NRC FORM 313
(10-87)
10 CFR 30, 32, 33, 34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires 6-30-90

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS. IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 47-21467-10

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip Code)*

GRAFTON CITY HOSPITAL
Highway 50 at Market Place
Grafton, West Virginia 26354

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.

Same as in 2

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Rose Stottlemyer, RT

TELEPHONE NUMBER Ext. 111
(304) 265-0400

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)*
FEE CATEGORY 7C
AMOUNT ENCLOSED $ 580.00

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN, IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948, 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

SIGNATURE–CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
John A Cosco	John A. Cosco	Administrator	10/21/88

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS	APPROVED BY
Ren	Nov-1-11	EXTC	FEE EXEMPT	
AMOUNT RECEIVED	**CHECK NUMBER**			**DATE**
$580	001747-ck returned	170.11(a)(4) Code 4		11/1/88

ITEM 5: RADIOACTIVE MATERIAL AND

ITEM 6: PURPOSE

Byproduct Material	Amount	Purpose
5a. Materials in 35.100	As needed	6a. Medical use
5b. Materials in 35.200	As needed	6b. Medical use

ITEM 7: INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

7.1 Physicians previously authorized by license number 47-21467-10.

Michael T. Hogan, M.D.
Carl C. Barger, M.D.
Timothy B. Hetzer, M.D.

7.3 Radiation Safety Officer

Timothy B. Hetzer, M.D.

ITEM 8: TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

We will establish and implement the model training program that was published in Appendix A to Regulatory Guide 10.8, Revision 2, and have appended a table ATT 8.1 that identifies groups of workers who will receive training and the method and frequency of training. See ATT. 8.1.

ITEM 9: FACILITIES AND EQUIPMENT

9.1 Annotated Drawing See ATT. 9.1.

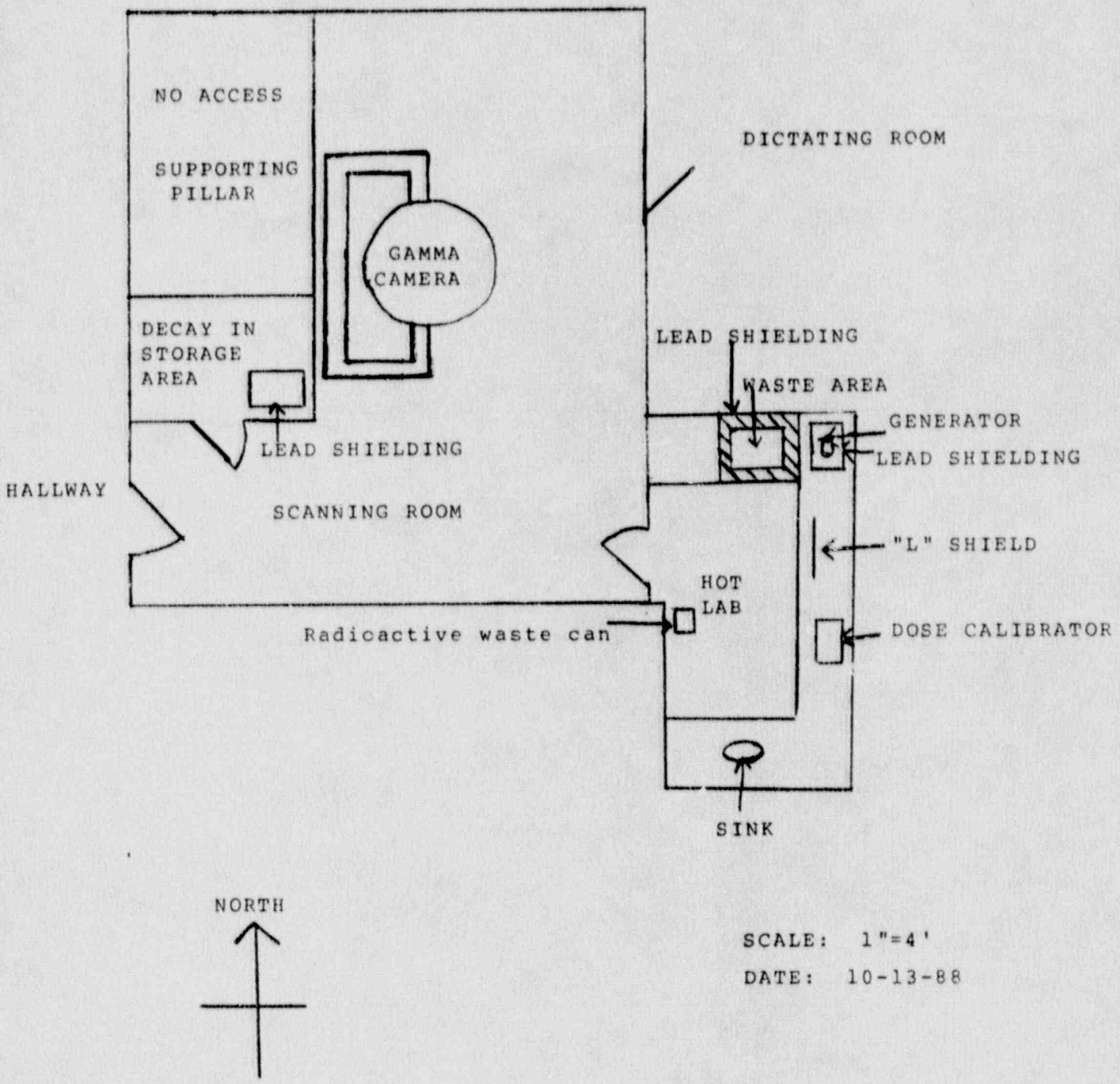
ATT. 8.1

ITEM 8: MODEL TRAINING PROGRAM

8.1 Table that identifies groups of workers who receive training, the method, and the frequency of training.

WORKERS	METHOD	FREQUENCY
Nursing, clerical, housekeeping, maintenance, X-ray technicians.	Lectures and inservice	Employees orientation and annually, thereafter, in October

ATT. 9.1



SCALE: 1"=4'

DATE: 10-13-88

ITEM 9: FACILITIES AND EQUIPMENT (cont.)

