NATIONAL COMPETENCY SKILL STANDARDS FOR
LONG-TERM MONITORING IN EPILEPSY

LTME providers practice in accordance with the facility policy and procedure manual which details every aspect and type of recording.

The American Society of Electroneurodiagnostic Technologists, Inc. presents this document to provide national criteria for evaluating competencies for performing studies associated with Long-term Monitoring in Epilepsy [LTME]. These national competencies were established following analysis of survey data collected in the summer of 2004. The tabulation was completed by the ASET office and the LTME team, according to the standards set by the Professional Testing Corporation, New York, NY. This document was revised for consistency in terminology with the new Scope of Practice and approved by the ASET Board of Trustees in April 2011.

Basic knowledge and technical performance, as well as quality patient care and patient interaction, were considered. The components include those defined in the publication of *Guideline 12: Guidelines for Long-Term Monitoring for Epilepsy, 2008,* authored by the American Clinical Neurophysiology Society [formerly the American EEG Society]. The ASET *National Competency Skill Standards for Performing an Electroencephalogram* are pre-requisite to the LTME competencies.

Section I: Core Knowledge Statements

LTME technologists will have the knowledge background to interact with the patient and obtain a quality, interpretable LTME recording that will yield information about the brain's neuronal activity. The following statements involve knowledge and concepts that are essential in collecting and processing LTME data.

Scope of Practice:
- Successful completion of national board examinations associated with practice administered by the American Board of Registration of Electroencephalographic and Evoked Potential Technologists, Inc. [ABRET]
- Specific training on procedures unique to LTME
- Additional training on equipment specific for LTME recordings.

Technical Skills and Other Abilities:
[These build on ASET's National Competency Skill Standards for Performing an Electroencephalogram]
- Follows American Clinical Neurophysiology Society [ACNS] guidelines for head measurement [International 10–20 System or modified 10–10 system]
- Is proficient in the best electrode application method using paste, collodion, or electrode caps as appropriate
- Employs methods to ensure electrode security and integrity

- Uses other special electrodes and assists in their application or set-up as needed [i.e., needle, sphenoidal, or subdural and depth electrodes]
- Knows head dressing and wrapping techniques to secure implanted electrode tails and reduce the risk of infection
- Follows facility policy and procedures for infection control
- Follows conscious sedation protocol if indicated
- Knows that sedation is ordered by the attending physician and administered by the resident or the staff nurse; then nursing staff monitors the patient closely
- Follows patient safety protocols especially those for seizures
- Is certified in CPR and knows hospital code for cardio-respiratory arrest
- Knows unit's procedures for high patient acuity [severity of patient's condition], i.e., respiratory distress or arrest codes, contagious diseases, death, etc.
- Is highly skilled in EEG pattern recognition to provide clinical descriptive information to clinical neurophysiologist or surgeon;
- Recognizes or minimizes artifacts, or when possible, eliminates artifacts on recordings in all electrically hostile units such as the operating room [OR]
- Possesses skills and cognitive abilities in videography
- Possesses knowledge and skills in data reformatting and data reduction techniques
- Understands computer operations and networking sufficiently to do basic troubleshooting and to report to information technology [IT] support services
- Is able to create custom montages using implanted electrodes or additional non-standard electrodes
- Able to work under stressful conditions, work quickly and accurately in urgent care areas such as the operating room or the angiography suite
- Recognizes EEG seizure activity and conducts seizure interview, and technical neuroassessment during seizures;
- Alerts nurse of the occurrence of sub-clinical and clinical seizure activity
- Instructs when to inject radioisotope for ictal SPECT scans
- Recognizes and acts appropriately when a patient experiences a respiratory or cardiopulmonary arrest initiating CPR procedures as needed
- Reports critical test results* to the interpreting physician and supervisor and documents this communication according to facility policy and procedures
- Completes and maintains patient documentation for charges, statistics, and medical records
- Demonstrates supportive behaviors necessary for age-specific care.

Knowledge Statements in LTME

The LTME technologist understands principles of LTME and the clinically relevant questions to be answered for each individual patient:
- Medical terminology and accepted abbreviations in LTME
- Basic electricity and electronic concepts of LTME equipment
- Basic safety [patient and electrical] issues relating to the patient and the patient's LTME biomedical equipment
- Basic functional neuroanatomy and neurophysiology relevant to LTME
- Anatomical correlation of EEG waveforms
- Pathologic and nonpathologic factors affecting LTME
- Electrographic correlates of clinical conditions such as generalized tonic-clonic seizures, complex partial seizures, and nonepileptic events

- Current antiepileptic medications and their effects
- Infection control standards [sterile techniques regarding patient and equipment].

