



# Medical Center Hospital

(614) 774-1111

September 16, 1985

272 Hospital Road  
P.O. Box 708  
Chillicothe, Ohio 43101

D. J. Sreniawski, Chief  
Nuclear Materials Safety  
Section 2  
U. S. Nuclear Regulatory Commission  
Region III  
799 Roosevelt Road  
Glen Ellyn, IL 60137

Re: Byproduct Material License No. 34-11852-01

Dear Mr. Sreniawski:

I am writing in response to your letter dated August 13, 1985 relative to the safety inspection conducted by Ms. C. C. Casey in July.

1. Refrigerator Storage of Food: While instructions had been given to all personnel not to have food in the refrigerator which stores radionuclides, this unfortunately did happen. Since the inspection, we have again met with all personnel working in nuclear medicine. In addition, we had a radiology department meeting where the matter of storing food in the refrigerator was discussed. Further, we have placed a large sign on the door of the refrigerator and on the door leading into the radionuclide hot lab. We can assure you, I believe, this will not happen again.

2. Sealed Source Leak Test: It appears the leak test results were not all immediately available to your inspector. Leak tests were performed on the following dates:

11-09-82	07-26-84
06-29-83	12-20-84
12-21-83	04-12-85
	09-09-85

Copies of these procedures are enclosed with this letter. We will continue to insure that the procedure is consistent with the regulation.

3. Survey Meter Calibration: Our physicist informs us that while he did not record the 1983 calibration he had evaluated this, and it had not changed from the previous one. He assures us that full records will be maintained and filed so they will be readily accessible.

With regard to the 1984 calibration, our physicist informs us that his interpretation of the regulation is that, as long as a chart or graph is prepared and attached to the instrument so meterings can be interpreted to within 10% of the actual reading, this is satisfactory. If his interpretation is in error, we would appreciate your informing him. Please also inform us about this procedure. In any event, we will conform, in the future, to the regulation.

8510220260 851017  
REG3 LIC30  
34-11852-01 PDR

SEP 19 1985

D. J. Sreniawski - NRC  
September 16, 1985

Page -2

4. Assay Calibration:

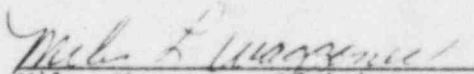
- .1 Accuracy: The accuracy of our dose calibrator is actually checked daily, since we evaluate the accuracy and constancy simultaneously by measuring our standard reference source at various settings. There was, however, no formal documentation listed as an accuracy test between the times the accuracy was established by our physicist.

In the future, we will transpose this accuracy information to a separate sheet so it will be easily visible.

5. Linearity: The dose calibrator accuracy was over 5% as stated in your letter at 30 mCi. However, it was just marginally over 5% and was less than 5% for a value down to approximately 5 mCi. Since most of our doses are above 5 mCi, and since all of our doses are diagnostic, our physicist advised us that the dose calibrator was satisfactory in this range. The dose tolerance for diagnostic applications is +50%. Our physicist had previously advised us of the non-linearity at the lower ranges and we had programmed to replace our dose calibrator, since it had been repaired once previously. While we had programmed this for next year, we have accelerated that and are replacing it as soon as possible. When the unit arrives we will have it tested for both accuracy and linearity by our physicist, and assure you we will require it to be within guidelines.

Should you have any questions concerning this response, do not hesitate to contact me. For any questions of a technical nature please contact our physicist, Dr. Callendine.

Sincerely yours,

  
Miles Waggoner, Administrator

MW:mt

cc: James Manchester, M. D.  
Judy Hines, R.T. C.T.  
Geo. W. Callendine, Jr., Ph.D.

SAMPLE					
NUMBER	DESCRIPTION	RADIONUCLIDE	GROSS CPM	MICRO-CURIES	COMMENTS
1	SQUIBB QC Set	137 Cs	106		
2	NEN NES 356 Vial E	137 Cs	119		
3	NEN Rod	137 Cs	99		
4	PICKER Well Sources	Several	113		
5	AMERSHAM 184622	226 Ra	92		
6	Vial - liquid <sup>137</sup> Cs	137 Cs	97		
	REFERENCE				
	REFERENCE	133 BA	44,815	0.05	
	BACKGROUND	NONE	92	-0-	

COMMENTS

*No Contamination*  
*measurable*  
*Jim Callendine*

GEORGE W. CALLENDINE, JR., PH. D.  
 CONSULTING RADIOLOGIC PHYSICIST  
 803 OXFORD STREET  
 WORTHINGTON, OHIO 43085  
 (614) 885-6187