9.2 Survey Instrument Calibration: We (our Contractor) will establish and implement the model procedure for calibrating survey instruments that was published in Appendix B to Reg. Guide 10.8, Rev. 2. Contractor: Bicron Corporation, License No.34-13845-01.

9.3 Dose Calibrator Calibration: We have developed a dose calibration procedure for your review that is appended as ATT. 9.3.

9.4 Personnel Monitor Program: We will establish and implement the model personnel external exposure monitoring program published in Appendix D to Reg. Guide 10.8, Rev. 2.

9.5 NA

9.6 Other Equipment and Facilities: See ATT 9.6

ITEM 10: RADIATION SAFETY PROGRAM

10.1 Radiation Safety Committee/Radiation Safety Office: We will issue the model Radiation Safety Committee Charter and Radiation Safety Officer Delegation of Authority that was published in Reg. Guide 10.8, Rev. 2. (Appendix F - etc.)

10.2 ALARA Program: We will establish and implement the model ALARA program that was published in Appendix G to Reg. Guide 10.8, Rev. 2.

10.3 Leak Test: We have developed a leak test procedure for your review that is appended as ATT. 10.3.

10.4 Safe use of Radiopharmaceuticals: We will establish and implement the model safety rules published in Appendix I to Reg. Guide 10.8, Rev. 2.

ITEM 10: RADIATION SAFETY PROGRAM (cont.)

10.5 Spill Procedures: We have developed spill procedures for your review that are appended as ATT.10.5.

10.6 Ordering and Receiving: We will establish and implement the model guidance for ordering and receiving radioactive material that was published in Appendix K to Reg. Guide 10.8, Rev. 2.

10.7 Opening Packages: We will establish and implement the model procedure for opening packages that was published in Appendix L to Reg. Guide 10.8, Rev. 2.

10.8 Unit Dose Records: We will establish and implement the model procedure for a unit dosage record system that was published in Appendix M.1 to Reg. Guide 10.8, Rev. 2.

10.9 Multidose Vial Records: We will establish and implement the model procedure for a multidose vial record system that was published in Appendix M.2, Reg. Guide 10.8, Rev. 2.

10.10 Molybdenum Concentration Records: We have developed a procedure for measuring and recording molybdenum concentration for your review that is appended as ATT. 10.10.

10.11 Implant Source Records: NA

10.12 Area Survey Procedures: We have developed survey procedures for your review that are appended as ATT. 10.12.

10.13 Air Concentration Control:

10.13.2 We will collect spent aerosol in a shielded, disposable trap.

10.14 Radiopharmaceutical Therapy: NA

PROCEDURE FOR CALIBRATING DOSE CALIBRATOR

1. Test for the following at the indicated frequency. Consider repair, replacement, or arithmetic correction if the dose calibrator falls outside the suggested tolerances. The tolerances will never exceed ±10%, but perferably will be within the range of ±5%.

   a. Constancy at least once each day prior to the assay of patient doses.
   b. Linearity at installation and at least quarterly, thereafter.
   c. Geometry dependence at installation.
   d. Accuracy at installation or at least annually, thereafter.

2. After repair, adjustment, or relocation of the dose calibrator, repeat the above tests as appropriate.

The results of these tests will be recorded in log books and retained for 2 years.

3. DOSE CALIBRATOR CONSTANCY TEST:

Before each daily use of the instrument, a test for the constancy of operation will be performed using the Cs-137 standard. Constancy means reproducibility in measuring a constant source over a long period of time.

a. The Cs-137 cource will be assayed using the Tc-99m, I-131, and the Cs-137 settings. Background levels will be subtracted to obtain the net activity.
b. Readings obtained are recorded in an appropriate log book.
c. The activity should agree with the certified activity of the standard source within ± 10% after decay corrections. Calibration checks that are recorded and do not agree within ± 10%, indicate that the instrument should be repaired or adjusted.
d. The action levels are listed in the log book. The Radiation Safety Officer will automatically be notified if there is a suspected malfunction of the calibrator.

The dose calibrator daily constancy check will be performed using the vial type "E" ion chamber gamma reference source.

MODEL: NES-356 NUCLIDE: Cs-137

Lot/Serial No.: 3561283A-06 Content: 0.218 mCi (12-28-83)

The source will be stored in the lead storage container provided with it and stored within the lead stockade, when not in use.

Date: _____

_____

RSO (quarterly)

DOSE CALIBRATOR CHECK

DAY	TECH. INITIALS	Tc-99	I-131	Cs-137	BKG-Tc 99
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					

4. INSTRUMENT LINEARITY TEST:

Linearity means that the calibrator is able to indicate the correct activity over the range of use of that calibrator. This test is done using a vial or syringe of Tc-99m whose activity is at least as large as the maximum activity normally assayed in a prepared radiopharmaceutical kit.

a. The 99m-Tc vial will be assayed in the dose calibrator and the background level subtracted to obtain the net activity in mCis.

b. Step a will be repeated at intervals of 6, 24, 30, 48, 54, 72, and 78 hours or until the assayed activity is down to 10 microcuries.

c. Using the 30 hour activity measurment as a starting point, the decay predicted activities are calculated at 0, 6, 24, 28, 54, 72, and 78 hours using the following table:

Assay Time (hrs.)	Correction Factor
0	31.633
6	15.853
24	1.995
30	1
48	0.126
54	0.064
72	0.008
78	0.004

d. The measured net activity for each time interval versus the decay predicted activity is plotted on semi-log graph paper.

e. The activities plotted will not exceed ±10%, but perferably within ±5% of the decay predicted curve if the instrument is linear and functioning properly.

f. Errors greater than ± 10% indicate the need for repair or adjustment of the instrument.

g. If the instrument linearity cannot be corrected, it will be necessary in routine assays to either assay an aliquot of the eluate that can be accurately measured or to use the graph constructed in step d to relate measured activities to true activities (decay predicted activities).

h. Put a sticker on the dose calibrator that says when the next linearity test is due.

