## Unshielded Facility Nondestructive Inspection (NDI) Radiation Protection Survey for Homestead ARB, FL

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<th>2. REPORT TYPE</th>
<th>3. DATES COVERED (From – To)</th>
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<td>9 Sep 2013</td>
<td>Consultative Letter</td>
<td>April 2013 – August 2013</td>
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### 4. AUTHOR(S)

Maj Zahid Sulaiman, TSgt Phillip Heil, SSgt Michael Ames

### 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

USAF School of Aerospace Medicine
Occupational and Environmental Health Department/OECM
2510 Fifth St.
Wright-Patterson AFB, OH 45433-7913

### 8. PERFORMING ORGANIZATION REPORT NUMBER

AFRL-SA-WP-CL-2013-0017

### 14. ABSTRACT

Radiation protection survey of the aircraft wash-rack used for unshielded NDI operations at Homestead ARB. The NDI personnel used a Lorad LPX-160 x-ray unit for inspections. Survey was performed in accordance with T.O. 33B-1-1 and applicable Air Force standards. The aircraft wash-rack was recertified as an “unshielded facility.”

### 15. SUBJECT TERMS

NDI, unshielded facility, x-ray survey, Lorad, LPX-160, Homestead ARB, FL
MEMORANDUM FOR 482 MSG/SGPB

ATTN: MR. MICHAEL SCHMIDT
29050 CORAL SEA BLVD, BOX 16
HOMESTEAD ARB, FL 33039-1299

FROM: USAFSAM/OEC
2510 Fifth Street
Wright-Patterson AFB, OH 45433-7913

SUBJECT: Consultative Letter AFRL-SA-WP-CL-2013-0017, Unshielded Facility Nondestructive Inspection (NDI) Radiation Protection Survey for Homestead ARB, FL

1. INTRODUCTION:

   a. Purpose: At the request of 482 MSG/SGPB, the U.S. Air Force School of Aerospace Medicine, Consultative Services Division (USAFSAM/OEC), Radiation Health Consulting Branch completed a radiation protection survey for 482 MXS/MXMFN NDI Laboratory’s unshielded facility NDI operations at the aircraft wash-rack on 30 Apr 13.

   b. Background: The purpose of this survey was to reevaluate the NDI unshielded facility for compliance with T.O. 33B-l-1, Chapter 6, Radiographic Inspection Method, and compliance with occupational and general public radiation safety standards. Specifically, this survey included establishing a 2-mrem/h perimeter around the unshielded facility, ensuring compliance with applicable occupational dose limits, a review of worker radiation dosimetry records, NDI’s operating procedures/instructions, and radiation safety training.

   c. Survey Personnel:

      (1) Health Physicist, USAFSAM/OEC
      (2) Lead Health Physics Technician, USAFSAM/OEC
      (3) Health Physics Technician, USAFSAM/OEC

   d. Personnel Contacted:

      (1) Installation Radiation Safety Officer (IRSO), 482 MSG/SGPB
      (2) NDI Laboratory Supervisor, 482 MXS/MXMFN
      (3) NDI NCO, 482 MXS/MXMFN
e. **NDI Survey Measurement Equipment:**

(1) Fluke Biomedical – 451P Pressurized Ion Chamber (Serial Number 3885, Calibrated 29 November 2012, Calibration Due 29 November 2013)
(2) Fluke Biomedical – 451P Pressurized Ion Chamber (Serial Number 3883, Calibrated 26 July 2012, Calibration Due 26 July 2013)
(3) Fluke Biomedical – 451P Pressurized Ion Chamber (Serial Number 3878, Calibrated 29 November 2012, Calibration Due 29 November 2013)
(4) Fluke Biomedical – 451P Pressurized Ion Chamber (Serial Number 3881, Calibrated 20 June 2012, Calibration Due 20 June 2013)

2. **METHODOLOGY:**

a. **Site Layout:** Unshielded NDI operations are conducted on the Homestead ARB flight line at the aircraft wash-rack as shown in Figure 1. The aircraft wash-rack is an open-sided metal-roof-covered structure that is able to fit F-16 aircraft underneath as shown in Figure 2. The rear of the aircraft wash-rack has an approximately 8-foot-high concrete wall that runs the entire width of the wash-rack stall as shown in Figure 3.