STATEMENT OF LEAK TEST RESULTS  
 - NUCLEAR MEDICINE -

MEDICAL CENTER HOSPITAL  
 Chillicothe, OH.

license no.  
 34-11852-01  
 date  
 09-09-85

SAMPLE					COMMENTS
NUMBER	DESCRIPTION	RADIONUCLIDE	GROSS CPM	MICRO-CURIES	
1	SQUIBB QC Set	137 Cs	120		
2	NEN NES 356 Vial E	137 Cs	105		
3	NEN Rod	137 Cs	112		
4	PICKER Well Sources	Several	98		
5	AMERSHAM 184622	<sup>226</sup> Ra	117		
6	Vial - liquid <sup>137</sup> Cs	137 Cs	107		
	REFERENCE				
	REFERENCE	133 BA	46,375	0.05	
	BACKGROUND	NONE	91	-0-	

COMMENTS

*No measurable contamination present (< 0.005  $\mu$ Ci)*  
*George W. Callendine*

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STATEMENT OF LEAK TEST RESULTS  
- NUCLEAR MEDICINE -

MEDICAL CENTER HOSPITAL  
Chillicothe, OH.

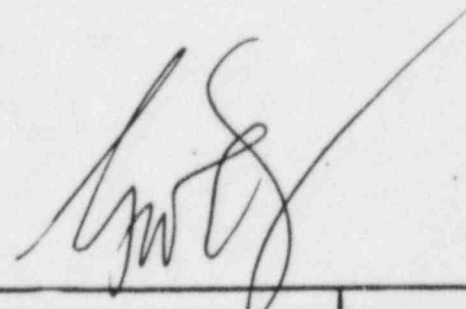
license no.  
34-11852-01  
date  
04-12-85

TEST PROCEDURE: Wipe Test X Immersion Test \_\_\_\_\_ Gaseous Leak Test \_\_\_\_\_

SAMPLE					COMMENTS
NUMBER	DESCRIPTION	RADIONUCLIDE	GROSS CPM	MICRO-CURIES	
1	Squibb QC Set	137 Cs	206		
2	NEN NES 356 Vial E	137 Cs	179		
3	NEN Rod	137 Cs	208		
4	Picker Well Sources	Several	184		
5	Amersham 184622	226 Ra	218		
6	Vial-Liquid <sup>137</sup> Cs	137 Cs	206		
	REFERENCE				
	REFERENCE	133 BA	46860	0.05	
	BACKGROUND	NONE	183	-0-	

COMMENTS

*No measurable contamination  
( $< 0.005 \mu\text{Ci}$ )*



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STATEMENT OF LEAK TEST RESULTS  
NUCLEAR MEDICINE

MEDICAL CENTER HOSPITAL  
Chillicothe, Ohio

license no.  
34-11852-01  
date  
12-20-84



TEST PROCEDURE: Wip. Test X Immersion Test        Gaseous Lea. est       

SAMPLE					
NUMBER	DESCRIPTION	RADIONUCLIDE	GROSS CPM	MICRO-CURIES	COMMENTS
A	SQUIBB QC SET	SEVERAL	135		
B	NES 356 VIAL E - NEN	$^{137}\text{Cs}$	116		
C	NEN ROD	$^{137}\text{Cs}$	102		
D	PICKER WELL SAMPLES	SEVERAL	118		
E	AMERSHAM 184622	$^{226}\text{Ra}$	91		
F	VIAL-LIQUID $^{137}\text{Cs}$	$^{137}\text{Cs}$	104		
	REFERENCE				
	REFERENCE	133 BA	50023	0.05	
	BACKGROUND	NONE	116	-0-	

## COMMENTS

No measurable contamination present ( $< 0.005 \mu\text{Ci}$ )

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## STATEMENT OF LEAK TEST RESULTS

MEDICAL CENTER HOSPITAL  
CHILLICOTHE OHIO

license no.	34-11852-01
date	07-26-84

TEST PROCEDURE: Wipe at X Immersion Test        Gaseous Leak T       

SAMPLE					COMMENTS
NUMBER	DESCRIPTION	RADIONUCLIDE	GROSS CPM	MICRO-CURIES	
01	Squibb QC Set	<sup>137</sup> Cs	116		
02			114		
03	NES 356 Vial E - NEN	<sup>137</sup> Cs	127		
04	NEN - Rod	<sup>137</sup> Cs	106		
05	PICKER Well Sources	Several	104		
06	AMERSHAM 184622	<sup>226</sup> Ra	98		
07	Vial - Liquid Cs-137 AR	<sup>137</sup> Cs	109		
	REFERENCE				
	REFERENCE	<sup>133</sup> BA	51466		
	BACKGROUND	NONE	105	-0-	