ATT. 9.3

Dose Calibrator Linearity Test

Manufacturer: _____

Model: _____ SN: _____

mCi	hours elapsed	date	time	assay	Prod. & assay var.
31.633	0				
15.853	6				
[illegible]	24				
0.126	48				
[illegible]	[illegible]				
.008	[illegible]				
.004	78				

46 6013

K&E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

Shield Method

If you decide to use a set of "sleeves" of various thicknesses to test for linearity, it will first be necessary to calibrate them.

a. Begin the linearity test as described in the decay method described above. After making the first assay, the sleeves can be calibrated as follows. Steps b through d below must be completed within 6 minutes.

b. Put the base and sleeve 1 in the dose calibrator with the vial. Record the sleeve number and indicated activity.

c. Remove sleeve 1 and put in sleeve 2. Record the sleeve number and indicated activity.

d. Continue for all sleeves.

e. Complete the decay method linearity test steps b through g above.

f. From the graph made in step d of the decay method, find the decay time associated with the activity indicated with sleeve 1 in place. This is the "equivalent decay time" for sleeve 1. Record that time with the data recorded in step b.

g. Find the decay time associated with the activity indicated with sleeve 2 in place. This is the "equivalent decay time" for sleeve 2. Record that time with the data recorded in step c.

h. Continue for all sleeves.

i. The table of sleeve numbers and equivalent decay times constitutes the calibration of the sleeve set.

The sleeve set may now be used to test dose calibrators for linearity.

a. Assay the Tc-99m syringe or vial in the dose calibrator, and subtract background to obtain the net activity in millicuries. Record the net activity.

b. Steps c through e below must be completed within 6 minutes.

c. Put the base and sleeve 1 in the dose calibrator with the vial. Record the sleeve number and indicated activity.

d. Remove sleeve 1 and put in sleeve 2. Record the sleeve number and indicated activity.

e. Continue for all sleeves.

f. On a sheet of semilog graph paper or on a copy of the sample form in Exhibit 8, label the logarithmic vertical axis in millicuries, and label the linear horizontal axis in hours elapsed. At the tip of the graph, note the date, and the model number and serial number of the dose calibrator.

g. Plot the data using the equivalent decay time associated with each sleeve.

h. Draw a "best fit" straight line through the data points. For the point farthest from the line, calculate its deviation from the value of the line.

(A-observed - A-line)/A-line = deviation.

i. If the worst deviation is more than $\pm$0.10, the dose calibrator should be repaired or adjusted. If this cannot be done, it will be necessary to make a correction table or graph that will allow you to convert from activity indicated by the dose calibrator to "true activity."

j. Put a sticker on the dose calibrator that says when the next linearity test is due.

5. Geometry independence means that the indicated activity does not change with volume or configuration. This test should be done using a syringe that is normally used for injections. Licensees who use generators and radiopharmaceutical kits should also do the test using a vial similar in size, shape, and construction to the radiopharmaceutical kit vials normally used. The following test assumes injections are done with 3-cc plastic syringes and that radiopharmaceutical kits are made in 30-cc glass vials. If you do not use these, change the procedure so that your syringes and vials are tested throughout the range of volumes commonly used.

   a. In a small beaker or vial, mix 2 cc of a solution of Tc-99m with an activity concentration between 1 and 10 mCi/ml. Set out a second small beaker or vial with nonradioactive saline. You may also use tap water.
   b. Draw 0.5 cc of the Tc-99m solution into the syringe and assay it. Record the volume and millicuries indicated on the Dose calibrator Geometry and Accuracy Form.
   c. Remove the syringe from the calibrator, draw an additional 0.5 cc of nonradioactive saline or tap water, and assay again. Record the volume and millicuries indicated.
   d. Repeat the process until you have assayed a 2.0-cc volume.
   e. Select as a standard the volume closest to that normally used for injections. For all the other volumes, divide the standard millicuries by the millicuries indicated for each volume. The quotient is a volume correction factor. Alternatively, you may graph the date and draw horizontal 10 percent error lines above and below the chosen 'standard volume."
   f. If any correction factors are greater than 1.05 or less than 0.95, or any data points lie outside the 10 percent error lines, it will be necessary to make a correction table or graph that will allow you to convert from "indicated activity" to

"true activity." If this is necessary, be sure to label the table or graph "syringe geometry dependence," and note the date of the test and the model number and serial number of the calibrator.

g. To test the geometry dependence for a 30-cc glass vial, draw 1.0 cc of the Tc-99m solution into a syringe and then inject it into the vial. Assay the vial. Record the volume and millicuries indicated.

h. Remove the vial from the calibrator and, using a clean syringe, inject 2.0 cc of nonradioactive saline or tap water, and assay again. Record the volume and millicuries indicated.

i. Repeat the process until you have assayed a 19.0-cc volume. The entire process must be completed within 10 minutes.

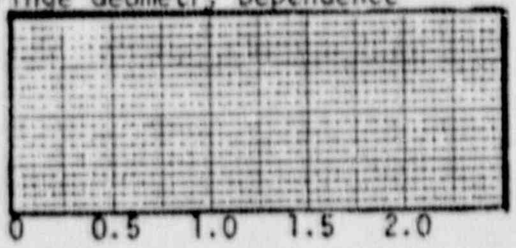
j. Select as a standard the volume closest to that normally used for mixing radiopharmaceutical kits. For all the other volumes, divide the standard millicuires by the millicuries indicated for each volume. The quotient is a volume correction factor. Alternatively, you may graph the data and draw horizontal 10 percent error lines above and below the chosen "standard volume."

k. If any correction factors are greater than 1.05 or less than 0.95 or if any data points lie outside the 10 percent error lines, it will be necessary to make a correction table or graph that will allow you be convert from "indicated activity" to "true activity." If this is necessary, be sure to label the table or graph "vial geometry dependence," and note the date of the test and the model number and serial number of the calibrator.