![Figure 1. Overhead view of survey area](image)

Figure 1. Overhead view of survey area
Figure 2. Aircraft wash-rack

Figure 3. Concrete wall rear of aircraft wash-rack
b. **Radiation Survey:** Radiation measurements were taken at the NDI operator’s console position, at 75 feet from the aircraft wash-rack at the control line, and at the 2-mrem/h line around the entire aircraft wash-rack, as seen in Figure 4 in the Results section. In total, 31 measurements were taken to establish the 2-mrem/h line for both the left and right wing operations. Additionally, measurements were taken to document exposure at the rear wall and 1 meter from the tube head. The x-ray tube head was placed on the ground and directed at the underside of the aircraft wing and fuselage to characterize current/past unshielded NDI operations. This was repeated on each side of the aircraft to show full coverage and/or worst case x-ray exposure possibilities. Measurements were made with the x-ray tube (Lorad LPX-160) lying on the ground pointing toward the aircraft to maximize x-ray scatter during this particular NDI operation. The power was set to 150 kVp and 5 mA for all measurements.

3. **RESULTS:**
   a. The radiation survey established a new recommended controlled area line as shown in Figure 4. The new recommended controlled area extends the current barrier to the southwest and southeast and establishes a new barrier line to the grass area to the northeast of the aircraft wash-rack. Measurements were taken in the area of the concrete wall to the rear of the aircraft wash-rack. The wall provides a high degree of shielding, albeit unintentional, while NDI operations are taking place. The 2-mrem/h line was found to be at the same location as the concrete jersey barriers, parallel to the rear wall, when measured from chest height. Measurements and dose estimates can be seen in Tables 1 and 2. The survey showed compliance with the occupational dose limit of 5 rem/yr and general public radiation dose limit of 100 mrem/yr. However, when measurements were taken above the height of the concrete wall, the hourly and annual dose limits were exceeded as shown in Table 2.

b. A general radiation safety review resulted in the following observations.

   (1) Unshielded NDI safety procedures meet occupational safety and health requirements as specified within T.O 33B-1-1, 10 CFR 20, and AFMAN 48-125.
(2) An adequate number of personal monitoring devices were available and operational. Personnel were observed correctly wearing these devices while performing NDI operations.

(3) Procedures establishing the exclusion/controlled areas were properly implemented.

(4) Controlled areas exhibited proper visual warnings, barrier ropes, and radiation warning signs. Audible warnings were not observed to be in place. Interlocks preventing activation unless a warning light was connected were observed to be functioning.

(5) At least two serviceable, properly calibrated radiation survey meters were in use by NDI personnel. In addition, at least one qualified radiographer was present during all operations.

Figure 4. Homestead Air Reserve Base Unshielded NDI Survey Map
### Table 1. Maximum Estimated Workload Summary

<table>
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<tr>
<th>Exposure Type</th>
<th>Technique</th>
<th>Exposures per Year</th>
<th>Maximum Estimated Exposure Duration (h)</th>
<th>Estimated Beam On – Time (h/yr)</th>
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<tr>
<td>Average AFTO 125 Documented Settings</td>
<td>145</td>
<td>5</td>
<td>58</td>
<td>0.4</td>
</tr>
</tbody>
</table>

*Average exposure time (min) per series = number of exposures in series x maximum exposure time in series / 15 series/yr.

*Average number of exposures per series.

*Exposure duration (h) = (averaged exposure time [min]) / (60 min/h)

*Beam on time (h/yr) = (exposures/yr) x (exposure duration in hours)

### Table 2. Survey Measurements and Dose Rate Estimated

<table>
<thead>
<tr>
<th>Diagram Location</th>
<th>Description</th>
<th>451P Serial No.</th>
<th>451P Bkg Reading (mR/h)</th>
<th>Area</th>
<th>Highest Reading (uR/h)</th>
<th>Updated Reading (mR/h)</th>
<th>Occupancy Factor</th>
<th>Max Estimated 1-h Dose (mrem)*</th>
<th>Max Estimated 1-yr Dose (mrem)*</th>
<th>Exceeds 2 mrem in any 1 h?</th>
<th>Exceeds 100 mrem/yr</th>
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</thead>
<tbody>
<tr>
<td>Operator’s console</td>
<td>@ 14 in from ground</td>
<td>3881</td>
<td>0.007</td>
<td>C</td>
<td>2000</td>
<td>1.9</td>
<td>1</td>
<td>0.8</td>
<td>43.5</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Controlled area line</td>
<td>chest height</td>
<td>3883</td>
<td>0.007</td>
<td>C</td>
<td>500</td>
<td>0.5</td>
<td>1</td>
<td>0.2</td>
<td>10.9</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>1 m from tube head</td>
<td>on ground</td>
<td>3878</td>
<td>0.007</td>
<td>C</td>
<td>866666</td>
<td>866.7</td>
<td>1</td>
<td>325.2</td>
<td>18861.2</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Wall rear of wash-rack</td>
<td>top of wall (8 ft)</td>
<td>3885</td>
<td>0.01</td>
<td>U</td>
<td>13000</td>
<td>12.9</td>
<td>1</td>
<td>4.9</td>
<td>282.9</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>2-mR Line</td>
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<td>3885</td>
<td>0.007</td>
<td>C</td>
<td>2000</td>
<td>1.9</td>
<td>1</td>
<td>0.8</td>
<td>43.5</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