COMMENTS

GEORGE W. CALLENDINE, JR., PH. D.  
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STATEMENT OF LEAK TEST RESULTS

MEDICAL CENTER HOSPITAL  
CHILLICOTHE, OHIO

license no.  
34-11852-01  
date  
12-21-83

SAMPLE					COMMENTS
NUMBER	DESCRIPTION	RADIONUCLIDE	GROSS CPM	MICRO-CURIES	
030	PICKER X-WELL SERIES	SEVERAL	116		
031	VIAL LIQUID CS-137AK	137CS	113		
032	SQUIBB QC SET	137CS	109		
033	AMERSHAM 184622	226Ra	94		
035	NES356 VIALE-NEN	137CS	102		
036	NEN ROD	137CS	115		
	REFERENCE				
	REFERENCE	133BA	56939		
	BACKGROUND	NONE	95	-0-	

COMMENTS

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## STATEMENT OF LEAK TEST RESULTS

MEDICAL CENTER HOSPITAL  
 CHILLICOTHE OHIO

license no.  
 34-11852-01  
 date  
 06-29-83



TEST PROCEDURE: Wipe Test X Immersion Test \_\_\_\_\_ Gaseous Leak Test \_\_\_\_\_

SAMPLE					
NUMBER	DESCRIPTION	RADIONUCLIDE	GROSS CPM	MICRO-CURIES	COMMENTS
1001	PICKER X-WELL SOURCES	<sup>137</sup> Cs, <sup>137</sup> Cs <sup>54</sup> Mn, <sup>22</sup> Na, <sup>60</sup> Co	119	—	
1002	VIAL- LIQUID CS137A	<sup>137</sup> Cs	109	—	
1003	SQUIBB QC SET	<sup>137</sup> Cs	106	—	
1004	Amersham 184622	<sup>226</sup> Ra	145	—	
	REFERENCE	<sup>138</sup> BA	60499	0.07	
	REFERENCE				
	BACKGROUND	NONE	115	-0-	

COMMENTS

No Measurable Contamination Present (<0.005  $\mu$ Ci)

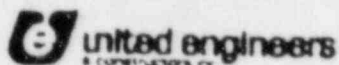
*George W. Callendine, Jr.*

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STATEMENT OF LEAK TEST RESULTS  
RADIOLOGY - NU MED  
MEDICAL CENTER HOSPITAL  
CHILlicoTHE OHIO

License no.  
Date  
11-09-82

# GENERAL COMPUTATION SHEET



6604-260-C-CR-01

CALL SET NO		REV	COM BY	CHKD BY
PRELIM				
FINAL	✓		276	✓
DATE			4-5/85	4-25-85
SHEET	8 OF 15			
NO	6604.260		DATE	DATE

NAME: P. J. S. V. UNIT: IP.3

SUBJECT: Dose Rates inside IP.3 Control Room

-1

Activity Concentration inside IP.3 Control Room due to containment leakage at IP.2 (μCi/hr) (C<sub>1</sub>)\*

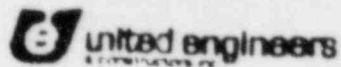
Isotope	2 hrs	1 hr	0.5 hr
Kr-85m	3.71-5	1.62-5	5.84-
Kr-85	2.11-6	9.20-7	3.32-
Kr-87	5.09-5	2.21-5	7.99-
Kr-88	9.29-5	4.04-5	1.46-
Xe-133m	5.53-5	2.41-5	8.73-
Xe-133	2.22-4	9.71-5	3.50-
Xe-135m	3.23-5	1.40-5	5.07-
Xe-135	6.21-5	2.71-5	9.77-
I-131	2.45-6	1.07-6	3.87-
I-132	3.23-6	1.40-6	5.07-
I-133	5.38-6	2.34-6	8.48-
I-134	2.69-6	1.17-6	4.24-
I-135	4.74-6	2.07-6	7.50-