Dose Calibrator Geometry and Accuracy

Manufacturer:____________________ Model:________________ SN:__________

Syringe Geometry Dependence



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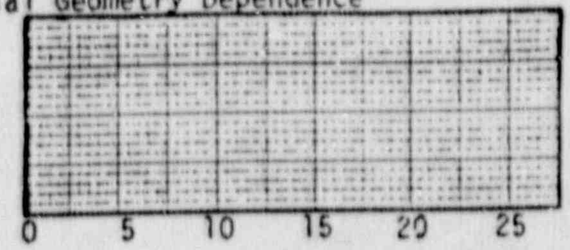
Vial Geometry Dependence



__ __ __ __ __ __ __ __

__ __ __ __ __ __

Date:__________ By:____________________ RSO:______________________

Accuracy Sources	19___	19___
______mCi of ______ Model:____________ SN:______________ Calibration date: ________________	first assay:______mCi second assay:______mCi third assay:______mCi average:______mCi ______mCi dev:______	first assay:______mCi second assay:______mCi third assay:______mCi average:______mCi ______mCi dev:______
______mCi of ______ Model:____________ SN:______________ Calibration date: ________________	first assay:______mCi second assay:______mCi third assay:______mCi average:______mCi ______mCi dev:______	first assay:______mCi second assay:______mCi third assay:______mCi average:______mCi ______mCi dev:______
______mCi of ______ Model:____________ SN:______________ Calibration date: ________________	first assay:______mCi second assay:______mCi third assay:______mCi average:______mCi ______mCi dev:______	first assay:______mCi second assay:______mCi third assay:______mCi average:______mCi ______mCi dev:______

Name: ____________________ ____________________

Date: __________ __________

7. Accuracy means that, for a given calibrated reference source, the indicated millicurie value is equal to the millicurie value determined by the National Bureau of Standards or by the supplier who has compared that source to a source that was calibrated by the NBS. Certified sources are available from the NBS and from many radioisotope suppliers. At least two sources with different principal photon energies should be used. The regulations require that one must have a principal photon energy between 100 keV and 500 keV. The regulations also require that, if a Ra-226 source is used, it must be at least 10 microcuries; other sources must be at least 50 microcuries. Consider using at least one reference source whose activity is within the range of activities normally assayed.

   a. Assay a calibrated reference source at the appropriate setting and then remove the source and measure background. Subtract background from the indicated activity to obtain the net activity. Record this measurement on the Dose Calibrator Geometry and Accuracy Form. Repeat for a total of three determinations.
   b. Average the three determinations. The average value will not exceed ±10%, but perferably ±5% of the certified activity of the reference source, mathematically corrected for decay.
   c. Repeat the procedure for other calibrated reference sources.
   d. If the average value does not agree, within 10 percent, with the certified value of the reference source, the dose calibrator may need to be repaired or adjusted. The regulation requires repair or replacement if the error exceeds 10 percent.

e. At the same time the accuracy test is done, assay the source that will be used for the daily constancy test on all commonly used radioisotope settings. Record the settings and indicated millicurie values with the accuracy data.

f. Put a sticker on the dose calibrator that says when the next accuracy test is due.

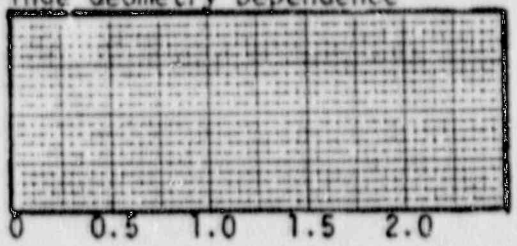
7. The RSO will review and sign the records of all geometry, linearity and accuracy tests.

ATT. 9.3

Dose Calibrator Geometry and Accuracy

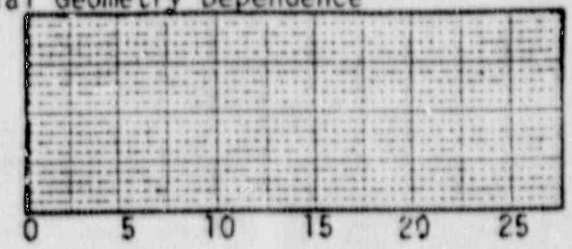
Manufacturer:__________________ Model:_______________ SN:__________

Syringe Geometry Dependence



___ ___ ___ ___

Vial Geometry Dependence



___ ___ ___ ___ ___ ___ ___ ___

___ ___ ___ ___ ___ ___

Date:_________ By:__________________ RSO:_____________________

Accuracy Sources	19___	19___
_____mCi of _____ Model:_________ SN:___________ Calibration date: ____________	first assay:_____mCi second assay:_____mCi third assay:_____mCi average:_____mCi _____mCi dev:_____	first assay:_____mCi second assay:_____mCi third assay:_____mCi average:_____mCi _____mCi dev:_____
_____mCi of _____ Model:_________ SN:___________ Calibration date: ____________	first assay:_____mCi second assay:_____mCi third assay:_____mCi average:_____mCi _____mCi dev:_____	first assay:_____mCi second assay:_____mCi third assay:_____mCi average:_____mCi _____mCi dev:_____
_____mCi of _____ Model:_________ SN:___________ Calibration date: ____________	first assay:_____mCi second assay:_____mCi third assay:_____mCi average:_____mCi _____mCi dev:_____	first assay:_____mCi second assay:_____mCi third assay:_____mCi average:_____mCi _____mCi dev:_____

Name: __________________ __________________

Date: __________ __________

FACILITIES AND EQUIPMENT

The hot lab is located in a room separate from the scanning room. When a generator is received it is immediately taken to the hot lab where it is inspected and surveyed, then placed in a lead shield. All radionuclides received by the department will be immediately stored in the hot lab.