*Area: C, Controlled Area; An area controlled by the NDI section and where workers have completed ALARA training. U, Uncontrolled Area; An area not controlled or monitored by the NDI section and where workers have not completed ALARA training.

*Max dose estimate for 1 h = (updated reading [mrem/h])*(exposure duration [h]).

*Annual dose estimate = (updated reading ([mrem/h])*(occupancy factor)*(total estimated beam on time in h/yr).

### 4. DISCUSSION:

a. The workplace Industrial Radiography Utilization Log, AFTO IMT 125, contains eight blocks from which different monitoring positions and the associated maximum observed dose rate can be annotated. For all past unshielded operations, to include this survey, three locations were annotated with a dose rate in mR/h. However, only two operational SM-400 ionization chamber instruments were in use by NDI personnel during this survey, and only two locations were observed to be measured by NDI personnel with the two available instruments. It can be assumed that the second and third locations are at the controlled area perimeter; however, the exact locations are not documented during unshielded NDI operations.
b. The electronic personal dosimeters (EPDs) worn by NDI personnel had not been cleared of previous radiation dose data. Data on the EPDs showed a cumulative radiation dose over a period of time since the last time they had been cleared out. This is a finding that had been noted previously when USAFSAM personnel completed a Shielded NDI Facility Survey for the 482nd NDI laboratory.

5. CONCLUSIONS AND RECOMMENDATIONS:

a. Increase and completely enclose restricted area by using additional rope barriers, cones, and signage as shown in Figure 4. It will prevent unauthorized personnel from accidentally wandering into the area where NDI operations may be taking place. Additionally, posting “Caution Radiation Area” signs on the back wall of the aircraft wash-rack during NDI operations will prevent accidental exposure to personnel who may be unaware of ongoing NDI operations. Refer to T.O. 33B-1-1, para 6.8.8.2 for guidance.

b. Additional Qualified Radiographers or Radiation Safety Monitor Assistants should be used to maintain visibility with the rear of the wash-rack during operations. This requirement is spelled out in T.O 33B-1-1, section 6.8.8.2.5, para a.

c. Ensure that Industrial Radiography Utilization Logs (AFTO IMT 125) are accurately and legibly filled out.

d. To avoid speculation or uncertainty regarding the specific monitoring locations and the associated maximum dose rate on the AFTO IMT 125, detailed descriptions of each monitoring position should be documented and reviewed by all personnel prior to performing radiography work.

d. Clear out previously recorded dose data on EPDs to ensure accuracy of their measurement during current operations and to prevent incorrect doses from being recorded on the AFTO IMT 115. The “Easy EPD” software and infrared transmitter/receiver should be available on at least one computer in the work center.

e. The offices responsible for CE operations as well as the MOC (Maintenance Operations Center) should be informed of unshielded NDI operations taking place at this location.

f. Any changes to NDI operations or to the aircraft wash-rack will require revalidation by qualified personnel.
6. If you have any questions regarding this report, please contact TSgt Phillip Heil at DSN 798-3412 or phillip.heil@wpafb.af.mil.

