



McLAREN GENERAL HOSPITAL, INC.

Gary R. Peterson  
President

September 19, 1985

Materials Licensing Section  
U. S. Nuclear Regulatory Commission  
Region III  
799 Roosevelt Road  
Glen Ellyn, Illinois 60137

Reference: License No. 21-04171-04  
Additional Information to Amendment No. 30

Gentlemen:

Enclosed please find information pertaining to the close-out survey of our temporary Nuclear Medicine Department site on the fifth floor of our hospital.

The area surveys were analyzed with an "open window" low level Geiger survey meter. The area wipe tests were analyzed by our health physics consultants using a windowless proportional counter and a sodium iodide scintillation counter. Area survey results and equipment information are given in Attachment 1. Wipe test results and equipment information are given in Attachment 2.

Any questions about this matter may be directed to Lawrence Irish, M.D., R.S.O. at (313) 762-2209 or Mr. Gerald Wicks, Consulting Health Physicist at (312) 564-3330.

Sincerely,

*Lawrence R. Irish, M.D.*  
Lawrence R. Irish, M.D.

LRI:ml  
Enc: 2

RECEIVED

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## EXIT WIFE SURVEY RECORD

HOSPITAL MCLAREN GENERALDATE: 8-30-85

Monitor Dose preparation, Generator, Room #1 (LFOV), Room #2 (Pho 4), once a week. Use a low level GM survey meter and record and initial the survey readings below. If radiation contamination is detected in any of the surveys, remonitor after decontamination. Record levels in mR/Hr.

Date	Dose prep	Generator HOT LAB	ROOM #1	ROOM #2	BKG.	INIT.
8-30-85	.05 mR/HR.	.05 mR/HR.	.05 mR/HR.	.05 mR/HR.	.05 mR/HR.	MS
<p>I monitored these priority areas of the Nuclear Medicine Department with the 498 Victoreen G-M Detector #113. Last calibration date 11-23-84. No detectable radiation present.</p> <p>Mary Lee Ryan, NMS</p>						
8-30-85	wipe = X-1 .05 mR/HR.	wipe .05 mR/HR. X-4 NS.	wipe = X-7 .05 mR/HR.	wipe = X-10 .05 mR/HR.		
	wipe = .05 mR/HR. X-2 NS.	wipe .05 mR/HR. X-5 NS.	wipe = X-8 .05 mR/HR.	.05 mR/HR.		
	wipe = .05 mR/HR. X-3 NS.	wipe = .05 mR/HR. X-6 NS.	wipe = X-9 .05 mR/HR.			
			A. .05 mR/HR. B. .05 mR/HR. C. .05 mR/HR.			

