Daniel Torres, M.S., M.P.A.
FISICO RADIOLOGICO

- Inspecciones Radiológicas
- Conferencias sobre Radiación
- Control de Contaminación Radiológica
- Solicitud de Licencias - N.R.C.
- Calibración Equipo Rayos X
- Consultoria Física Radiológica

Feb. 21-2001

Nuclear Regulatory Commission
Atlanta Ga.

ATT. Mr. Jose Diaz

Dear Mr. Diaz:

Enclosed find Calibration Certificates for the survey meters used during 1998-2000 period The instruments were used at different sites including Dr. Luis Cruz office.

If any further questions need clarification please let me know.

Sincerely
Daniel Torres

Yaurel B-2, Alturas de Mayagüez, Mayagüez, P.R. 00680 • Tel. (787) 831-8424

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

ORDER NO. 232949/216304

CUSTOMER BIODEX MEDICAL SYSTEMS

Ludlum Measurements, Inc. Model 14C Serial No. 59952

Ludlum Measurements, Inc. Model 44-7 Serial No. PR052457

Cal Date 17-Apr-98 Cal Due Date 17-Apr-99 Cal. Interval 1 Year Meterface 202-330

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 72 °F RH 20 % Alt 697.8 mm Hg

☐ New Instrument Instrument Received ☐ Within Toler. +-10% ☐ 10-20% ☑ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☑ F/S Resp. ck ☑ Reset ck. ☐ Window Operation ☑ Geotropism
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC

☐ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☑ Calibrated in accordance with LMI SOP 14.9 rev 12/19/89.

Instrument Volt Set 900 V Input Sens. 34 mV Det. Oper. 900 V at 34 mV Threshold Dial Ratio ____ = ____ mV

☐ HV Readout (2 points) Ref./Inst. ____ / ____ V Ref./Inst. ____ / ____ V

COMMENTS:

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X 1000	1500 mR/hr	1.3	1.5
X 1000	500 mR/hr	0.4	0.5
X 100	150 mR/hr	1.5	1.5
X 100	50 mR/hr	0.5	0.5
X 10	15 mR/hr	1.5	1.5
X 10	5 mR/hr	0.5	0.5
X 1	1.5 mR/hr = 3380 CPM	1.5	1.5
X 1	1.0 mR/hr	1.0	1.0
X 0.1	338 cpm	1.0	1.5
X 0.1	112 cpm	0.06	0.5

*Uncertainty within ± 10% C.F. within ± 20%

X 0.1 Range(s) Calibrated Electronically

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*		REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout				Log Scale			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of MIL-STD-45662A and ANSI N323-1978.

State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☑ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☑ E551 ☐ Neutron Am-241 Be S/N T-304

☐ Alpha S/N ____ ☐ Beta S/N ____ ☐ Other ____

☑ m 500 S/N 125489 ☐ Oscilloscope S/N ____ ☑ Multimeter S/N 123647

Calibrated By: James Graham Date 17 apr 98

Reviewed By: Rhonda Harris Date 18 Apr 98

FORM C22A 09/08/97

checked by flows

RMC CALIBRATION SERVICES, INC.

CERTIFICATE OF CALIBRATION

RMC Calibration Services (RMC/CS) certifies that the instrument listed below was calibrated and inspected before shipment and has met the manufacturer's published specifications. RMC/CS certifies that our calibration measurements are traceable to the National Institute of Technology. Applicable corrections are made to correct to 22° C and 760 mmHg.

RMC SERVICE NO. 023198

INSTRUMENT IDENTIFICATION Biodex (Manufacturer) 051-014/44-7 (Model) 101796/099491 (Serial Number)

CALIBRATION SOURCE ID. R59-10 10mCi ^{137}Cs A-0009-6 130 Ci ^{137}Cs

RANGE	CALIBRATION POINT	INSTRUMENT READING Before Adjustment	INSTRUMENT READING After Calibration
X0.1	0.075 mR/HR	0.092 mR/HR	0.072 mR/HR
	0.150	0.160	0.140
X1	0.50	0.55	0.53
	1.50	1.54	1.52
X10	5.0	5.0	5.0
	15	14.3	14.3
X100	50	49	49
	150	155	155
X1000	500	470	470
	1500	1570	1570

COMMENTS

BKG: 0.02 mR/HR AND IS SUBTRACTED FROM "AFTER CALIBRATION" READINGS

DOSERATE RESPONSE WITHIN ±10%

PROBE POSITIONED PERPENDICULAR TO SOURCE

Calibration Performed by [signature] Date July 8, 1998

I certify that the above information is correct.