To enable personnel to work safely with unsealed radioactive materials the nuclear medicine department must have the proper radiation handling equipment. The following is a list of basic radiation handling equipment available to ensure personnel safety.

Equipment (shielding)
- --lead syringe holders for transporting syringes containing radioactivity
- --lead syringe shields for reducing exposure during injection of radiopharmaceuticals
- --lead vial and container shields (pigs) for reducing exposure during transport and storage of vials, etc. that contain radioactivity
- --area enclosed by lead bricks for storage of radioactivity

Remote Handling
- --remote handling tools

Contamination Control
- --disposable gloves
- --absorbent pads (absorbent layer backed by non-absorbent plastic material) for covering work surfaces
- --decontaminating agents--special agents commercially available for decontaminating hands, utensils, work areas, etc.
- --signs and labels indicating the presence of radioactive materials in areas or rooms where they are being used or stored. Labels on containers indicating radionuclide activity and date. Labels indicating where airborne radionuclides are being used.

Radioactive Waste Storage
- --lead shielded "hot trash" can
- --locked, inaccessible, radioactive waste storage area

Preparation and Administration of Radiopharmaceuticals

All radiopharmaceuticals are to be prepared in the HOT LAB ONLY. Preparation must be done only on the areas covered by absorbent plastic backed pads. After the radiopharmaceuticals are prepared, they are to be labeled as to type, activity, date, and time of preparation and stored in lead pigs. The lead pig must also be labeled with a proper radioactive materials label.

All radiopharmaceuticals are to be prepared according to manufacturer's instructions.

All refrigerated materials are to be stored in the refrigerator in lead pigs.

All injection of radiopharaceuticals is to be done only by those persons being approved by the hospital.

ATT. 9.6

REF: NRC 3131 - Item 11

FACILITIES AND EQUIPMENT

Generator Shielding

The generator is shielded on the rear by a wall of standard size lead bricks (each 2" thick X 4" wide X 8" long) or equivalent. This wall is three (3) bricks (12") high and two (2) bricks (16") long. Immediately adjoining both sides of this rear wall are side walls of lead bricks of the same dimensions as the rear wall. The front of the generator area is shielded by an upright Protective Lead Barrier 15" high X 15" wide X 1/2" thick, to prevent direct exposure to personnel eluting the generator. The generator area location on the hot lab work bench is shown on the facility sketch.

Storage and Waste Area Shielding:

The active storage/waste area is shielded on all four (4) sides by standard size lead bricks or equivalent, as described above for the generator area shielding, except that a front lead brick wall may be substituted for the protective lead barrier. This storage area is located on the hot lab area work bench as shown on the facility sketch. We do not anticipate the use of many long-lived radionuclides and the short-lived waste compartment contents can be more frequently surveyed for disposal to avoid waste accumulation or the need for any other radioactive storage or waste areas.

Dose Preparation Area:

The dose preparation area on the hot lab area work bench as shown on the facility sketch, is shielded in the front by an upright Protective Lead Barrier (15" X 15" X 1/2" thick) or equivalent. Disposable gloves, remote handling forceps (3" to 8" long), survey meters, plastic backed absorbent pads and all other ancillary supplies mentioned in NRC Regulatory Guide 10.8, dated October 1980, will also be on hand in this hot lab area.

These are approximate shielding descriptions which may be changed as needed by the Radiation Safety Officer to assure ALARA exposure levels.

Facilities and Equipment

The shielding requirements for the rooms used in the nuclear medicine department are felt to be adequate due to the small workload and low activity and energies of radioactivity that is used.

Adequate distances are kept between technologist and patient being scanned or imaged.

ATT. 10.3

SEALED SOURCE TEST FOR LEAKAGE

1. The sealed source (see attached sheet for required information) will be tested for leakage before its first use and in intervals of six months.
2. Wipes were obtained from Medical Physics Service through Mallinckrodt, Inc. These wipes will be dampened and wiped over the surface of the sealed source. The wipe will be mailed to Medical Physics Service, Raymond L. Kaczur, B.S., 2722 Penn Ave., Pittsburg, PA. 15222 to be assayed.
3. If the leakage test reveals the presence of .005 uCi or more of removable contamination, the sealed source will be immediately removed from use and stored.
4. A report will be filed within five days to the NRC in Atlanta, and a copy to Director, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555 describing the equipment involved, the test results, and the action taken.

Revised 10-4-88

CERTIFICATE OF RADIOACTIVITY CALIBRATION

Cesium-137 Reference Source – NES-356

Half-Life: 30.0 ± 0.2 years

The cesium-137 activity was determined to be 218 microcuries on 12/27/83
for Source Serial Number 3561283A-06

DESCRIPTION OF THE SOURCE – The activity is uniformly distributed in a cast epoxy matrix equivalent to 20 milliliters of solution in a 27 milliliter polyethylene vial.

DECAY SCHEME – **Principle Emissions**

ENERGY (MeV)	X-ray 0.0318	X-ray 0.0322	X-ray 0.0364	0.6616
INTENSITY (%)	2.0	3.7	1.34	85.0

Reference: *A Handbook of Radioactivity Measurements Procedures,* NCRP Report No. 58, November 1978.

METHOD OF CALIBRATION – The source was calibrated by direct measurement with an ionization chamber whose response for the radionuclide and geometry had been verified through the use of a secondary standard. The secondary standard was prepared gravimetrically from a solution whose activity was determined by direct comparison to an NBS certified solution, SRM 4233.

New England Nuclear participates in a National Bureau of Standards-Atomic Industrial Forum measurement assurance program in order to insure the continuing traceability of NEN's radioassays to NBS.