BRIAN D. SHULER, Capt, USAF, BSC
Chief, Radiation Consulting Branch

2 Attachments:
1. Unshielded Nondestructive Inspection Survey Form
2. Instrument Calibration Sheets
Attachment 1
UNSHIELDED NONDESTRUCTIVE INSPECTION SURVEY FORM

Survey Performed By: USAFSAM/OEC          Survey Date: 30 Apr 2013
Radiation Health Consulting Branch

Reviewed and Approved By: Installation Radiation Safety Officer, 482nd FW

I. FACILITY IDENTIFICATION:

A. Base: Homestead ARB           B. Bldg Number: Aircraft Wash-Rack
C. State/Country: FL, USA        D. Room Number: N/A
E. Command: AFRC               F. Phone Number (DSN): 535-7350
G. Organization: 482 MXS/MXMFN   H. WPI: 0088-FAND-404A

II. PERSONNEL:

TITLE          ROLE/RESPONSIBILITY
Shop Chief, NDI  Radiographer in Charge (RIC)
NDI Technician   Radiation Safety Monitor

III. EQUIPMENT IDENTIFICATION:

<table>
<thead>
<tr>
<th>Manufacturer / Model Number</th>
<th>Serial Number</th>
<th>Maximum kVp</th>
<th>Maximum mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>LORAD / LPX-160</td>
<td>CO496446 (Console)</td>
<td>150</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>X0496449 (X-Ray Tube)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV. DOSE ASSESSMENT AND PERSONNEL MONITORING:  YES  NO  N/A

A. Persons adequately monitored (10 CFR 20.1502; T.O. 33B-1-1, 6.8.5.3)  ☒ ☐ ☐

B. Thermoluminescent device available
   1. One per radiographer  ☒ ☐ ☐
   2. Worn during radiography  ☒ ☐ ☐
   3. TLDs properly stored (AFMAN 48-125; T.O. 33B-1-1, 6.8.5.4.4)  ☒ ☐ ☐
   4. TLDs returned to storage rack at the end of the work day  ☒ ☐ ☐
   5. TLD exchange frequency:  Quarterly
   6. TLD review period:  Quarterly
C. Pocket ionization chamber (PIC) or electronic personal dosimeter (EPD) available
   1. Proper central storage location for PIC/EPDs and control
   2. Date of last usage
      Date of last usage: 22 Feb 13
   3. Quantity of dosimeters on-hand:
      Quantity at PMEL: 0
   4. Sufficient number on-hand
   5. Worn during radiography
   6. Calibration interval
      Calibration of all on-hand current
   7. All function properly
   8. EPD audible alarm checked prior to each work day
   9. EPD audible alarm set at dose <500 mR?
   10. Utilization log available (T.O. 33B-1-1, 6.3.10.2.1)
   11. Readings recorded daily (Unshielded Operations)
      Date of last entry: 30 Apr 13
   12. Real-time dosimeter log maintained for 3 years
   13. Exposures within limits (10 CFR 20.120; T.O. 33B-1-1, 6.8.5.2.1.1)
   15. Exposure data supplied to workers annually (10 CFR 19.13)

V. Standard Operating Procedures:
   1. Procedures clearly define radiation exclusion/controlled areas
      a. Areas properly established and adequately controlled
      b. Audible warnings
      c. Visible warnings
      d. Interlocks
      e. Delay switches
      f. Emergency shut-off (ESO) switches
      g. Restricted areas roped off to control access during irradiation operations
      h. Safety monitors designated to control restricted areas where other controls are not practical?
   2. Doses in controlled areas and environments meet general public limits (T.O. 33B-1-1, 6.8.8.2.4b)
   3. At least two individuals to include one qualified radiographer are in attendance during all radiographic operations?
   4. At least two serviceable, properly calibrated radiation survey meters are in use during unshielded Ops
   5. Restrict use of X-radiography equipment to qualified radiographers
   6. Clearly define emergency procedures and designate individuals to be
   7. Clearly define responsibilities and actions to be taken to investigate overexposures to radiation
   8. Mandate recording of records of radiation surveys to document that radiation safety surveys are actually being performed prior to each radiography operation
   9. Ensure that x-ray equipment is adequately secured when not in use to preclude unauthorized use
Attachment 2
Instrument Calibration Sheets

AIR FORCE PRIMARY STANDARDS LABORATORY
CERTIFICATE OF CALIBRATION

Report Number: 123320178  Department: Photonics/Nucleonics  Date of Issue: 20121129

Calibration Item:
Manufacturer: FLUKE BIOMEDICAL
Model/Part No.: 451P SERIES
Equipment Type: ION CHAMBER SURVEY METER
Serial Number: 0000003878
ID Number: F162864

Equipment Submitted by:
88 MFG/GRMD
5060 PEARSON ROAD
WRIGHT PATTISON AFB, OH, 45433-5517

Item Condition:
As Received: IN-TOLERANCE
The measured values of all parameters tested or calibrated were found to be within specification limits.
As Returned: IN-TOLERANCE
The item was returned and returned in-tolerance. This includes TOL directed limits.

