Washington Hospital

Biomedical Engineering Department

Who we are and what we do.
The Beginning of our field – March 1971
The Beginning of our field – March 1971

Too many hospitals are hazardous electrical horror chambers, says America’s leading safety crusader. At least 1,200 people a year are electrocuted and many more are killed or injured in needless electrical accidents in hospitals. Here’s a report on the danger—and what must be done about it by the hospitals themselves, by the makers of medical equipment, by the government and by concerned citizens. By Ralph Nader

Ralph Nader’s Most Shocking Exposé

Too many hospitals are hazardous electrical horror chambers, says America’s leading safety crusader. At least 1,200 people a year are electrocuted and many more are killed or injured in needless electrical accidents in hospitals. Here’s a report on the danger—and what must be done about it by the hospitals themselves, by the makers of medical equipment, by the government and by concerned citizens. By Ralph Nader
In the Beginning

Washington Hospital had joined a group that provided shared Biomedical Services.

This program evolved over time, and eventually was purchased by a large Independent Service Provider – Contractor.

In April 1998 Washington Hospital decided to bring the department in-house.

Sometimes the perception is that equipment service (and servicing) is easy. If Biomed does our job properly it really should be as easy as:
It’s not really that easy

WHHS Biomedical Engineering
Who we are

Biomedical Engineering is a team of engineering professionals working in a clinical environment to resolve technology issues related to patient care, improvement in outcomes and cost effectiveness. The Biomedical Engineering Department functions and provides engineering services to a clinical environment supporting technology, clinicians and the patient technology interface to reduce risks, improve patient outcomes and enhance patient care in a cost effective manner. This is accomplished via cost effective maintenance, repair and acquisition of all clinical technology, and proper management of clinical technology resources. It is the goal of the Biomedical Engineering Department to be THE technical liaison, reference and resource for all clinical equipment. The mission of the Biomedical Engineering Department is to provide knowledgeable, timely and cost effective quality service to clinicians in a professional and responsible manner to improve and enhance patient care by supporting all aspects of patient care related technology.
Biomedical knowledge base

- Anatomy and Physiology
- Medical Terminology
- Safety In The Health Care Facility – Codes and Standards
- Fundamentals of Electricity, Electronics, and Solid-State Devices
- Medical Equipment Function and Operation
- Medical Equipment Problem Solving
- Information Systems
- Customer Service
Certification as Biomedical Equipment Technician (CBET)

EXAMINATION REQUIREMENTS

I. Anatomy and Physiology
   A. Systems
      1. Respiratory
      2. Gastrointestinal
      3. Nervous
      4. Circulatory
      5. Musculoskeletal
      6. Endocrine
   B. Organs
      1. Heart
      2. Lungs
      3. Liver
      4. Kidneys
      5. Brain
      6. Gallbladder
      7. Pancreas
      8. Other
   C. Blood
      1. Components
      2. Metabolism
   D. Terminology
Certification as Biomedical Equipment Technician (CBET)

II. Public (employee, patient, visitor) Safety In The Health Care Facility
   A. Electrical
      1. Microshock/Electrical Safety Testing
      2. Other
   B. Chemical
      1. Material Safety Data Sheet
      2. Other
   C. Radiation Hazards
      1. Light Spectrum
      2. Types of Rays
   D. Biological
      1. Universal Precautions
      2. Other
   E. Fire
      1. Class
      2. Fire Extinguishers
   F. Codes and Standards
      1. JCAHO Comprehensive Accreditation Manual
      2. AABB
      3. NFPA 99
         a. Gas and Vacuum Systems
         b. Electrical Systems
      4. FDA
      5. SMDA
      6. OSHA
      7. Other
III. Fundamentals of Electricity, Electronics, and Solid-State Devices
   A. Transducers
   B. Calculations and Conversions
      1. Hex/Decimal/Binary
      2. Other
   C. Devices
      1. Passive
      2. Active
      3. Digital
   D. Circuits
      1. Operational Amplifier
      2. Power Supplies
      3. Common Base/Emitter/Collector Transistor Circuits
      4. AC Power
         a. Transformer
         b. Distribution
   E. Test Equipment
   F. Batteries
   G. Terminology
IV. Medical Equipment Function and Operation