The LTME technologist knows indications for LTME:
- Diagnosis of epilepsy
- Classification and characterization of seizures
- Quantification of seizures
- Localization of seizures using surface or implanted electrodes
- Determination of cortical function using electrical stimulation
- Differentiation of epileptic versus non-epileptic events.

The LTME technologist maintains and improves knowledge and skills by:
- Reviewing recording with clinical neurophysiologist or by alternative criteria (such as reviewing reports) on a regular basis
- Reading journal articles
- Attending didactic continuing education courses in clinical neurophysiology
- Studying textbooks related to the field of LTME and epilepsy monitoring
- Participating in hospital in-service and department conferences on LTME patients
- Completing online courses
- Participating in quality assurance/improvement activities and reviews
- Achieving LTM certification and meeting recertification requirements.

The LTME technologist is proficient in LTME recording options.
- Scalp electrodes without video, continuous trace EEG
- Scalp electrodes with video
- Intracranial electrodes with video
- Added scalp and/or sphenoidal electrodes without video
- Added scalp and/or sphenoidal electrodes with video.

The LTME technologist understands details of LTME instrumentation.
- Various types of recording and storage media
- Basic concepts of digital recording, including appropriate sampling rates, aliasing, Nyquist frequency, sampling skew, amplitude resolution, horizontal resolution [analysis time] and digital video specifications
- Effects of recording parameters [filters, gain/sensitivity] on EEG waveforms
- Electrode impedance test current, appropriate amperes for electrode type
- Electrical safety issues of equipment
- Automatic seizure detection software including understanding of basic algorithms used for detection
- Parameters used in event detection, how to alter these parameters and their effects
- Computer operation including organization of file structures and maneuvering around a menu environment
- Calibration appropriate for analog or digital recording and how to make adjustments when standards are not met
- Technique of reformatting and the use of a system reference
- Audio/video instrumentation, including digital video technology.

The LTME technologist knows duties specific to LTME:
- Using electrode application techniques appropriate for extended monitoring and for patients in critical care settings
- Securing and protecting invasive monitoring cable connections
- Assisting with sterile procedures including sphenoidal electrode insertion and dressing patient's head
- Reviewing events detected by automated spike/seizure detection system
- Printing EEG from stored computer data
- Assisting with cortical stimulation and mapping
- Selecting appropriate recording parameters and customizing these parameters based on the case
- Reviewing, analyzing, and extracting clinical events from recorded data
- Adjusting video recording system and troubleshooting problems
- Using safety precautions when caring for patients having seizures
- Assisting in the care and transfer of patients
- Transporting recording equipment as needed.

The LTME technologist understands various types of electrodes.
- Scalp – disk
- Scalp – needle
- Sphenoidal
- Monitoring electrodes [eye movement, EMG, respiratory, etc.]
- Intracranial electrodes
- Subdural strips, grids, cylinders
- Epidural strips, grids
- Depth electrodes
- Different electrode metals and their effects on EEG recording.

Section II: Competencies Needed in LTME

The LTME technologist interacts with the patient to obtain a quality, interpretable LTME recording that will yield information about neuronal activity of the brain. The following statements involve action procedures.

The LTME technologist verifies the integrity of LTME equipment by:
- Calibrating with a square wave electrical pulse of appropriate amplitude and using parameters that will be used during the recording
- Demonstrating biological calibration
- Recognizing and correcting all malfunctions seen with calibration of EEG amplifiers and synchronized video recording
- Having all equipment checked for safety per facility policy and procedures
- Ensuring audio/video equipment is working properly
- Ensuring that peripheral equipment [e.g., cortical stimulator] is properly calibrated, synchronized, and functionally safe
- Maintaining individual logs on equipment malfunctions.

