Chain Saw Safety

Robert A. Schultheis
Natural Resource Engineering Specialist

National Statistics - Chain Saws
- 40,000+ injuries by chain saws in U.S. annually
- Average chainsaw injury requires 110 stitches
- Average medical cost was $5,600 in 1989; $12,000 in 2000
- Total medical costs = $350 million in 2000
- Workman’s comp. costs = $125 million per year
  - Based on four weeks recovery time
- Largest cost (not included) = Loss of production & quality of life for the injured

Source: Consumer Product Safety Commission, and Davis Garvin Agency, insurance underwriter for loggers

Where are the Injuries?
- Cuts to legs, feet, hands, arms & shoulders
- Head injuries from falling limbs or tree debris
- Eye injury from flying objects such as sawdust & debris
- Hearing loss from prolonged exposure to saw noise

Source: U.S. Consumer Products Safety Commission
Photo credit: www.elvex.com/facts08.htm

Where are the Injuries?

Where are the Injuries?

Four Steps to Injury Prevention
- Prepare Yourself
- Saw Selection
- Prepare the Saw
- Starting and Operating Techniques
- Felling the Tree
- Limbing the Tree
- Bucking the Log
- Kickback Safety Tips
- Key Safety Tips
- Transport and Storage of the Chain Saw

Steps to Safe Chain Saw Operation

CAUTION
THIS MACHINE HAS NO BRAIN USE YOUR OWN
**Prepare Yourself**

- Read the operator’s manual
- Consider training from one experienced with chain saws
- Good physical & mental condition
- No medications or alcohol
- Proper protective gear

**Reaction Time vs. Distance**

Chain moves at 40-55 MPH (60-80 feet per second = 600 teeth per sec.)

<table>
<thead>
<tr>
<th>Time (sec.)</th>
<th>PTO @ 540 rpm</th>
<th>PTO @ 1000 rpm</th>
<th>Tractor @ 20 mph</th>
<th>Object Thrown by 21” Mower</th>
<th>Chain Saw @ full throttle</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>2.1</td>
<td>3.9</td>
<td>9</td>
<td>89</td>
<td>20</td>
</tr>
<tr>
<td>0.5</td>
<td>3.5</td>
<td>6.5</td>
<td>15</td>
<td>156</td>
<td>33</td>
</tr>
<tr>
<td>0.7</td>
<td>4.9</td>
<td>9.2</td>
<td>21</td>
<td>218</td>
<td>46</td>
</tr>
<tr>
<td>1.0</td>
<td>7.1</td>
<td>13.1</td>
<td>29</td>
<td>312</td>
<td>66</td>
</tr>
</tbody>
</table>

**Chain Saw Protective Gear**

- Clothing
  - Well-fitted, consider nylon mesh (ANSI F1414)
  - Hard hat (ANSI Z89.1 1986)
  - Safety goggles or glasses, plus a face screen (ANSI Z87.1 1969)
  - Ear muffs or ear plugs
  - Safety boots or high-top leather shoes
    (ANSI F1448 or ASTM F2413-05)
  - Ballistic nylon or leather gloves

**Chain Saw Protective Gear**

- Ballistic nylon chaps, $80
- Ballistic nylon vest, $80
- Hard hat with NR22 ear muffs & face screen, $40

**Chain Saw Protective Gear**

See 4:18 min. video of protective gear
Chain Saw Safety Training - Springfield, MO

Chain Saw = 110 dB Sound Level

<table>
<thead>
<tr>
<th>Duration (hours/day)</th>
<th>Sound Level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>90</td>
</tr>
<tr>
<td>4</td>
<td>95</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>105</td>
</tr>
<tr>
<td>1/2</td>
<td>110 (circled)</td>
</tr>
<tr>
<td>1/4 or less</td>
<td>115</td>
</tr>
</tbody>
</table>

Source: OSHA Noise Standard

Hearing Loss Indicators
- Do you have trouble hearing when two or more people are talking?
- Do you have trouble hearing over the telephone?
- Do others complain you turn the TV volume up too high?
- Do you strain to understand conversations?
- Do you have trouble hearing if the background is noisy?
- Do you frequently ask people to repeat themselves?
- Do you think people mumble frequently?

Rule of Thumb:
If you need to raise your voice to be heard an arm’s length away, the noise is loud enough to damage your hearing.