Nuclear Medicine Dept.  
Temporary Site

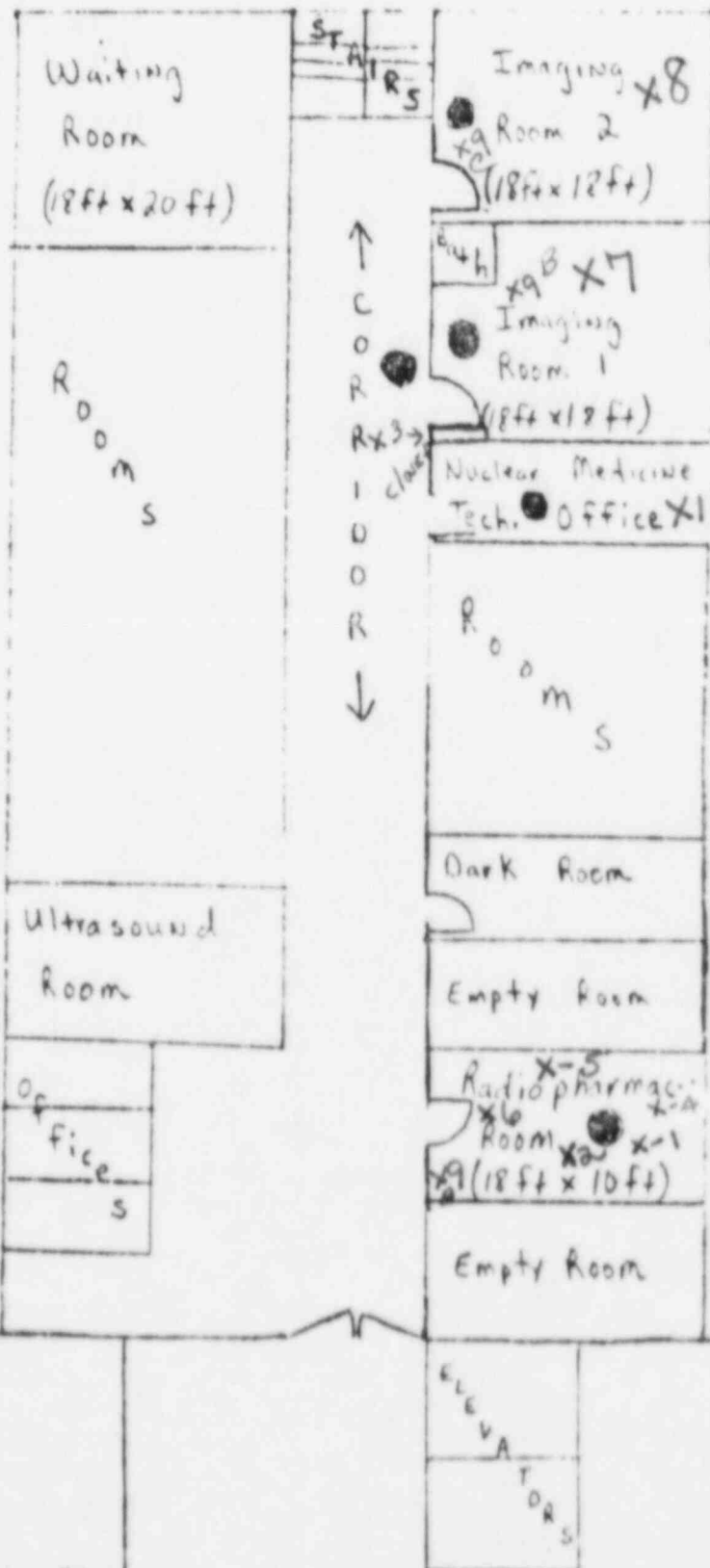
OUTSIDE

Fifth Floor  
East Wing

OUTSIDE

OUTSIDE

● Areas to be  
wipe tested  
and surveyed.



Bkgd. = 100 mCi

X - wipe test

Rooms

Rooms

← CORRIDOR →

Jan 11 (7/85)

ATTACHMENT 2



CERTIFICATE OF RADIOACTIVITY LEAK TEST

FOR McLaren General Hospital, Flint, MI      KIT# \_\_\_\_\_

**HEALTH PHYSICS ASSOCIATES LTD.** CONSULTANTS IN RADIATION SAFETY

BETA CONTAMINATION ANALYSES

3304 COMMERCIAL AVENUE / NORTHBROOK, IL 60062 / PHONES: 312 564-3330

Received SAMPLE DATE	LOCATION	TIN#	ISOTOPE	TOTAL Gross CPM	TOTAL Net DPM	TOTAL Net uCi
9/6/85	Generator	1	BetaEmitters	18.3	<6.8	$<3.1 \times 10^{-6}$
9/6/85	DosePrep	2		15.0	<6.8	$<3.1 \times 10^{-6}$
9/6/85	Rad Waste	3		15.6	<6.8	$<3.1 \times 10^{-6}$
9/6/85	Storage Sealed Sources	4		13.1	<6.8	$<3.1 \times 10^{-6}$
9/6/85	Hot Lab Counter	5		13.4	<6.8	$<3.1 \times 10^{-6}$
9/6/85	Hot Lab Floor	6		14.7	<6.8	$<3.1 \times 10^{-6}$
9/6/85	Image Room 1	7		10.6	<6.8	$<3.1 \times 10^{-6}$
9/6/85	Image Room 2	8		11.7	<6.8	$<3.1 \times 10^{-6}$
9/6/85	Injection Sites	9		13.1	<6.8	$<3.1 \times 10^{-6}$
9/6/85	Technologist Office	10		11.1	<6.8	$<3.1 \times 10^{-6}$
9/6/85		11		13.9	<6.8	$<3.1 \times 10^{-6}$
-	Background	-		14.8	<6.8	$<3.1 \times 10^{-6}$

