTS - YES OR NO

NO