Noise-Induced Hearing Loss

 Wear Appropriate Hearing Protection

Chain Saw Selection - Electric
- Indoor or outdoor use
- Needs nearby electric power or rechargeable batteries
  - Use heavy-duty, 3-wire, outdoor extension cord; 100 ft. cord limit
- No fuel = no exhaust fumes
- Starts easily & instantly; runs quietly; vibrates less
- Usually limited to 16” bar length
- Potential shock hazard; don’t stand in wet area
- Usually costs less

Chain Saw Selection - Gasoline
- Outdoor use only
- Usable anywhere; not limited by electric cord
- Use gasoline-oil mixture as fuel
- Relatively noisy and smoky
- Many engine & bar length choices
- Requires some effort to start
- Potential fire & burn hazard
Match Saw Bar Length to Job
- 8”-12” = light use; limbing, felling very small trees
- 12”-20” = frequent use; felling/cutting small trees
- Over 20” = heavy use by professionals

Prepare the Saw
- Preventative maintenance
  - Clean air filter
  - Proper gap on correct spark plug
  - Effective muffler (900 °F)
- Check safety features for proper operation
  - Chain brake
  - Anti-kickback chain
  - Safety tip on bar end
  - Vibration-reduction bushings
  - Automatic chain oiling
  - Trigger or throttle lockout

Prepare the Saw
- Wear gloves or cover chain with heavy rag when sharpening saw teeth
- Sharpen chain if...
  - it "walks" sideways under power
  - produces fine powder instead of chips
  - must press hard to improve cutting
- Tension chain to avoid binding/derailing
  - 1/32” chain gap if cold
  - 1/8” chain gap if hot
- Regular chain lubrication extends life & maintains tension

Saw Maintenance Tools
- Owners’ manual in plastic bag
- Gas-oil fuel mix stored in approved container
- Chain oil
- Round file & guide for sharpening chain
- Flat file & depth gauge to file the depth guides
- Wrenches to fit all nuts & lugs on the saw
- Screwdriver
- Extra spark plug
- Small brush to clean off sawdust & wood chips
- Cleaning rags

Supplemental Tools
**How to Carry a Chain Saw**
- Engine should be shut off
- Chain brake should be engaged
- Scabbard is covering the guide bar to prevent cuts
- Chain saw is carried backward
- Muffler away from the body to prevent burns

**Correct Starting Procedure**
- Clear loose debris away from guide bar
- Always use both hands; no “drop-starting”
- Brace firmly on ground to start saw
- Engage chain brake
- Grip front handle with left hand

**How to Hold & Operate a Chain Saw**
- Wrap thumbs firmly around both handles
- Right hand should be firmly on the rear handle, so you can reach throttle latch & stop switch
- Never force the saw through a cut
- Refuel engine only when cool on bare ground

**Definitions**
- Felling = cutting down the tree
- Limbing = removing branches from fallen tree
- Bucking = cutting a log into sections

**Felling the Tree**
- "Read" the tree before felling
  - Clear of people, power lines, vehicles & other trees
  - Pre-plan unobstructed escape paths at 45° retreat angle
- Notch depth should be 20% of the tree diameter
Felling the Tree:
- Make the notch cut, then the felling cut
- Leave 10% of the wood for a hinge
- Shut off and leave saw before retreating

Watch Out for Dangerous Trees:
- “Widowmaker”
  - A tree with broken or dead limbs or a dead tree hung up in another tree
- “Spring pole”
  - A sapling bent and held under tension by another tree
- “Schoolmarm”
  - A tree with a prominent fork in the trunk, which makes it difficult to predict which way it will fall

Limbing the Tree:
- Don’t saw above shoulder height
- “Look beyond” limb you cut for kickback hazards
- Keep limb between you & the saw, when possible
- Stay out of chain path

Bucking the Log:
- Check log “support points” before cutting
- Stay uphill from a tree on a slope to avoid rolling log
- Stay out of chain path

Pruning Standing Trees:
- Do not flush cut
- Do not leave stubs
- Use three-step method
- No wound dressing
  - Except oaks
- Use hand tools
- Ideal time = winter
  - Not oaks in mid-March through June due to oak wilt

Pruning Standing Trees:
- Avoid pruning limbs >2” diameter
- Avoid pruning limbs >½ the main stem diameter
- Avoid removing >¼ of the total live crown
- Prune a little each year instead
Causes of Saw Blade Kickback