**STANDARD:**

CPM - Counts per  
minute

Cs-137

77,126 ± 176

144,744 ± 330

0.0652 ± 0.0002

DPM - Disintegrations  
per minute

M - Less than 0.0001  
Microcuries

**NOTE:** All errors shown are given at 2 standard deviations.  
Less than values are based on 3 standard deviations of the  
background count rate.

*Heald W. Jr.*

APPROVED FOR HEALTH PHYSICS ASSOCIATES

9/10/85

DATE

ATTACHMENT 2



CERTIFICATE OF RADIOACTIVITY LEAK TEST

FOR McLaren General Hospital, Flint, MI KIT# \_\_\_\_\_

**HEALTH PHYSICS ASSOCIATES LTD.** CONSULTANTS IN RADIATION SAFETY

GAMMA CONTAMINATION ANALYSES

3304 COMMERCIAL AVENUE / NORTHBROOK, IL 60062 / PHONES: 312 564-3330

Received SAMPLE DATE	LOCATION	TIN#	ISOTOPE	TOTAL Gross CPM	TOTAL Net DPM	TOTAL Net uCi
9/6/85	Generator	1	Gamma Emitters	167	<40	$<1.8 \times 10^{-5}$
9/6/85	Dose Prep	2		176	<40	$<1.8 \times 10^{-5}$
9/6/85	Rad.Waste	3		166	<40	$<1.8 \times 10^{-5}$
9/6/85	Sealed Source Storage	4		172	<40	$<1.8 \times 10^{-5}$
9/6/85	Hot Lab Counter	5		172	<40	$<1.8 \times 10^{-5}$
9/6/85	Hot Lab Floor	6		168	<40	$<1.8 \times 10^{-5}$
9/6/85	Image Room 1	7		167	<40	$<1.8 \times 10^{-5}$
9/6/85	Image Room 2	8		167	<40	$<1.8 \times 10^{-5}$
9/6/85	Injection Sites	9		172	<40	$<1.8 \times 10^{-5}$
9/6/85	Technologist Office	10		172	<40	$<1.8 \times 10^{-5}$
9/6/85		11		165	<40	$<1.8 \times 10^{-5}$
-	Background	-	-	173	<40	$<1.8 \times 10^{-5}$

**STANDARD:**

CPM - Counts per  
minute

DPM - Disintegrations  
per minute

M - Less than 0.0001  
Microcuries

NOTE: All errors shown are given at 2 standard deviations  
Less than values are based on 3 standard deviation of the  
background count rate.