RADIOIMPURITIES – The solution from which this reference source was prepared was examined for photon-emitting impurities with a Ge(Li) spectrometer system. The radioimpurities were determined to be <1% expressed as a percentage of the gamma-ray-emission rate of the 661.6 keV gamma ray of cesium-137.

ERRORS

Random Errors (99% confidence level)	
Precision of the measurement of the source	± 0.6%
Precision of the measurement of the NEN secondary standard	± 0.6%
Systematic Errors	
Accuracy of the NEN secondary standard (linear sum of the estimated upper limits of errors involved in preparation).	± 3.2%
Overall Error	
$[(0.6)^2 + (0.6)^2]^{1/2} + 3.2 = \pm 4.0\%$	±4.0%

THIS VIAL "E" REFERENCE SOURCE IS LICENSED BY THE U.S. NUCLEAR REGULATORY COMMISSION PURSUANT TO 10 CFR 32.74 FOR DISTRIBUTION TO PERSONS LICENSED PURSUANT TO 10 CFR 35.14 OR EQUIVALENT AGREEMENT STATE LICENSE.

NEN New England Nuclear
601 Treble Cove Rd., North Billerica, MA 01862
CALL TOLL-FREE 800-225-1572 Telex: 94-7126
(In Massachusetts and International 617-667-9531)

Trevor Cooke

MINOR SPILLS OF LIQUIDS AND SOLIDS:

1. Notify persons in the area that a spill has occured.
2. Prevent the spread of contamination by covering the spill with absorbent paper.
3. Clean up the spill using disposable gloves and absorbent paper. Carefully fold the absorbent paper with the clean side out and place in a plastic bag for transfer to a radioactive waste container. Also, put contaminated gloves and any other contaminated disposable material in this bag.
4. Survey the area with a low range radiation detector survey meter. Check the area around the spill. Also, check your hands, clothing, and shoes for contamination.
5. Report the incident to the Radiation Safety Officer.
6. The RSO will follow up on the cleanup of the spill. The nuclear medicine technician will complete the Radioactive Spill Report and the Radioactive Spill Contamination Survey.

MAJOR SPILLS OF LIQUIDS AND SOLIDS:

1. Clear the area. Notify all persons not involved in the spill to vacate the room.
2. Prevent the spread of contamination by covering the spill with absorbent paper, but do not attempt to clean it up. To prevent the spread of contamination, limit the movement of all people who may be contaminated.
3. Shield the source if possible. This should be done only if it can be done without further contamination or a significant increase in radiation exposure.

4. Close the room and lock or otherwise secure the area to prevent entry.
5. Notify the RSO immediately.
6. Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water and then washing with mild soap. If contamination remains, induce perspiration by covering the area with plastic. Then wash the affected area again to remove any contamination that was released by perspiration.
7. The RSO will supervise the cleanup of the spill and will complete the Radioactive Spill Report and the Radioactive Spill Contamination Survey.

Radioactive Spill Report

The spill occurred at ___:___ am / pm on ___-___-___ room ____.

Instrument used to check for personnel contamination:
Meter model: _____ Meter S/N: _____ Probe model: ____ Probe S/N: _____

Personnel present	Personnel contamination results*
_____	_____
_____	_____
_____	_____
_____	_____

*On the back of the sheet, indicate any personnel decontamination, additional monitoring, or care instituted.

Survey the spill area to identify hot spots, then begin decontamination. When finished, conduct a postcleaning contamination wipe-test.

Radioisotopes present or suspected in the spill:

_____mCi of _____ as _____

_____mCi of _____ as _____

_____mCi of _____ as _____

Give a brief description of the accident: _____

_____

_____

_____

_____

Give a brief description of followup actions taken to prevent recurrence:

_____

_____

_____

Name: _____
Date: _____

Radioactive Spill Contamination Survey

The spill occurred at ___:___ am pm on ___-___-___ in room _____. Decontamination completed at ___:___ am pm.

loc	pre-clean mR/hr	post-clean mR/hr	post-clean dpm/100cm^2

Name: _____

MOLYBDENUM-99 BREAKTHROUGH TEST

The allowable level of Molybdenum-99 contamination is not more than 0.15 microcuries per millicuries of Technetium at the time of administration. (Within six hours of elution from generator.) The assay procedure is carried out by taking a reading of the days elution of Technetium-99m using the Cal/Rad II dose calibrator.

PROCEDURE:

1. Switch to the 99-Mo setting on the dial. Make sure there are no radioisotopes near the calibrator.
2. Insert elution vial into the 99-Mo shield and insert shield into the chamber and obtain reading.
3. Set calibrator back to normal range, remove the generator elution vial from the chamber and read and record the amount of 99m-Tc.
4. The reading obtained is the amount of 99-Mo (mCi) per the amount of 99m-Tc (mCi) in the elution vial.
5. To obtain the amount of 99-Mo (mCi) per mCi of 99m-Tc, divide the amount of 99m-Tc (in vial) into the amount of 99-Mo present.
6. The answer obtained is the amount of 99-Mo in millicuries. Multiply this answer by 1000 to obtain the amount of Mo-99 in microcuries per millicuries of Tc-99.
7. The manufacturer was contacted. No correction factor is needed with this model.

The NRC will be notified in case of excessive Mo-99 concentration. This would indicate a manufacturing defect. The records obtained will be retained in an appropriate log book.

Revised: 9/13/88

ATT. 10.10

MOLYBDENUM BREAKTHROUGH

DATE / TIME	99m-Tc Activity (mCi)	99-Mo (99mTe with shield)	$\frac{\text{99-Mo}}{\text{99m-Tc}}$ Impurity = X 1000	Ratio Mo-Tc	INITIA

TRIGGER LEVEL: .15 uCi of Mo-99 per 1 mCi of Tc-99m

ATT. 10.12

GRAFTON CITY HOSPITAL
NUCLEAR MEDICINE DEPARTMENT

PROCEDURE FOR ROOM SURVEY CONTAMINATION CHECK

1. It is the responsibility of the nuclear technologist to insure the performance of this test and to maintain records of it's performance.