A. Monitoring Systems (i.e. ECG, EEG, Blood Pressure, Pulse Oximetry, Fetal Monitor)
B. Portable Equipment (i.e. Infusion Devices Syringe Pumps, PCA Pumps; Hypo Hyperthermia)
C. Life Support Equipment (i.e. Defibrillators, Hemodialysis, Anesthesia Machines, Critical Care Ventilators, Balloon Pumps)
D. Therapeutic Equipment (i.e. Infant Warmers, Ultrasound Therapy)
E. Laboratory Equipment (i.e. Centrifuges, Water Baths, Analyzers)
F. Diagnostic Imaging (i.e. Ultrasound, Radiographic/Fluoroscopy)
G. Operating Room (i.e. Electro Surgical Generators, Video Carts, Lasers, Tourniquets, Sterilizers, Warmers)
H. Information Systems (i.e. Computers, Networks, Topology)
I. Test Equipment (i.e. Electrical Safety, Defibrillator, Electro Surgical, Physiologic Simulators, Oscilloscopes, Meters)
J. Terminology
V. Medical Equipment Problem Solving

A. Electronic Component Level, Block Level
B. Monitoring Systems (i.e. ECG, EEG, Blood Pressure, Pulse Oximetry, Fetal Monitor)
C. Portable Equipment (i.e. Infusion Devices Syringe Pumps, PCA Pumps, Hypo Hyperthermia)
D. Life Support Equipment (i.e. Defibrillators, Hemodialysis, Anesthesia Machines, Critical Care Ventilators, Balloon Pumps)
E. Therapeutic Equipment (i.e. Infant Warmers, Ultrasound Therapy)
F. Laboratory Equipment (i.e. Centrifuges, Water Baths, Analyzers)
G. Diagnostic Imaging (i.e. Ultrasound, Radiographic/Fluoroscopy)
H. Operating Room (i.e. Electro Surgical Generators, Video Carts, Lasers, Tourniquets, Sterilizers, Warmers)
I. Information Systems (i.e. Computers, Networks, Topology)
J. Situational (i.e. User error, user training, applications)
Regulatory Bodies

Advancement of Medical Instrumentation (AAMI)
California Administrative Code (CAC) Title 22
Code of Federal Regulations (CFR)
Environmental Protection Agency (EPA)
FDA - Center for Devices and Radiological Health (CDRH)
Federal Communications Commission (FCC)
Food and Drug Administration (FDA)
International Electrotechnical Commission (IEC)
International Organization for Standardization (ISO)
Joint Commission
National Fire Protection Association (NFPA)
Occupational Safety and Health Administration (OSHA)
Office of Statewide Health Planning and Development (OSHPD)
The American National Standards Institute (ANSI)
Underwriters Laboratories, Inc.
Who we are – Mission Statement

To ensure electrically safe and functional equipment for patients, visitors, and hospital employees through a program of continuing inspection, testing, and repairs of patient care equipment, regardless of ownership, and assistance with inservice training.

To act as a resource in selecting new patient care equipment and fulfilling manufacturers' recalls as needed.

Our main customers are the direct caregivers of Washington Hospital. Other customers include:

- Support departments
- Patients
- Some of the DEVCO sites
- Administration
- Regulatory authorities such as Joint Commission, and California Department of Health Services (DHS).
Who we are - Services offered

We see ourselves as MEDICAL TECHNOLOGY EXPERTS

- Pre-purchase Evaluations/ Consulting
  MDBuylines - ECRI HPCS - Peers
- Equipment Recommendations
- Purchasing assistance
  Service Options - Manuals, other Service Media, Training Classes, Specialized Equipment
- Incoming Inspections
- Service Equipment
  1,000s of Parts in inventory, Specialized Test Equipment
- Provide (some) Loaners
- Contract Management (Service)
  negotiations and administration
- User (Inservice) Training
- Regular Preventive Maintenance / Safety / Performance Testing / Calibrations
- Corrective Work orders (Repairs)
- Safety Fair presentations
Who we are - Services offered

✓ Equipment Installations
✓ Recalls and Alerts FDA/ECRI
✓ Obsolescence Notifications
✓ Replacement Recommendations
✓ International Biomedical Networking
✓ User Error Tracking
✓ Equipment History on every device - "Regardless of Ownership"
✓ Consultation of Equipment Incidents
✓ Members of many Committees
✓ Construction projects – Medical equipment aspects
✓ “Community" related activities
✓ GOAL - Bring as much "in-house" as possible
✓ FREE TECH SUPPORT
Equipment “Asset” tag