APPROVED FOR HEALTH PHYSICS ASSOCIATES

9/10/85

DATE

## CLOSE-OUT SURVEY PROCEDURES

- A. Areas to be surveyed and wipe tested will include the following:
1. Generator storage area
  2. Dose preparation area
  3. Radioactive waste storage area
  4. Sealed source storage area
  5. Hot lab counter tops
  6. Hot lab floor
  7. Imaging room 1 floor, counter tops and walls
  8. Imaging room 2 floor, counter tops and walls
  9. Injection site locations
  10. Technologist office and corridor (neighboring unrestricted areas).
- B. Equipment used for radiation survey will include a Victoreen Model No. 498 open window low level GM survey meter. Equipment used to analyze the wipes will include a windowless gas flow proportional counter and a NaI scintillation well counter (Units 1 and 3 on the attached equipment list) available at Health Physics Associates, Ltd., Northbrook, Illinois, NRC license No. 12-09160-01. The wipes will be mailed to Health Physics Associates for analysis. Wipe test instructions are attached.
- C. Wipe test analyses will include assaying for alpha and beta activity with the windowless gas flow proportional counter and for gamma radiation with the NaI scintillation well counter. Radiation surveys will be made with the low level GM survey meter with the window open and held in close proximity to surface where radioactive contamination may exist.
- D. Radiation survey and wipe test results will be reviewed by Lawrence Irish, M.D., R.S.O. and Gerald Wicks, M.S.(Radiologic Sciences). All areas listed in Part A above will be at background radiation exposure rates (0.05 mR/hr) prior to release of the temporary site for unrestricted use. All areas listed in Part A above will meet the wipe test criteria listed below, prior to release of the temporary site for unrestricted use.

\*Removable alpha surface contamination - 20 dpm/100 cm<sup>2</sup> or less

\*Removable beta-gamma surface contamination - 1000 dpm/100 cm<sup>2</sup> or less

It should be noted that radioactive gases are not used and sewer dilution of radioactive materials has not occurred in the temporary site of the Nuclear Medicine Department, therefore, surveys and wipe tests of ductwork and pipes are not necessary.

- **Note:** As given in Table I of "Guidelines For Decontamination of Facilities and Equipment Prior to Release For Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Material", July, 1982, pub. by U.S.N.R.C.

## 1 a &amp; b - Equipment list and uses

UNIT	EQUIPMENT	MANUFACTURER	MODEL No.	RADIATION TYPE DETECTED	RANGE OF RADIATION ENERGY DETECTED
①	Windowless Gas Flow Proportional Counter	G. D. Searle (Nuclear-Chgo)	480	Alpha Beta	All Alpha Particles Above 6 KeV
2	Window Gas Flow Proportional Counter	G. D. Searle (Nuclear-Chgo)		Alpha Beta	Above 4 MeV Above 50 KeV
③	Scintillation Well Counter	G. D. Searle	4216	Gamma	Above 25 KeV
4	Scintillation Well Counter	Picker	2904	Gamma	Above 25 KeV

## 1 c &amp; d -

UNIT	RADIOACTIVE MATERIAL	RADIATION TYPE	*RADIATION ENERGY	**EFFICIENCY	**MINIMUM SENSITIVITY
①	Am-241	Alpha	5.4 MeV	45%	$9.3 \times 10^{-7}$ $\mu$ Ci
①	Ni-63	Beta	0.057	12%	$1.8 \times 10^{-5}$ $\mu$ Ci
	C-14	Beta	0.156	35%	$6.1 \times 10^{-6}$ $\mu$ Ci
	Pm-147	Beta	0.225	46%	$4.6 \times 10^{-6}$ $\mu$ Ci
	Tc-99	Beta	0.292	42%	$5.1 \times 10^{-6}$ $\mu$ Ci
	Cs-137	Beta	0.514	43%	$5.0 \times 10^{-6}$ $\mu$ Ci
	Co-60	Beta	0.314	31%	$6.9 \times 10^{-6}$ $\mu$ Ci
	Cl-36	Beta	0.714	40%	$4.5 \times 10^{-6}$ $\mu$ Ci
	Bi-210	Beta	1.16	42%	$5.1 \times 10^{-6}$ $\mu$ Ci
	Sr-90/Y-90	Beta	0.546 / 2.27	44%	$4.8 \times 10^{-6}$ $\mu$ Ci

Unit 2 is in the process of being recalibrated. Data will be submitted as soon as available.