2. All radiopharmaceutical elution, preparation and administrative areas will be surveyed at the end of each day the department is in use. The test will be done using a Bicron 2000 survey meter. Readings will be taken on a scale of 0.1 mR/hr.

3. The test will consist of:

   A. Battery check

   B. Readings taken at the following defined areas;

      Area 1 - Background data, located in the hallway adjacent to the nuclear medicine room.

      Area 2 - Background data, center of scanning room

      Area 3 - Camera

      Area 4 - Scanning cot

      Area 5 - Hot lab, storage area (1 meter)

      Area 6 - Hot lab, generator (1 meter)

      Area 7 - Hot lab, preparation area (1 meter)

      Area 8 - Hot lab, sink (1 meter)

      Area 9 - Radioactive waste can

      Area 10 - Nonradioactive waste can

      Area 11 - Area outside of used generator storage

      Area 12 - Consoles

      Area 13 - Hot lab, dose calibrator

      Area 14 - Background data, center of hot lab.

4. Readings in excess of 2.0 mR/hr at 1 meter in nuclear storage area and 0.1 mR/hr in the other areas of the Nuclear Medicine Department will require that corrective action be taken. The area will, then, be resurveyed and the findings documented.

5. Weekly, wipe test will be done, to verify the absence or presence of removable radioactive contamination in the hot lab.

6. Wipe test will be performed using a wetted Q tip that will be wiped over 20 cm X 60 cm area. Wipe tests performed in "high background" areas will be removed to "low background" areas for measurement.

7. Readings will be taken with the Bicron 2000 survey meter set at .1 mR/hr., using the cpm scale. This will be converted to dpm using the following formula:
(Regulatory Guide, 10.8, rev. Aug'87 N-2, para 2)

BICRON SURVEYOR, 2000 (serial A7028)

Above BG Net Count rate (mR/hr)		DPM
0.01	12.0 cpm	$0.43 \times 10^3 = 430$
0.02	24.0 cpm	$0.87 \times 10^3 = 870$
0.03	35.0 cpm	$1.3 \times 10^3 = 1300$
0.04	48.0 cpm	$1.7 \times 10^3 = 1700$
0.05	60.0 cpm	$2.2 \times 10^3 = 2200$
0.06	72.0 cpm	$2.6 \times 10^3 = 2600$
0.07	84.0 cpm	$3.0 \times 10^3 = 3070$
0.08	96.0 cpm	$3.5 \times 10^3 = 3500$
0.09	108.0 cpm	$3.9 \times 10^3 = 3900$
0.10	120.0 cpm	$4.3 \times 10^3 = 4300$
0.20	240.0 cpm	$8.7 \times 10^3 = 8700$
0.30	360.0 cpm	$1.3 \times 10^4 = 13000$
0.40	480.0 cpm	$1.7 \times 10^4 = 17000$
0.50	600.0 cpm	$2.2 \times 10^4 = 22000$
0.60	720.0 cpm	$2.6 \times 10^4 = 26000$
0.70	840.0 cpm	$3.0 \times 10^4 = 30000$
0.80	960.0 cpm	$3.5 \times 10^4 = 35000$
0.90	1080.0 cpm	$3.9 \times 10^4 = 39000$
1.00	1200.0 cpm	$4.3 \times 10^4 = 43000$

ARE HOSP.
Wise, VA
May 13, 1988

Example: Activity - Background = Actual activity
BG = .02mR/hr
wipe = .09mR/hr Net = .09 - .02 = .07mR/hr

.07mR/hr = 3.0×10^3 dpm
area wiped = 20cm X 60cm = $1200cm^2$ = 12 X $100cm^2$

$$\frac{3.0 \times 10^3 dpm}{12 \times 100cm^2} = \frac{3000}{12} = \frac{250\ dpm}{100\ cm^2}$$

Decontaminate to $\frac{200dpm}{100cpm^2}$

8. Wipe test will be performed in the following defined areas:

   Area 5 - Hot lab, storage area
   Area 7 - Hot lab, dose preparation area
   Area 8 - Hot lab, sink
   Area 9 - Radioactive waste can (surface)
   Area 13 - Hot lab, dose calibrator

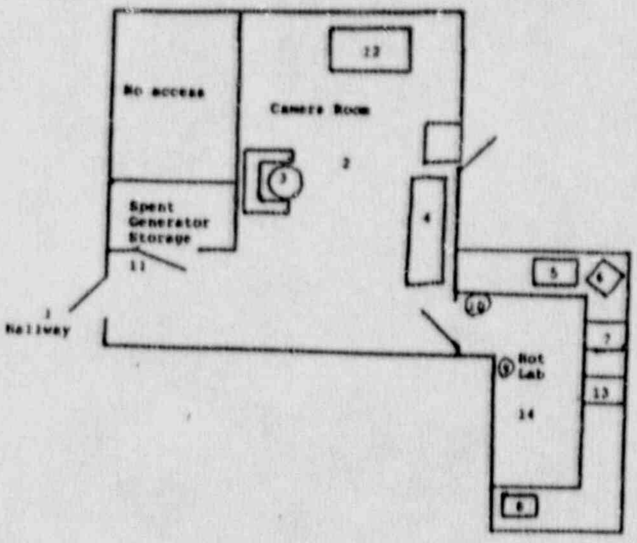
9. Readings in excess of 200 dpm/100 cm^2 over background will require that corrective action be taken, then, the area resurveyed and the findings documented.