The LTME technologist acquires information and evaluates the patient and his/her needs prior to the procedure by:
- Reading medical records
- Interviewing patient

- Interviewing family/friends
- Discussing with referring physician
- Viewing previously recorded data
- Determining and accommodating the patient's age-specific needs [i.e., mental age, state, comprehension level, disability, and/or other special needs]
- Providing appropriate patient education including expectations and guidelines while in the monitoring unit and explanation of technical procedures, such as limitation of movement, use of event signal devices, continuous audio/video recording, and some loss of privacy
- Answering questions relating to the LTME monitoring procedure
- Answering questions [education/ information] related to subsequent testing procedures, Wada, PET, SPECT, psychological testing, etc.

The LTME technologist prepares a basic data sheet that includes:
- Patient demographic information [name, age, ID number, referring MD, etc.]
- Procedure information: number, recording time, date, technologist's initials
- Significant relevant medical history and clinical findings specific to procedure
- Seizure or event types, duration, frequency, first and last event
- Patient's mental, behavioral, consciousness and neuroassessment baseline states
- All patient medications, drug levels if available
- Results of studies relevant to LTME [PET, MRI, neuropsychology, SPECT].

The LTME technologist follows a method of electrode application that includes:
- Identifying appropriate method of electrode application
- Checking supplies, number of electrode headboxes, interconnector cables, and amplifiers for each patient
- Determining set-up and recording protocols including montage derivations appropriate for the patient
- Using standard precautions for infection control during patient preparation
- Using physician-ordered placement of additional electrodes
- Ensuring security and integrity of electrodes for an extended period of time
- Measuring the patient's head according to the International 10–20 System or modified 10–10 system
- Cleaning patient's scalp and skin prior to electrode application
- Maintaining sterility of incision and implant site
- Discarding or autoclaving electrodes that come in contact with body fluids
- Providing sterile indwelling electrodes [i.e., sphenoidal, etc.]
- Placing appropriate recording reference and ground electrodes in digital recording systems and using spares whenever possible
- Assessing the patient's potential for skin breakdown and taking steps to minimize such a risk.

The LTME technologist obtains a baseline recording from all intracranial electrodes:
- Verifies electrode recording
- Uses appropriate recording and stimulus parameters
- Is able to reformat recording, adding electrode derivations and montages, or other techniques that enhance or clarify the EEG abnormality
- Uses sequential montage arrangement going from left to right, central to temporal, anterior to posterior, superior to inferior
- Verifies accuracy of input connections
- Determines adequacy of scalp site used for recording reference location

- Documents and verifies electrode input descriptors, placement and equipment associations [which electrode name from what anatomical area, plugged into which jack input]
- Follows all recording standards set by ACNS Guidelines for LTME.

The LTME technologist identifies and eliminates or reduces artifacts contaminating the recording of EEG and video:
- Checks the quality of the signal
- Sets equipment gain factors and amplifier parameters appropriately
- Recognizes artifact as physiologic or non-physiologic
- Identifies source of artifact and corrects or eliminates
- Secures headbox/transmitter system to protect against disconnection during seizures or patient events
- Ensures proper grounding of patient and equipment
- Under certain circumstances reviews with medical staff the need for sedatives, relaxants, anesthetics, as appropriate to reduce excessive muscle artifact
- Has knowledge of the instrumentation schematics and can articulate this set-up for troubleshooting purposes
- Recognizes artifacts related to networking and loss of connectivity
- Is able to quickly resolve computer hang-ups or "freezes" and knows data recovery tools.

The LTME technologist is skilled in bedside testing of patients during and after seizures:
- Performs baseline testing appropriate to patient's age and level of development
- Carefully assesses patient's language function by having patient read standardized phrases or name pictures during ictal and post-ictal states and compares results to baseline testing
- Gives patients simple and complex commands during LTME procedures
- Tests memory and cognitive function relative to LTME
- Notifies physician and nursing staff of significant patient events.

The LTME technologist acquires, reviews, and presents selected data to clinical neurophysiologist:
- Sets up seizure detection computer selecting appropriate montage and other parameters, such as alarm level, event detection threshold, sensitivity of detection, etc.
- Reviews complete data from monitoring period by some form of fast review method or reviews data extracted by a computerized automatic event detection system
- Extracts portions of electrographic data for interictal [both wake and sleep] and ictal samples
- Identifies and accurately describes the chronology of clinical correlates during an event
- Selects 2 to 3 minutes of baseline recording before and after an event
- Documents seizure/event clinical behavior, time, and date
- Documents neuroassessment completion and time
- Scores event as "real" or artifactual and selects these for physician review and interpretation
- Documents LTME review on technical worksheet including:
  1. Patient identification
  2. Recording parameters and system integrity check