\* NOTE: Maximum beta energies are listed

\*\* NOTE: Sample calculations follow

## c) Efficiency Calculations:

$$\text{Efficiency} = \text{cpm} / \text{dpm}$$

## Sample Calculations

$$\text{Am-241 efficiency} = \frac{30,000 \text{ cpm}}{65,400 \text{ dpm}} = 0.46$$

$$\text{Ca-137 efficiency} = \frac{66,700 \text{ cpm}}{155,600 \text{ cpm}} = 0.43$$

$$\text{Co-60 efficiency} = \frac{66,500 \text{ cpm}}{156,000 \text{ dpm}} = 0.43$$

## d) Minimum Sensitivity Calculations:

Sensitivity of Instrument 1 at alpha voltage for Am-241

Alpha energy is calculated as follows:

Background count rate = 1 cpm

Background counted for 10 minutes

Background standard deviation (S.D.) = 13.16 counts

3 S.D. confidence interval = 19.49 counts

Minimum sensitivity for 10 minute counts of Am-241 alpha

$$\frac{9.49 \text{ counts}}{10 \text{ minutes}} \times \frac{1 \text{ disintegration}}{0.46 \text{ counts}} \times \frac{1 \text{ } \mu\text{Ci}}{2.22 \times 10^6 \text{ dpm}}$$

$$= 9.3 \times 10^{-7} \text{ } \mu\text{Ci}$$

Sensitivity of Instrument 2 at beta voltage

Background count rate = 25 cpm

Ten minute background count = 250 counts

One S.D. =  $\pm 5.0$  counts

3 S.D. Confidence Interval =  $\pm 15.0$  counts

Minimum sensitivity for 10 minute count of Co-137 betas

$$\frac{15.0 \text{ counts}}{10 \text{ minutes}} \times \frac{1 \text{ d}}{0.43 \text{ counts}} \times \frac{1 \text{ } \mu\text{Ci}}{2.22 \times 10^6 \text{ dpm}}$$

$$= 1.6 \times 10^{-6} \text{ } \mu\text{Ci}$$

Sensitivity of Instrument 3 for Co-60 gammas

Background count rate = 120 cpm

Ten minute background count = 1200 counts

One S.D. = 34.6 counts

3 S.D. = 104 counts

Minimum sensitivity for 10 minute count of 1.2 - 1.3<sup>54</sup> gammas

$$\frac{104 \text{ counts}}{10 \text{ minutes}} \times \frac{1 \text{ d}}{0.43 \text{ counts}} \times \frac{1 \text{ } \mu\text{Ci}}{2.22 \times 10^6 \text{ dpm}}$$

$$= 1.1 \times 10^{-5} \text{ } \mu\text{Ci}$$

Similar calculations were performed for other instruments and radionuclides

7/5



<u>UNIT</u>	<u>RADIOACTIVE MATERIAL</u>	<u>RADIATION ENERGY (MeV)</u>	<u>**EFFICIENCY</u>	<u>**MINIMUM SENSITIVITY</u>
①	I-129	0.040	42%	$1.1 \times 10^{-5} \mu\text{Ci}$
	Cd-109	0.088	22%	$2.1 \times 10^{-5} \mu\text{Ci}$
	Co-57	0.122	70%	$6.7 \times 10^{-6} \mu\text{Ci}$
	Ra-226	0.186	85%	$5.5 \times 10^{-6} \mu\text{Ci}$
	Ba-133	0.356	80%	$5.8 \times 10^{-6} \mu\text{Ci}$
	Na-22	0.511/1.29	63%	$7.4 \times 10^{-6} \mu\text{Ci}$
	Cs-137	0.662	30%	$1.6 \times 10^{-5} \mu\text{Ci}$
	Mn-54	0.840	27%	$1.7 \times 10^{-5} \mu\text{Ci}$
	Co-60	1.17 / 1.33	43%	$1.1 \times 10^{-5} \mu\text{Ci}$
4	Ra-226	0.186	9.9%	$9.6 \times 10^{-5} \mu\text{Ci}$