\* Using equation  $C_1 = C_0 (1 - e^{-\frac{F}{V}t})$

where  $F = 1500$  cfm,  $V =$  control room volume  $= 47200 \text{ ft}^3$  and  $t = 2 \text{ hrs}$

+ From: Plot # 6604-NR-1500-0003, Page 23

## GENERAL COMPUTATION SHEET



CALC SET NO		REV	COMP BY	TIME BY
PRELIM			MS	W
FINAL	✓		DATE	4-19-85
VOIC				4-19-85
SHEET 9	OF 13			
JO 6604260			DATE	DATE

NAME OF COMPANY PASNY UNITS IP-3  
 SUBJECT Dose Rates inside IP-3 control Room

Source Term 3 inside IP-3 control room due to containment loss from  
 IP-2 (mer/ci-Su)

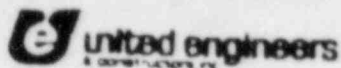
<u>Energy (mev)</u>	<u>2 hr<sup>4</sup></u>	<u>1 hr<sup>4</sup></u>
0.0 - 0.2	7.84-1	3.42-1
0.2 - 0.4	7.02-1	3.06-1
0.4 - 0.9	2.05	8.91-1
0.9 - 1.35	6.33-1	2.76-1
1.35 - 1.80	1.11	4.81-1
1.8 - 2.2	1.77	7.68-1
2.2 - 2.6	3.92	1.70
2.6 - 3.0	3.11-2	1.35-2
3.0 - 4.0	2.81-2	1.22-2
4.0 - 5.0	0.0	0.0

\* From: Computer Run # 6601 T

\*\* From: Computer Run # 8098 T

# GENERAL COMPUTATION SHEET

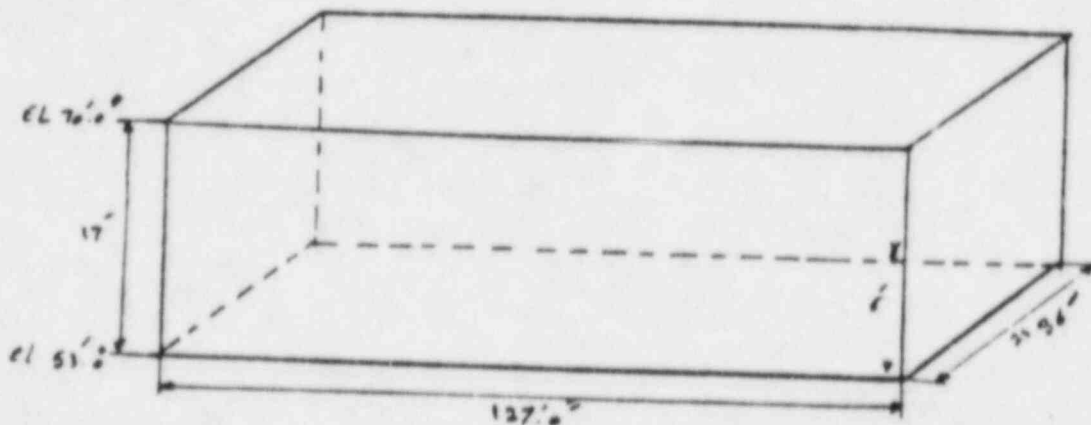
DISCIPLINE



NAME OF COMPANY: PASNY UNIT: IP-3  
 SUBJECT: Dose Rates inside IP-3 control room

CALC SET NO		REV	COMP BY	CHK BY
PRELIM				
FINAL	✓		MG	YTW
DATE			4/22/85	4/25-85
SHEET	10 of 13			
	6604-260			

4. Dose Rates



C.R. Geometry model for QAD

Control room volume =  $47200 \text{ ft}^3$

Time (hr)

Dose Rate ( $\text{mR-hr}^{-1}$ )

2

4.04

1

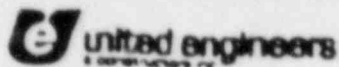
1.75

\* From: PIN # 6604-NA.1500.0003, Page 23

\* From Computer Run # 1276 T and 6993 T

## GENERAL COMPUTATION SHEET

DISCIPLINE

NAME OF  
COMPANY

PASNY

UNITS IP-3

SUBJECT

Dose Rates Inside IP-3 control Room

CALC SET NO		REV	COMP BY	CHPT BY
PRELIM			MG	JPW
FINAL	✓		DATE 4/14/85	DATE 4-25-85
VOID				
SHEET 11 OF 13				
JO 6604.260			DATE	DATE