3. Electrode placement including additional electrodes, input descriptors
4. Diagram of implanted electrodes
5. Patient room and equipment used
6. Any system malfunction and troubleshooting steps
7. Mapping parameters and findings
8. Medication dosages and when anticonvulsants were tapered off or any other changes
9. Clinical events, times, behavioral correlates, patient assessment

- Transfers data between local and network drives from acquisition to review station for data review and permanent storage
- Archives selected portions, such as patient events, for permanent storage
- Prepares a master tape of video and electrographic data
- Prints out and labels all events based on facility policy and procedures
- Prepares a "monitoring report" [shift report] for review by staff taking care of patient during the course of the LTME, summarizing number of events, types of events, special studies needed, precautions necessary, and any other relevant information
- Reviews daily chart notes regarding patient
- Interviews patient or relatives daily to determine if events occurred and any unusual clinical behavior to confirm sensitivity of event detection system.

When the LTME procedure is completed, the LTME technologist:
- Disconnects patient from monitoring equipment, removes scalp electrodes from patient, and cleans scalp noting and taking care of any skin breakdown
- Cleans electrodes and patient equipment
- Replenishes and maintains adequacy of supplies for LTME procedure
- Stores equipment, making it ready for the next procedure.

Section III: Other Associated LTME Practice Statements

Bedside or Intraoperative Localization of Language and Sensorimotor Cortex:
- Assists the physician during motor mapping to identify specific areas of motor function
- Observes the patient carefully and documents movement or sensation during cortical mapping
- Identifies and reports the presence of after-discharges during cortical stimulation
- Assists in accurate localization of the language and sensorimotor cortex or memory areas
- Prepares the equipment for cortical mapping:
  1. Selects and verifies current intensities for mapping
  2. Documents intensities used and results of stimulation
  3. Notes thresholds for after-discharges
  4. Calibrates EEG equipment prior to recording
  5. Selects appropriate timebase, sensitivity and bandpass setting to record after-discharges.

Cortical Recording in the Operating Room [ECoG]:
- Prepares patient for electrocorticography [ECoG] by explaining recording procedure and applying appropriate reference/ground electrodes

- Calibrates and sets up EEG recording equipment using appropriate filters and sensitivity settings
- Selects montages based on electrodes applied to cortex by the neurosurgeon before and during resection
- Identifies and troubleshoots artifacts encountered during the recording
- Maintains and ensures completeness of supplies used for ECoG
- Documents electrographic findings during the recording, completing paperwork for submission to the clinical neurophysiologist.

The Wada Test:
- Prepares equipment and supplies needed for recording in the special procedure;
- Applies electrodes using the International 10–20 System or modified 10–10 system of electrode placement based on ACNS guidelines
- Runs a 10-minute baseline with appropriate montage and filter settings
- Makes notations on the recording as to the time of the injection of medicine, behavioral correlates and any other changes observed during the procedure
- Informs the neuroscience team of the initial change on EEG with injection of medicine, and the return to baseline
- Completes all paperwork associated with the Wada testing procedure.

Home Ambulatory 24-hour EEG:
- Prepares equipment
- Prepares and educates patient on procedure:
    1. Applies electrodes with collodion technique
    2. Explains take-home diary, event button, and computer
    3. Wraps head or has patient bring hat, scarf for travel home
    4. Explains safety precautions
- Upon patient's return to the laboratory:
    1. Removes electrodes and cleans scalp
    2. Correlates patient diary and verbal 24-hr history with acquired data
    3. Identifies events detected and those signaled by patient
    4. Identifies artifacts.
    5. Prints events and transfers event data for review and interpretation by clinical neurophysiologist.

SPECT Scan:
[Understands radiation safety]
- Informs staff assigned to inject radioisotope that a seizure is occurring
- Documents injection of radioisotope
- Disconnects equipment so patient can have the SPECT procedure
- Reconnects EEG recording equipment after SPECT scan.

* Critical test results – any values/interpretations where delays in reporting may result in serious adverse outcomes for patients. MA Coalition for Prevention of Medical Errors; www.macoalition.org/document/CTRPractices.pdf

-- Approved by ASET Board of Trustees April 2011