Room Ambient Conditions:
Temperature: 73 °F  Relative Humidity: 36 %  Barometric Pressure: N/A

Remarks:
Traceability: Measurement standards and test equipment used are traceable to the International System of Units (SI) through the National Institute of Standards and Technology, to the extent allowed by the Institute’s calibration facilities; or to other National Metrology Institutes (NMI); or have been derived from accepted values of natural physical constants; or mutual consent standards; or have been derived by the ratio or reciprocity type measurement techniques.

General Conditions:
1. The standards and calibration program of the AFPDL, as operated by The Bionetics Corporation, Newark Metrology Operations, complies with the requirements of the current version of ISOIEC 17025 on the date of calibration.
2. This report may not be reproduced, except in full, without written approval of The Bionetics Corporation, Newark Metrology Operations.

Calibrated By:
Chris Morris  Metrology Technician

Approved By:
Donald M. Hayes  Lead Metrology Technician

Phone: (740) 788-5451  Phone: (740) 788-5451
E-mail: Christopher.Morris.ctr@afmetcal.af.mil  E-mail: Don.Hayes.ctr@afmetcal.af.mil

Bionetics
813 Irving-Wick Drive West, Heath, Ohio 43056-6118  TEL: (740) 788-5400  FAX: (740) 788-5404

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Procedures and Equipment Used

PROCEDURES

Procedure
33K7-4-83-1

Date
30 Nov 2003

EQUIPMENT

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</tbody>
</table>

- The instrument calibration results are accurate to within ±10% of reading between 10 and 100% full scale on any range, exclusive of energy response.

Bioptechs
813 Irving-Wick Drive West, Heath, Ohio 43056-6118 TEL: (740) 788-5400 FAX: (740) 788-5404

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AIR FORCE PRIMARY STANDARDS LABORATORY

CERTIFICATE OF CALIBRATION

Report Number: 121710063   Department: Photonics/Nucleonics   Date of Issue: 20120820

Calibration Item:
Manufacturer: FLUKE BIOMEDICAL
Model/Part No.: 451P SERIES
Equipment Type: ION CHAMBER SURVEY METER
Serial Number: 0000003881
ID Number: F160579

Equipment Submitted by:
88 MSG/LGRMD
5000 PEARSON ROAD
WRIGHT PATTERSON AFB, OH, 45433-5517

Item Condition:
As Received: IN-TOLERANCE
As Returned: IN-TOLERANCE

Room Ambient Conditions:
Temperature: 72.66 °F   Relative Humidity: 48.6 %   Barometric Pressure: N/A

Remarks:

Traceability: Measurement standards and test equipment used are traceable to the International System of Units (SI) through the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities; or to other National Metrology Institutes (NMI); or have been derived from accepted values of natural physical constants; or mutual consent standards; or have been derived by the ratio or reciprocity type measurement techniques.

General Conditions:
1. The standards and calibration program of the AFPSL, as operated by The Bionetics Corporation, Newark Metrology Operations, complies with the requirements of the current version of ISO/IEC 17025 on the date of calibration.
2. This report may not be reproduced, except in full, without written approval of The Bionetics Corporation, Newark Metrology Operations.

Calibrated By:
Mark Coopermander   Metrology Technician

Approved By:
Curtis A. Brissette   Metrology Technician

Phone: (740) 788-5451
E-mail: Mark.Cooperrider.ctr@afmetcal.af.mil

Phone: (740) 788-5451
E-mail: Curtis.Brissette.ctr@afmetcal.af.mil

813 Irving-Wick Drive West, Heath, Ohio 43066-6118   TEL: (740) 788-5400   FAX: (740) 788-5404

Page 1 of 2
Procedures and Equipment Used

PROCEDURES

<table>
<thead>
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<th>Procedure</th>
<th>Date</th>
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<tbody>
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EQUIPMENT

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* The instrument calibration results are accurate to within ±10% of reading between 10 and 100% full scale on any range, exclusive of energy response.