\*\* NOTE: Sample calculations follow

Nuclear Medicine Dept.  
Temporary Site

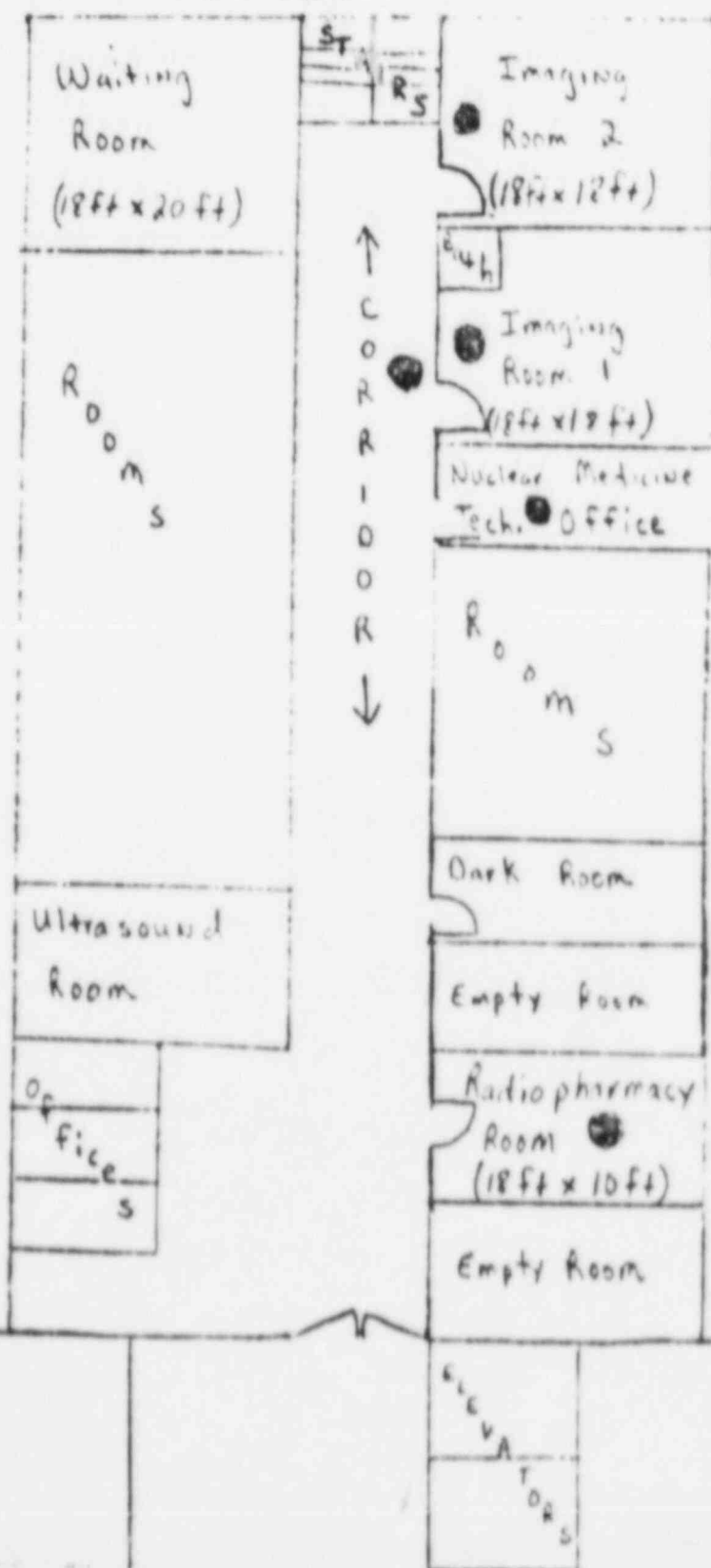
Fifth Floor  
East Wing

OUTSIDE

OUTSIDE

OUTSIDE

● Areas to be  
wipe tested  
and surveyed.



← CORRIDOR →

11/17/84