Authorizing Agent C. E. McGee (Signature) RSO (Title) Date 7-8-98

(RMC/CS is not responsible for damage incurred during shipment or use of this instrument.)

RMC CALIBRATION SERVICES, INC.

CERTIFICATE OF CALIBRATION

RMC Calibration Services (RMC/CS) certifies that the instrument listed below was calibrated and inspected before shipment and has met the manufacturer's published specifications. RMC/CS certifies that our calibration measurements are traceable to the National Institute of Technology. Applicable corrections are made to correct to 22° C and 760 mmHg.

RMC SERVICE NO. C23780

INSTRUMENT IDENTIFICATION BIODEX (Manufacturer) 051-014/44-7 (Model) 101796/099491 (Serial Number)

CALIBRATION SOURCE ID. R59-10 10mCi ^{137}Cs A-0009-6 130 Ci ^{137}Cs

RANGE	CALIBRATION POINT	INSTRUMENT READING Before Adjustment	INSTRUMENT READING * After Calibration
X0.1	0.075mR/hr	0.095mR/hr	0.075mR/hr
	0.150	0.170	0.150
X1	0.50	0.62	0.52
	1.50	1.58	1.45
X10	5.0	5.3	5.3
	15.0	15.1	15.1
X100	50	49	49
	150	155	155
X1000	500	475	475
	1500	1610	1610

COMMENTS

* BKG: 0.02mR/hr and is subtracted from "After" readings.

DOSE RATE RESPONSE WITHIN ±10%.

PROBE POSITIONED PERPENDICULAR TO SOURCE.

Calibration Performed by Charles E. McGee Date 09 JULY 1999

I certify that the above information is correct:

Authorizing Agent C. E. McGee (Signature) RSO (Title) Date 7-9-99

(RMC/CS is not responsible for damage incurred during shipment or use of this instrument.)

OK Checked

AM CALIBRATION SERVICES

9290 Gaither Rd., Gaithersburg, MD 20877 (301) 840-9269

CALIBRATION CERTIFICATE

Owner: Hospital Dr Pila Calibration Date: 7/3/00 Next Due: 7/3/01

Manufacturer: Biodex Model Number: 14.C Serial Number 101796

Batteries Changed: No Internal Adjustment: ✓ Yes No

This instrumentation was calibrated with a Cs-137 source: Sheppard 28.6 #10258/300 MCI

Calibration geometry: ⟶ ▭ ⟶ ⟶ ⟶ 44.7 # 099491 -w/cap-

Window: ☐ open ☐ closed ☒ fixed

Meter Response (mR/hr)	Scale	True Exposure (mR/hr)	CF	Meter Response (mR/hr)	Scale	True Exposure (mR/hr)	CF
2000.0	x 1000	1807.0	0.903	1.55	x.1	1.73	1.116
320.0	"	319.0	0.993	0.450	"	0.440	0.977
SCALE CF:	0.95			SCALE CF:	1.046		
127.0	x10	126.0	0.992	0.160	x.1	0.160	1.00
41.0	"	41.40	1.0891	0.090	"	0.090	1.00
SCALE CF:	1.09			SCALE CF:	1.00		
14.50	x1	15.40	1.062				
4.80	"	4.40	0.916				
SCALE CF:	0.99						

Exposure Rate from Check Source —

THIS CERTIFIES that the instrument described above was calibrated with a Cs-137 source. Exposure rates for this source have been verified with instrumentation whose calibration is traceable to the National Institute of Standards and Technology.

MD License #Md-31-206-01

Health Physics Technician

AM Calibration Services verifies all the above before shipping, not responsible for damages incurred in shipping.

RSO