In accordance with the ALARA principle, TRA policies and protocols promote the utilization of radiation dose reduction techniques for all CT examinations. For scanner/protocol combinations that allow for the use of automated exposure control and/or iterative reconstruction algorithms while maintaining diagnostic image quality, those techniques can be employed when appropriate. For examinations that require manual or fixed mA/kV settings as a result of individual patient or scanner/protocol specific factors, technologists are empowered and encouraged to adjust mA, kV or other scan parameters based on patient size (including such variables as height, weight, body mass index and/or lateral width) with the goals of reducing radiation dose and maintaining diagnostic image quality.

If any patient at a TRA-MINW outpatient facility requires CT re-imaging, obtain radiologist advice prior to proceeding with the exam.

The following document is an updated CT protocol for all of the sites at which TRA-MINW is responsible for the administration, quality, and interpretation of CT examinations.

Include for ALL exams
- **Scout:** Send all scouts for all cases
- **Reformats:** Made from thinnest source acquisition
  - **Scroll Display**
    - Axial recons - Cranial to caudal
    - Coronal recons - Anterior to posterior
    - Sagittal recons - Right to left
  - Chest reformat should be in separate series from Abdomen/Pelvis reformat, where applicable
- **kVp**
  - 100 @ <=140lbs
  - 120 @ >140lbs
- **mAs**
  - Prefer: Quality reference mAs for specific exam, scanner and patient size
  - Auto mAs, as necessary
CT Chest HRCT
CT Chest WO

**Indication:** Interstitial lung disease, chronic progressive dyspnea/shortness of breath, bronchiectasis, abnormal PFTs, history of connective tissue/rheumatologic disorder, etc.

Note: If routine chest CT has been performed within 1 week, please contact body/chest radiologist to discuss if supine inspiration series should be acquired

See below for detailed breathing instructions. Following breathing instructions exactly is critical for this examination.

**Patient Position:**
- Supine: Inspiration and expiration, feet down with arms above head
- Prone: Inspiration, feet down with arms above head

**Scan Range (CC z-axis):** Lung apices through L1

**Prep:** No solids (liquids OK) for 3 hours prior to examination
- Note: Okay to continue examination if prep is incomplete or not done

**Oral Contrast:** None

**IV Contrast:** Not applicable

**Acquisitions:** 3 (multiple non-contrast positions/breath-holds – see instructions below)
- **Non-contrast chest supine inspiration** → Helical acquisition with pitch as follows:
  - GE → pitch of 1.375
  - Siemens 64 Sensation → pitch of 0.8
  - Siemens 16 Sensation → pitch of 1.0
  - Siemens 16 Emotion → pitch of 0.8
  - Toshiba 64 Aquilion → pitch of 1.484
- **Non-contrast chest supine expiration**
- **Non-contrast chest prone inspiration**

**Breathing instructions** MUST be followed to ensure diagnostic quality HRCT images
- This is especially CRITICAL for adequate end-expiratory images.
- Use the below instructions verbatim.
  - **Inspiration:**
    1. Take a deep breath in, breath out (2 second delay)
    2. Take a deep breath in, hold it
    3. Scan immediately at end-inpiration
  - **Expiration:**
    1. Take a deep breath in, blow it out (2 second delay)
    2. Take a deep breath in, now blow all your air out (1 second), keep exhaling (1 second), blow all the air out, now stop breathing
    3. Scan immediately at end-exhalation
Series + Reformats:

1. Non-contrast chest supine inspiration
   a. Axial 2-2.5 mm ST kernel
   b. Axial 1-1.5 mm lung kernel
   c. Axial 10 x 2 mm MIP ST kernel
   d. Coronal 2 mm ST kernel
   e. Sagittal 2 mm ST kernel
   f. Axial 1.25 x 1 mm ST kernel (SuperD where doable)

2. Non-contrast chest supine expiration
   a. Axial 1-1.25 mm thickness with 20 mm intervals in lung kernel

3. Non-contrast chest prone inspiration
   a. Axial 1-1.25 mm thickness with 20 mm intervals in lung kernel

**SuperD series should be sent on all scanners capable of creating this series**

***Machine specific protocols are included below for reference***

Machine specific recons (axial ranges given above for machine variability):

*Soft tissue (ST) Kernel, machine-specific thickness (axial):
  - GE = 2.5 mm
  - Siemens = 2 mm
  - Toshiba = 2 mm

*Lung Kernel, machine-specific thickness (axial)
  - GE = 1.25 mm
  - Siemens = 1.2 mm or 1.5 mm on older generation
  - Toshiba = 1 mm
General Comments

NOTE:
Use of IV contrast is preferred for most indications aside from: pulmonary nodule follow-up, HRCT, lung cancer screening, and in patients with a contraindication to iodinated contrast (see below).

Contrast Relative Contraindications

- **Severe contrast allergy**: anaphylaxis, laryngospasm, severe bronchospasm
  - If there is history of severe contrast allergy to IV contrast, avoid administration of oral contrast
- **Acute kidney injury (AKI)**: Creatinine increase of greater than 30% over baseline
  - Reference hospital protocol (creatinine cut-off may vary)
- **Chronic kidney disease (CKD) stage 4 or 5** (eGFR < 30 mL/min per 1.73 m²) **NOT** on dialysis
  - Reference hospital protocol

Contrast Allergy Protocol

- Per hospital protocol
- Discuss with radiologist as necessary

Hydration Protocol

- For eGFR 30-45 mL/min per 1.73 m²: Follow approved hydration protocol

IV Contrast (where indicated)

- Isovue 370 is the default intravenous contrast agent
  - See specific protocols for contrast volume and injection rate
- If Isovue 370 is unavailable:
  - Osmolality 350-370 (i.e., Omnipaque 250): Use same volume as Isovue 370
  - Osmolality 380-320 (i.e., Isovue 300, Visipaque): Use indicated volume + 25 mL (not to exceed 125 mL total contrast)

Oral Contrast

- Dilutions to be performed per site/hospital policy (unless otherwise listed)
- Volumes to be given per site/hospital policy (unless otherwise listed)
- TRA-MINW document is available for reference if necessary (see website)

Brief Summary

- **Chest only**
  - Chest W, Chest WO
  - CTPE
  - HRCT
  - Low Dose Screening/Nodule
  - None
- **Pelvis only**
  - Pelvis W, Pelvis WO
    - Water, full instructions as indicated

- **Routine, excluding chest only and pelvis only**
  - Abd W, Abd WO
  - Abd/Pel W, Abd/Pel WO
  - Chest/Abd W, Chest/Abd WO
  - Chest/Abd/Pel W, Chest/Abd/Pel WO
  - Neck/Chest/Abd/Pel W, Neck/Chest Abd Pel WO
  - CTPe + Abd/Pel W
    - TRA-MINW offices: Dilute Isovue-370
    - Hospital sites:
      - ED: Water, if possible
      - Inpatient: prefer Dilute Isovue 370
        - Gastrografin OK if Isovue unavailable
        - Avoid Barium (Readi-Cat)
      - FHS/MHS Outpatient: Gastrografin and/or Barium (Readi-Cat)

- **Multiphase abdomen/pelvis**
  - Liver, pancreas
    - Water, full instructions as indicated
  - Renal, adrenal
    - None

- **CTA abdomen/pelvis**
  - Mesenteric ischemia, acute GI bleed, endograft
    - Water, full instructions as indicated

- **Enterography**
  - Breeza, full instructions as indicated

- **Esophogram**
  - Dilute Isovue 370, full instructions as indicated

- **Cystogram, Urogram**
  - None

- **Venogram**
  - Water, full instructions as indicated