- Causes 1/3 of all chain saw injuries

1. Top of chain touches limb or other object
2. Blade nose strikes another object
3. Top of blade nose touches bottom or side of kerf during reinsertion

Kickback Safety Tips

- Keep a firm, two-hand grip on the saw with left arm locked
- Saw only with the bottom part of the chain
- Never cut with the nose of the chain
- Use a high chain speed
- Saw only at waist level and below
- Keep the chain properly sharpened & tensioned
- Use a saw with a chain brake, anti-kickback chain, and nose guard (when possible)

Key Safety Tips

- Always
  - Cut with saw to the outside of your legs
  - Stand to one side of the limb you are to cut; never straddle it
  - Know where chain will go if it breaks; never put yourself or others in line with the chain
- Don’t
  - Stand on a log & saw between your feet

Small Nonroad Engine (SNRE) Definition

- Defined as:
  - Less than 25 HP
  - Used in household or light commercial application
  - 2 or 4 stroke engine
  - 1 or 2 cylinders
- Examples
  - Chain saws
  - Lawn mowers
  - Trimmers
  - Leaf blowers
  - Chippers/Shredders
  - Tillers
  - Pressure washers
  - Snow blowers
  - Generators
  - Boats
  - All-Terrain Vehicles (ATVs)
  - Many others….

SNRE – Ethanol Issues

- Gasoline
  - Hydrophobic (hates water)
  - 83-84 octane
  - 114,500 BTUs/gallon (summer)
  - 112,500 BTUs/gallon (winter)
- Ethanol
  - Hygroscopic (attracts water)
  - 100 octane
  - 76,330 BTUs/gallon
- Octane = measure of resistance to “knock” or “ping”
- 83-84 octane gas + 100 octane ethanol = 87 octane gas with ethanol (111,800 BTUs/gallon)
- Up to 10% blend (E10) in gas for general use
  - Some Missouri gas pumps have measured E15-E17 = illegal
- Ethanol is a mild solvent
  - Cleans deposits, clogs filters, swells natural rubber, dissolves fiberglass

SNRE – Ethanol Issues

- Check the owner’s manual; most accept up to E10
- Pre-1996 engines likely to have more problems with E10 fuel
- Ethanol absorbs water
  - Avoid storing gas in tank for longer than 30 days
  - Phase separation happens with 3.8 tsp. water per gallon of E10 fuel
    - Upper gasoline layer has lower octane & volatility
    - Lower water layer has up to 75% ethanol, but burns poorly
- Maintain a sealed fuel tank
  - Humid air worse on unsealed fuel systems
  - Store indoors to prevent contact with water
Transport & Storage of the Saw

- **Transport**
  - Use saw chain guard or carrying case
  - Keep saw level with the gas cap up; secure on vehicle
  - Avoid carrying in vehicle’s passenger area

- **Storage**
  - Drain fuel tank & run engine at idle until it stops
  - Especially with fuel containing ethanol (phase separation)
  - Remove chain & store it in a container of oil
  - Disconnect spark plug on gasoline models
  - Follow owner’s manual for cleaning & lubrication
  - Place saw out of reach of children

When Do You Call a Professional?

- Any time a situation requires more skills than you have
- If a tree has a larger diameter than the length of the guide bar
- If the tree is dead, hollow, split, or rotten
- If there isn’t enough room to safely fell the tree, or if there is no clear escape route
- If there are any other obstacles to the tree

A Final Caution

- You are the “safety director” both on and off the job
- Do a regular safety hazard walk-around
- Get safety guidesheets from your county University of Missouri Extension Center or on the Web at [extension.missouri.edu/publications](http://extension.missouri.edu/publications)

Program Complaint Information
To file a program complaint you may contact any of the following:
- University of Missouri
  - MU Extension AA/EEO Office
  - 109 F. Whitten Hall, Columbia, MO 65211
  - MU Human Resources Office
  - 130 Heinkel Bldg, Columbia, MO 65211
- USDA
  - Office of Civil Rights, Director
  - Room 326-W, Whitten Building
  - 14th and Independence Ave., SW
  - Washington, DC 20250-9410

University of Missouri Extension provides equal opportunity to all participants in extension programs and activities, and in employment on the basis of their demonstrated ability, without discrimination on the basis of race, color, religion, sex, national origin, age, disability or status as a protected veteran.