Minimum Requirements for Computerized Tomography (CT) Operators:
(As of January 30, 2006)

Part 2 of the *Colorado Rules and Regulations Pertaining to Radiation Control* RH 2.6.1.7 states:

2.6.1.7 For computed tomography systems used on living humans, "adequately trained" shall mean that the individual has met the requirements of Appendix 2E by:

(1) Being an ARRT-registered radiologic technologist who is also either ARRT-registered in computed tomography or has met the requirements of Section 2E.2.2 in Appendix 2E; or

(2) Being certified in computed tomography by a specialty board recognized by the Department, including or in combination with training accepted by the Department.

Appendix 2E states:

PART 2, APPENDIX 2E:
COMPUTED TOMOGRAPHY (CT)
ADEQUATE RADIATION SAFETY TRAINING AND EXPERIENCE

The registrant shall require each computed tomography operator to be an individual at least 18 years of age who:

2E1 Is certified:
- 2E1.1 As ARRT(R) and also certified in computed tomography by ARRT; or
- 2E1.2 As ARRT(N) or ARRT(T); or
- 2E1.3 As CNMT by the Nuclear Medicine Technologist Certification Board; or
- 2E1.4 By a specialty board that has been recognized by the Department, including or in combination with documentation accepted by the Department for the training required by 2E2A through 2E2L; or

2E2 Is ARRT(R) and also has satisfactorily completed:

[Elements of the following are from the July 2004 *Content Specifications For The Examination In Computed Tomography* and used with ARRT permission.]

2E2.1 At least 60 hours of didactic training providing the minimum hours of instruction in the specific subjects listed in 2E2A through 2E2L:

2E2A IV Procedures—2 hours
1. Venipuncture
   a. Site selection
   b. Aseptic and sterile techniques
2. Injection techniques
   a. Manual
   b. Automatic
      (1) Single phase
      (2) Multi-phase
      (3) Flow rate

2E2B Contrast Agent—6 hours
1. Types
   a. Ionic
   b. Non-ionic
   c. Water soluble
   d. Air
   e. Water
2. Administration route and dose calculations
   a. IV (angiocatheter or butterfly)
   b. Oral
   c. Rectal
   d. Intrathecal
   e. Catheters
3. Special considerations
   a. Allergy preparation
   b. Pathologic processes
   c. Contraindications
   d. Indicators
4. Adverse reactions
   a. Recognition and assessment of symptoms
   b. Treatment (e.g., compresses, medications)
   c. Documentations

2E2C Radiation Safety and Dosimetry—6 hours
1. Technical factors affecting patient dose
2. Radiation protection
3. CT Dose Index (CTDI) / Multiple Scan Average Dose (MSAD)
4. Pediatric dose reduction

2E2D Type of Study (24 hours; 1 hour for each topic—2E2E, 2E2F, 2E2G and 2E2H—for each type of study)
1. Head
2. Neck
3. Chest
4. Abdomen
5. Pelvis
6. Musculo-skeletal

2E2E Sectional Anatomy (for each type of study)
1. Sagittal plane
2. Transverse plane (axial)
3. Coronal plane
4. Off-axis (oblique)
5. Landmarks
6. Pathology recognition

2E2F Contrast Media (for each type of study)
1. Types of agents
2. Indications
3. Contraindications

4. Dose calculation
5. Administration route
6. Scan/prep delay

2E2G Scanning Procedures (for each type of study)
1. Positioning
2. Scout
3. Acquisition methods (e.g., spiral, non spiral, dynamic, multi-row detector)
4. Parameter selection (e.g., slice thickness, mA, time, algorithm, pitch)
5. Protocol modification for pathology or trauma

2E2H Special Procedures (for each type of study)
1. 3-D studies
2. Biopsies
3. Radiation therapy planning
4. Drainage and aspiration
5. Post-myelography
6. CT arthrography and angiography
7. Cardiac gating

2E2I Systems Operation and Components—4 hours
1. Tube
2. Detector (single row and multi row)
3. Collimation
4. Computer and array processor
5. Equipment maintenance

2E2J Image Processing & Display—10 hours
1. Image reconstruction
    a. Filtered back projection reconstruction
    b. Reconstruction filters (algorithms)
    c. Raw data vs. image data
    d. Prospective / retrospective reconstruction (single and multi-row)
    e. Effective slice thickness
    f. Reconstruction interval
2. Image display
    a. Pixel, voxel
    b. Matrix
    c. Image magnification
    d. Field of view (scan, reconstruction and display)
    e. Attenuation coefficient
    f. CT number
    g. Window level, window width
    h. Plane specification (X, Y, Z coordinates)
    i. ROI (single and multiple image)
3. Post-processing
    a. Multiplanar reformation

b. 3 D rendering (MIP, SSD, VR)
c. Quantitative measurements (volume, distance, diameter)

4. Data management
   a. Hard copy
   b. Storage / archive
   c. Electronic transmission

2E2K Image Quality—4 hours

1. Spatial resolution
2. Contrast resolution
3. Noise
4. Quality assurance procedures

2E2L Artifact Recognition and Reduction—4 hours

1. Beam hardening
2. Partial volume averaging
3. Motion
4. Metallic
5. Edge gradient
6. Patient positioning
7. Equipment-induced
   a. Rings
   b. Streaks
   c. Tube arcing
   d. Cone beam; and

2E2.2 At least 480 hours of clinical training during which time computed tomography examinations are performed only under direct supervision of an ARRT(N), ARRT(R)(CT), ARRT(T) or CNMT computed tomography operator or other qualified trainer:

2E2.2.1 "Direct supervision" means the supervisor must be present in the facility and immediately available to furnish assistance and direction throughout the performance of a procedure. The supervisor is not required to be present in the room when the procedure is performed.

2E2.2.2 A signed statement by the individual(s) who provided supervision and evaluation shall be kept on file to document dates and locations of clinical training; and

2E2.3 Documented performance of the following imaging procedures (at least 60 examinations in total, with record of each examination kept on file):

2E2.3.1 Head—10 examinations
2E2.3.2 Neck—10 examinations
2E2.3.3 Chest—10 examinations
2E2.3.4 Abdomen—10 examinations
2E2.3.5 Pelvis—10 examinations
2E2.3.6 Musculo-skeletal—10 examinations