-9

S-Thyroid Dose:

$$D = \sum (OF)(IDF)(BR) \cdot C_{1hr}$$

where OF = occupancy factor = 1, IDF = Isidene dose factor (Rem/ci)

$$BR = \text{breathing rate} = 1.25 \frac{m^3}{hr} \quad 0-8 \text{ hr}$$

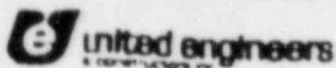
	1hr dose rate (MC/ci) $\times 1 \text{ (hr)}$	IDF ( $\frac{\text{Rem}}{\text{ci}}$ )
I-131	1.07-6	1.18+6
I-132	1.40-6	5.35+4
I-133	2.34-6	40+5
I-134	1.17-6	2.5+4
I-135	2.07-6	1.24+5

$$D = 3.6 \text{ Rem}$$

\* From: P3N# 6604-WA-1500-0003, Page 89



## GENERAL COMPUTATION SHEET



NAME OF COMPANY: New York Power Authority UNITS: IP-3  
 SUBJECT: Control Room Habitability

6604 260 - C (CR-01)

CALC SET NO		REV	COMMIT BY	CHD BY
PRELIM				
FINAL				
VOID				
SHEET 12 OF 13				
10 6604.260				

DATE: 4-25-88

Overall Dose for IP-3 Control Room Personnel due to an IP-2 LOCA

The overall doses for IP-3 Control Room personnel are to be obtained from the results for IP-2 Control Room (Ref. 1).

• Overall (X/Q) adjustment factor =  $\frac{230}{960} = \underline{0.24}$ , see sheet 5

Iodine Protection Factor (IPF) =  $\frac{F_I + \eta F_R + F_U}{(1-\eta)F_I + F_U}$ , see Ref. 6

$F_I$  = filtered intake air flow;  $\eta$  = charcoal filter efficiency;

$F_R$  = filtered recirculation air flow;  $F_U$  = unfiltered infiltration

IPF for IP-2 Control Room =  $\frac{(0.99)(1840) + 164}{164} = 12.1$

( $F_I = 0$ ;  $\eta = 0.99$ ;  $F_R = 1840$  cfm;  $F_U = 164$  cfm.)

IPF for IP-3 Control Room =  $\frac{1000 + (0.95)(1000) + 10}{(1-0.95)(1000) + 10} = 32.7$

( $F_I = 1000$  cfm =  $F_R$ ;  $\eta = 0.95$ ;  $F_U = 10$  cfm.)

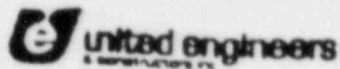
• IPF adjustment factor (thyroid dose only) =  $\frac{12.1}{32.7} = \underline{0.37}$

Geometry Factor (GF) =  $\frac{1173}{V_{CR}^{0.338}}$ ;  $V_{CR}$  = control room volume, see Ref. 6

GF for IP-2 Control Room =  $\frac{1173}{(103400)^{0.338}} = 23.7$

( $V_{CR} = 103,400$  ft<sup>3</sup>)

## GENERAL COMPUTATION SHEET



CR-01 260-C-CR-0

CALC SET NO		REV	COMP BY	CHKD BY
PRELIM				
FINAL		C	TPE	gfw
VOID			DATE	DATE
SHEET 12 OF 13				
10 6604.260				

NAME OF COMPANY: New York Foreign University UNIT: II-2  
 SUBJECT: Control Room Habitability

$$GF \text{ for IP-3 Control Room} = \frac{1173}{(47200)^{0.338}} = 30.9$$

$$(V_{CR} = 47,200 \text{ ft}^3)$$

• GF adjustment factor =  $\frac{23.7}{30.9} = \underline{0.77}$ , Whole Body (8) Dose only

∴ Overall Thyroid Dose for IP-3 Control Room = Dose before Isolation  
 + Dose after Isolation =  $3.6 \text{ rem} + (10.8 \text{ rem})(0.24)(0.37)$   
 $= \underline{4.6 \text{ rem}}$

Overall Whole Body (8) Dose for IP-3 Control Room  
 $= (0.24) \{ 2.3 \text{ rem} + (0.23 \text{ rem})(0.77) \} = \underline{0.6 \text{ rem}}$

∴ Overall Skin (β) Dose for IP-3 Control Room  
 $= (0.24) (7.1 \text{ rem}) = \underline{1.7 \text{ rem}}$