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 reformats should be in separate series from Abdomen/Pelvis reformats, 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 Low Dose Nodule Follow-up
CT Chest WO

Indications:

Low Dose Nodule Follow-up – “Pulmonary nodule follow-up” in clinical indication WITH prior chest CT available for comparison, prior radiologist reports recommends low dose non-contrast chest CT, LungRads 3 and 4A on prior report from lung cancer screening CT

**Please see table at end of this protocol for questions regarding Lung Cancer Screening CT (LDCT) follow-up guidelines for use of Lung Cancer Screen Protocol versus Low Dose Nodule Follow-up**

Patient Position: Supine, 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: 1 (non-contrast)

- Non-contrast chest (low dose)
  - Low dose technique – CTDI vol <= 3 mGy
    - kVp: 100-140
    - mAs: set in combination with kVp to meet CTDI vol dose limit
  - Single breath, full inspiration

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

Series + Reformats:

1. Non-contrast chest (low dose)
   a. Axial 2-2.5 mm ST kernel
   b. Axial 1.2-1.5 mm lung kernel
   c. Axial 10 x 2 mm MIP ST kernel
   d. Coronal 2 mm ST kernel
   e. Sagittal 2 mm ST kernel

- Machine specific recons:
  - Soft tissue (ST) Kernel, machine-specific thickness:
    - GE = 2.5 mm
    - Siemens = 2 mm
    - Toshiba = 2 mm
  - Lung Kernel, machine-specific thickness
    - GE = 1.25 mm
    - Siemens = 1.2 mm (or 1.5 mm on older generation)
- Toshiba = 1.5 mm

Source(s):
https://www.acr.org/~/media/99D260410DF44A3BA01F1AB716DE8F2F.pdf
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
    o 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
    o TRA-MINW offices: Dilute Isovue-370
    o 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
    o Water, full instructions as indicated
  ✓ Renal, adrenal
    o None

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

• **Enterography**
  o Breeza, full instructions as indicated

• **Esophogram**
  o Dilute Isovue 370, full instructions as indicated

• **Cystogram, Urogram**
  o None

• **Venogram**
  o Water, full instructions as indicated
Low Dose Lung Cancer Screening CT Chest should only be performed every 12 months.

Please call radiologist if less than 12 months between requested screening exams.

<table>
<thead>
<tr>
<th>Description</th>
<th>LungRADS Category</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete</td>
<td>0</td>
<td>Additional/repeat lung cancer screening CT and/or comparison to prior chest CT examination is needed</td>
</tr>
<tr>
<td>Negative (no nodules or definitely benign nodules)</td>
<td>1</td>
<td>Continue annual screening with <strong>Low Dose Lung Cancer Screen CT Chest</strong> non-contrast in 12 months</td>
</tr>
<tr>
<td>Benign appearance or behavior</td>
<td>2</td>
<td>Continue annual screening with <strong>Low Dose Lung Cancer Screen CT Chest</strong> non-contrast in 12 months</td>
</tr>
<tr>
<td>Probably benign</td>
<td>3</td>
<td>6 month <strong>Low Dose Nodule Follow-up CT Chest</strong> non-contrast**</td>
</tr>
<tr>
<td>Suspicious</td>
<td>4A</td>
<td>3 month <strong>Low Dose Nodule Follow-up CT Chest</strong> non-contrast <strong>PET/CT may be used if solid component ≥ 8 mm.</strong></td>
</tr>
<tr>
<td></td>
<td>4B</td>
<td><strong>Routine CT Chest</strong> contrast or non-contrast**, PET/CT, and/or tissue sampling.</td>
</tr>
<tr>
<td>Significant finding modifier</td>
<td>S</td>
<td>Schedule as indicated by radiologist in prior report</td>
</tr>
<tr>
<td>Prior lung cancer modifier</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

Note: PET/CT may be used if solid component ≥ 8 mm.