Every device has a unique identification number, assigned by us that is used to:

- Track equipment history – from “cradle to grave” (incoming inspection to disposal)
- Assign and track Preventive (Predictive) Maintenance work orders
- Assign and track Corrective work orders (repairs)
- Search for recalled devices
- Analyze trends for replacement or other issues.
Who we are – What we want to prevent

WHHS Biomedical Engineering
Who we are - Staff

1 – Manager

1 – Lead Biomedical Technician

3 – Biomedical Technicians

1 – Per-Diem Biomedical Technician

1 – Executive Assistant (half time)
Biomedical Staff

Carol Garibaldi, CBET  
Lead Biomedical Technician  
April 13, 1998

Christopher Ney, CBET  
Biomedical Technician  
July 12, 2001

Tiberiu “Tibi” Pop  
Biomedical Technician  
November 29, 2004
Biomedical Staff

Jim Rominger
Biomedical Technician
May 2, 2005

Fe Mendoza
Executive Assistant
May 30, 2006

James Bocade
Per-Diem Biomedical Technician
February 27, 2007
Who we are – Staff Sergeant Chris Ney

WHHS Biomedical Engineering
Medical Equipment Management Plan

CRITERIA FOR SYSTEMS AND COMPONENTS INCLUDED IN PLAN

All powered (electrical, air, nitrogen, etc.) technology that is directly involved or supports patient care is included in the medical equipment management program.

The department oversees all medical equipment repairs, maintenance and service independent of ownership or service methodology.
PRIORITIZATION

Repair and maintenance work is prioritized by:

- **Life support/life saving**
  (ventilators, anesthesia machines, defibrillators)

- **Diagnostic**
  (laboratory, radiographic, imaging)

- **“Routine” technologies**
  (otoscopes, exam lights)
In-house coverage is provided eleven hours per day (7a.m. – 6p.m.), five days a week, excluding holidays.

Biomedical Engineering is available on a call back basis 24 hours a day seven days a week.

All staff have long-range pagers.
NON-HOSPITAL EQUIPMENT

All medical equipment, REGARDLESS OF OWNERSHIP must be held to the same standards. Loaner, Demo, and Rental devices must have proof of current Preventive Maintenance, and a safety test before use.

Biomedical Engineering keeps this documentation on file.

Departments should notify Biomed when devices leave the Hospital.

Items returning must be re-tested.
Community Involvement

• Partnered with Underwriters Laboratories to orient new Engineers about actual usage of equipment in hospitals
Devices Supported by Biomed

ACTIVE ASSETS

Dec-00 Apr-01 Aug-01 Dec-01 Apr-02 Aug-02 Dec-02 Apr-03 Aug-03 Dec-03 Apr-04 Aug-04 Dec-04 Apr-05 Aug-05 Dec-05 Apr-06 Aug-06 Dec-06 Apr-07
Work orders Closed by Month

Total work orders by month
(since 1999)

Jan-99, Jul-99, Jan-00, Jul-00, Jan-01, Jul-01, Jan-02, Jul-02, Jan-03, Jul-03, Jan-04, Jul-04, Jan-05, Jul-05, Jan-06, Jul-06
Statistics

Current Inventory of devices supported: 3,200

2006

Corrective work orders (Service calls): 4,202

Preventive Maintenance work orders (PMs) Completed: 4,328

Total work orders: 8,530
Biomedical Resources - ECRI

HEALTH DEVICES

Guidance Article
The Hazards of Alarm Overload
Keeping Excessive Physiologic Monitoring Alarms from Impeding Care

- The Problem: Excessive Alarms Degrade the Quality of Care
- The Source of Excessive Alarms
- Developing a Systematic Plan

Also in This Issue
- Transitioning Systems
- Portable Transport Ventilators
- For Home Care: Long-Term Care Settings
- For In-Hospital Transport
- Tracheostomy
- Ventilator-Related Malignant Hyperthermia
- New Products
- Closing HMOs: Implications for Utilization Services

WHHS Biomedical Engineering
Health Devices Alerts Action Item

Accession Number: A7547

Blood Pressure Monitors and Sphygmomanometers: MHRA Offers Advice on Obtaining Accurate Blood Pressure Measurements [U.K.]