813 Irving-Wick Drive West, Heath, Ohio 43056-6118    TEL: (740) 788-5400    FAX: (740) 788-5404
AIR FORCE PRIMARY STANDARDS LABORATORY

CERTIFICATE OF CALIBRATION

Report Number: 121730026  Department: Photonics/Nucleonics  Date of Issue: 20120726

Calibration Item:
Manufacturer: FLUKE BIOMEDICAL
Model/Part No.: 451P SERIES
Equipment Type: ION CHAMBER SURVEY METER
Serial Number: 0000003883
ID Number: F160576

Equipment Submitted by:
88 MSG/LGRMD
5080 PEARSON ROAD
WRIGHT PATTERSON AFB, OH, 45433-5517

Item Condition:
As Received: UNKNOWN or Not applicable  As Returned: IN-TOLERANCE
The item was not calibrated by the PMEL and/or the calibration condition as received cannot be determined.
This item was calibrated and returned in tolerance. This includes TO-directed limitations.

Room Ambient Conditions:
Temperature: 72.92 °F  Relative Humidity: 50.4 %  Barometric Pressure: N/A

Remarks:

Traceability: Measurement standards and test equipment used are traceable to the International System of Units (SI) through the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities; or to other National Metrology Institutes (NMI); or have been derived from accepted values of natural physical constants; or mutual consent standards; or have been derived by the ratio or reciprocity type measurement techniques.

General Conditions:
1. The standards and calibration program of the AFPSL, as operated by The Bionetics Corporation, Newark Metrology Operations, complies with the requirements of the current version of ISO/IEC 17025 on the date of calibration.
2. This report may not be reproduced, except in full, without written approval of The Bionetics Corporation, Newark Metrology Operations.

Calibrated By:
Mark Cooperider  Metrology Technician

Approved By:
Donald M. Hayes  Lead Metrology Technician

Phone: (740) 788-5451  E-mail: Mark.Coopider@afmetcal.af.mil
Phone: (740) 788-5451  E-mail: Don.Hayes.ctr@afmetcal.af.mil

Bionetics
813 Irving-Wick Drive West, Heath, Ohio 43066-6118  TEL: (740) 788-5400  FAX: (740) 788-5404

Page 1 of 2

Distribution A: Approved for public release; distribution is unlimited. Case Number: 88ABW-2013-3977, 9 Sep 2013
Procedures and Equipment Used

PROCEDURES

Procedure
33K7-4-93-1

Date
30 Nov 2003

EQUIPMENT

<table>
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<tr>
<th>Nomenclature</th>
<th>Model/Part No.</th>
<th>ID No.</th>
<th>NIST Report No.</th>
<th>Cal Due Date</th>
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The reported value(s) and uncertainties resulting from the measurement process are:

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<th>Applied mR/hr</th>
<th>T.J. Reading mR/hr</th>
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<td>3.93</td>
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</table>

- The instrument calibration results are accurate to within ±10% of reading between 10 and 100% full scale on any range, exclusive of energy response.
AIR FORCE PRIMARY STANDARDS LABORATORY

CERTIFICATE OF CALIBRATION

Report Number: 123320180  Department: Photonics/Nucleonics  Date of Issue: 20121129

Calibration Item:
Manufacturer: FLUKE BIOMEDICAL
Model/Part No.: 451P SERIES
Equipment Type: ION CHAMBER SURVEY METER
Serial Number: 0000003885
ID Number: F162663

Equipment Submitted by:
88 MSG/LGRMD
5080 PEARSON ROAD
WRIGHT PATTERSON AFB, OH, 45433-5517

Item Condition:
As Received: IN-TOLERANCE
The measured values of all parameters tested or calibrated were found to be within specification limits.

As Returned: IN-TOLERANCE
Item was calibrated and returned in tolerance. This includes TO defined limits.

Room Ambient Conditions:
Temperature: 73 °F  Relative Humidity: 36 %  Barometric Pressure: N/A

Remarks:

Traceability: Measurement standards and test equipment used are traceable to the International System of Units (SI) through the National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facilities; or to other National Metrology Institutes (NMI); or have been derived from accepted values of natural physical constants; or mutual consent standards; or have been derived by the ratio or reciprocity type measurement techniques.

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Calibrated By:
Chris Morris  Metrology Technician

Approved By:
Donald M. Hayes  Lead Metrology Technician

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Phone: (740) 788-5451  E-mail: Don.Hayes.ctr@afmetcal.af.mil

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PROCEDURES

Procedure | Date
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33K7-4-93-1 | 30 Nov 2003

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<td>4.16</td>
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