10. The signature of the Radiation Safety Officer will be recorded monthly and upon corrective action.

11. Records of these surveys will be retained for 2 years.

DAILY
Radiation Survey for the
month of____________________

Instrument: BICRON 2000 Survey Meter



mR/hr at location

	date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Int.
mR/hr	trigger	.1	.1	.1	.1	5	5	5	5	5	.1	.1	.1	5	.1	

ATT. 10:12

GRAFTON CITY HOSPITAL
NUCLEAR MEDICINE DEPARTMENT
WEEKLY
CONTAMINATION SURVEY REPORT

Nuclides commonly used:

$^{99}Mo/^{99m}Tc$, ^{131}I, ^{137}Cs

Survey Instruments Used:

Room: Bicron 2000 Survey Meter

Swipe Tests: Bicron 2000 Survey Meter with conversion chart to dpm

Action Levels: Room Exposure Rate Surveys: 5 mR/hr nuclide storage

.1 mR/hr other areas

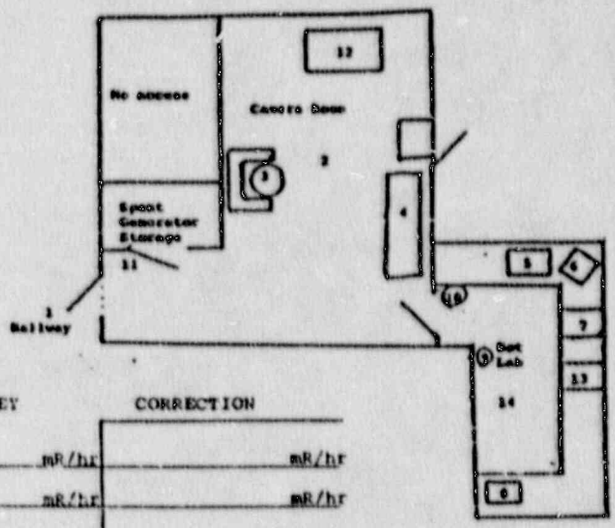
Removable Contamination Swipes: 200 dpm above background

CORRECTIONS: In case of excessive exposure rates/contamination, actions taken and follow up levels will be documented.

Date_____

BKG_____mR/hr

_____dpm



		ROOM SURVEY	CORRECTION
1.	Background Data (hallway)	mR/hr	mR/hr
2.	Background Data (scanning room)	mR/hr	mR/hr
3.	Camera	mR/hr	mR/hr
4.	Scanning cot	mR/hr	mR/hr
5.	Hot lab, storage area	mR/hr	mR/hr
		dpm	dpm
6.	Hot lab, generator	mR/hr	mR/hr
7.	Hot lab, preparation area	mR/hr	mR/hr
		dpm	dpm
8.	Hot lab, sink	mR/hr	mR/hr
		dpm	dpm
9.	Radioactive waste can	mR/hr	mR/hr
		dpm	dpm
10.	Nonradioactive waste can	mR/hr	mR/hr
11.	Area outside of used generator storage area	mR/hr	mR/hr
12.	Consols	mR/hr	mR/hr
13.	Hot lab, dose calibrator	mR/hr	mR/hr
		dpm	dpm
14.	Background Data (center of hot lab)	mR/hr	mR/hr

_____
Technician

_____
RSO

Monthly and upon action

ITEM 10: RADIATION SAFETY PROGRAM (cont.)

10.15 Implant Therapy: NA

10.16 Other Safety Procedures: NA

ITEM 11: WASTE MANAGEMENT

We have developed a procedure for waste disposal for your review that is appended as ATT 11.1.

WASTE DISPOSAL PROCEDURES

General Guidance:

1. All radioactive labels must be defaced or removed from containers and packages prior to disposal in in-house waste.
2. Nonradioactive waste, such as reagents, boxes, and packing materials, will not be mixed with radioactive trash.
3. All procedures are occasionally monitered to ensure that radioactive waste is not created unnecessarily. All new procedures are reviewed to ensure that waste is handled in a manner consistent with established procedure.

Procedure for disposal by decay in storage (DIS)

Short lived material (physical half life less than 65 days) may be disposed by DIS. The material is separated according to half life.

1. Separate containers are used for different kinds of waste, e.g., capped needles and syringes in one container, other injection paraphernalia such as swabs and guaze in another container, and unused dosages in a third. They are placed within the lead stockade to decay, then to a lead lined trash can.
2. When it becomes full, the material is placed within another container, sealed with string or tape and an identification tag is attached that includes the date sealed and the initials of the person sealing the container. The container is then transferred to the DIS area and covered with a lead apron.
3. The material is decayed for at least 10 half lives.
4. Prior to the disposal as in-house waste, each container is monitored as follows:
   a. The radiation detection survey meter is checked for proper operation.
   b. The container is monitored in a low-level area.

c. Any shielding is removed from around the container.

d. All surfaces of each individual container are monitored.

e. Only those containers that cannot be distinguished from background are discarded as in-house waste. The others are returned to the DIS area.

f. The date on which the container was sealed, the disposal date, the type of material, the survey instrument used, the background, the dose rate measured at the surface of the container and the name of the person who performed the disposal will be recorded and records will be kept for 2 years.

Procedure for returning generators to the manufacturer.

Used Mo-99/Tc-99m generators are returned to the manufacturer two weeks after the expiration date.

1. The records demonstrate that the package qualifies as a DOT specification 7A container.
2. The package is labelled, and the shipping papers are completed in accordance with the manufacture's instructions.
3. The dose rate measurements are performed per instructions.
4. A courier returns the package to the manufacturer.

SURVEY INSTRUMENT: Bicron 2000 Survey Meter

CONTAMINATED TRASH REPORT

DATE WASTE WAS SEALED	TYPES OF MATERIAL WITHIN TRASH	SURVEY METER READING	BG	DATE OF DISPOSAL IN NORMAL TRASH	TECH.

ATT 11.1

GENERATOR DISPOSAL

DATE	NO.	DISPOSITION	Int.