Priority: Normal Priority

In This Issue: Blood Pressure Monitors and Sphygmomanometers [U.K.]

Monitors, Bedside, Blood Pressure [16-764];

Physiologic Monitor Modules, Invasive Blood Pressure [20-772];

Physiologic Monitor Modules, Noninvasive Blood Pressure [20-773];

Sphygmomanometers [13-106]

Device: (1) Blood Pressure Monitors; (2) Sphygmomanometers [Capital Equipment]

Problem: The U.K. Medicines and Healthcare Products Regulatory Agency (MHRA) has issued a Medical Device Alert because it has received reports of user problems related to obtaining accurate blood pressure measurements.

Action Needed: On a poster titled “Measuring Blood Pressure—Top Ten Tips,” MHRA offers the following guidance on obtaining accurate blood pressure measurements:

(1) Ensure that only clinically validated equipment is purchased for use and that all sphygmomanometers are checked regularly—mercury devices should be checked at least once annually, and aneroid devices should be checked at least twice annually.

(2) To reduce the likelihood of inappropriate cuff use, ensure that both large and regular cuffs are available in each consulting room.

Friday, July 28, 2006
### Technologies Evaluated

<table>
<thead>
<tr>
<th>Anesthesia Depth Monitoring</th>
<th>Lithotripter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthesia Information Management System</td>
<td>Localization System</td>
</tr>
<tr>
<td>Anesthesia Machine</td>
<td>Long Term Epilepsy Monitoring</td>
</tr>
<tr>
<td>Audiometer</td>
<td>Magnetic Resonance Imager (MRI)</td>
</tr>
<tr>
<td>Autologous Blood Recovery System</td>
<td>Mammography Information System</td>
</tr>
<tr>
<td>Automated Dispensing System</td>
<td>Mammography System</td>
</tr>
<tr>
<td>Bed</td>
<td>Materials Management</td>
</tr>
<tr>
<td>Bed Management System</td>
<td>Medical Records Administration</td>
</tr>
<tr>
<td>Biopsy Systems</td>
<td>Metabolic Measurement System</td>
</tr>
<tr>
<td>Blood and Fluid Warmer</td>
<td>Microbiology System</td>
</tr>
<tr>
<td>Blood Bank Automation</td>
<td>Microtome</td>
</tr>
<tr>
<td>Blood Gas Analyzer</td>
<td>Mini C-Arm</td>
</tr>
<tr>
<td>Bone Densitometer</td>
<td>Mobile C-Arm</td>
</tr>
<tr>
<td>Cardiac Cath and Special Procedures</td>
<td>Molecular Diagnostics</td>
</tr>
<tr>
<td>Angiography</td>
<td>Neonatal Ventilator</td>
</tr>
<tr>
<td>Cardiac Stress Test System</td>
<td>Non Invasive Cardiac Output</td>
</tr>
<tr>
<td>Cardiac Ultrasound (ECHO)</td>
<td>Non-Invasive Vascular Diagnostic System</td>
</tr>
<tr>
<td>Cardiologist/Echo PACS</td>
<td>Nurse Call</td>
</tr>
<tr>
<td>Cardiologist/Management System</td>
<td>Oncology Information Management System</td>
</tr>
<tr>
<td>Cardiologist/PACS</td>
<td>Open Shift Management</td>
</tr>
<tr>
<td>Cardio-pulmonary Bypass Pump</td>
<td>Ophthalmic Laser</td>
</tr>
</tbody>
</table>

---

**WHHS Biomedical Engineering**
Stand Designed by Biomedical Engineering
Cabling diagram for equipment on cart
Welch Allyn “Acuity” Network
Cardiac PACS in the Cath Lab

GE Cardiac PACS
At Washington Hospital

WHHS Biomedical Engineering
Medical Network
Supported Devices - Defibrillators
Supported Devices – Ventilator and CRRT
Supported Devices – Patient Monitors

WHHS Biomedical Engineering
Supported Devices
Supported Devices - Pumps

WHHS Biomedical Engineering
Supported Devices – Cardiac PACS
New Vital Sign Monitors
“BioWeb” is the Biomedical Engineering presence on the intranet.

To access it, go to the WHHS intranet homepage

Click on “Department Postings”

and then “Biomedical”

BioWeb
WHHS Biomedical Engineering
Thank You

Be safe