

## Is a Quiet Chainsaw an Oxymoron?

**N**OT ANY MORE. While the quietest chainsaws are not exactly silent, we've found some that are quiet enough that the operator need not wear hearing protection, and we've found a quality saw that is quieter than the quietest gas powered lawn mower we've ever tested.

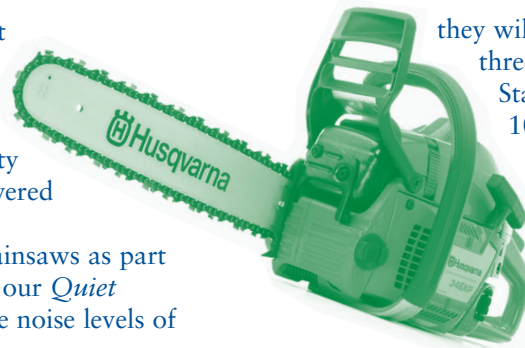
NPC is testing and promoting quieter chainsaws as part of our expanded Quiet Lawns Project. (See our *Quiet Lawns Special Report* where we examine the noise levels of more than 70

lawnmowers.) As we expand the number and types of lawn equipment tested, we are starting with chainsaws, because for years the chainsaw has been the poster child for noise. By showing that chainsaws can be quieted, we show that almost anything can be quieted.

Secondly, we're testing chainsaws because we want to balance our projects between rural, suburban, and urban noise. Testing chainsaws expands the scope of our Quiet Lawns Project to rural areas, since chainsaws have a significant impact on the rural soundscape.

Finally, we're testing chainsaws because they are no longer solely the tools of lumberjacks and loggers. Chainsaws are found in more and more garages; their noise is found in more and more neighborhoods. There are probably more than 30 million chainsaws used in the US. More than three million chainsaws are sold in the US each year. The National Gardening Association reports that 5.7 million new and used chainsaws were sold last year. If there aren't any chainsaws in your neighborhood right now,

*Chainsaws are coming out of the woods. In fact, most of the three million-plus chainsaws sold this year will never see the woods, let alone travel more than a couple hundred feet from the garage.*



they will be coming soon. There aren't three million loggers in the United States; there are slightly more than 100 million households in the United States. The people buying chainsaws today don't need gas saws. There is no reason electric chainsaws, which are currently about 10% of the market, couldn't be 80% of the market.

The demand for chainsaws will continue to increase as more and more homeowners are using them for lawn maintenance and clean-up. In addition, with oil prices at the highest levels since the energy crises of the 1970s, many households are turning or returning to wood as an energy source. Newer EPA certified stoves which burn much cleaner than the older ones and the fact that wood is a renewable fuel with no net carbon dioxide emissions are also driving this trend. The increased demand for chainsaws, combined with falling prices for chainsaws, make their noise which was once limited to wooded rural areas, now much more common in suburbs too.

### Chainsaw Safety and Hearing Protection Often Forgotten

Chainsaws are a remarkably powerful tool, but they come with a number of drawbacks, and noise is just one of them. A chainsaw in the hands of a careless, inexperienced, or tired operator can be very dangerous. Approximately 28,000 to 40,000 people per year require emergency treatment for injuries from using chainsaws. So we are beginning our report on chainsaw noise with a brief look at chainsaw safety and hearing health, because the best way to quiet a neighborhood is to get the people who shouldn't be using a chainsaw in the first place not to use them.

The graphic from the Consumer Products Safety Commission (CPSC) shows chainsaws can cut up flesh as well as wood. And when a moving chain meets a human-being, the results are not small flesh wounds. Chainsaw



wounds require an average of 110 stitches. Hearing loss from chainsaws, since it does not result in a trip to the emergency room, is not reported on this graphic. Fatalities are not reported either. As you look at the graphic, remember that both hearing loss and fatalities do occur.

Gas powered chainsaws measured by NPC ranged from 106 to 117 dBA at the operator's ear. The EPA and World Health Organization recommend daily unprotected exposure to 106 decibels be less than 23 seconds; to 117 decibels, less than 2 seconds (assuming no other noise exposure for the rest of the day). Not a lot of wood can be cut in 2 seconds, or even 23 for that matter. Chainsaws have been the poster child of noise because they have been very, very loud.

Electric chainsaws (excluding battery powered ones) ranged from 90 to 102 dBA at the operator's ear. The Noise Pollution Clearinghouse recommends the use of hearing protection be used when 85 dBA is exceeded for any extended period of time. Although the electric chainsaws have significantly lower community noise levels, the short distance between the saw and the person's ear, compared to a lawnmower, for example, where the engine is five to six feet away, makes hearing protection necessary.

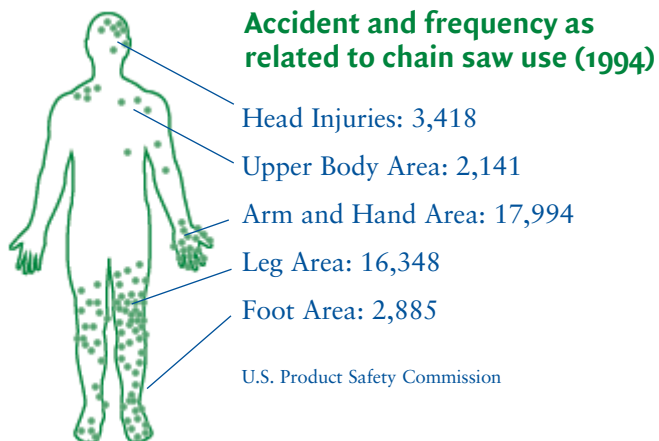
Fatalities from chainsaws themselves are less common than fatalities due to trees or branches striking the chainsaw operator. According to a Minnesota study "90 percent of the chainsaw deaths resulted from trees or branches falling on operators as they used a chainsaw." Nevertheless, the scientific literature on the subject contains graphic depictions and photos of chainsaw kickback injuries to the neck, severing carotid and jugular blood vessels and resulting in fatalities.

The chainsaw is actually cheap compared to the full cost of proper safety attire for chainsaw operation. The total cost of a chainsaw safety package is \$350-\$400 (10 times the cost of the cheapest saws we tested, twice as much as the best electric saw we tested, and equivalent to a high-end gas powered saw). One very important reason chainsaw noise is becoming more common is that people are purchasing the relatively cheap chainsaw and not the necessary safety items. No one should be operating a chainsaw, quiet or noisy, without the following. Included in the list are a number of chainsaw safety products we tested and liked:

- **Proper training on how to use the equipment.**
- **Head, Hearing, Face Protection**— a hardhat, combined with a mesh visor or shield and earmuffs ( earmuffs are preferable to earplugs because they also provide some protection to the outer ear). We used three hardhat/ screen/ earmuff combinations. When it comes to hearing protection, we recommend you select the most comfortable quality hardhat/hearing protection combination. That will change from individual to individual. The most important thing about hearing protection is that it be worn. If additional hearing

protection is needed for very loud noises, earplugs can be worn with earmuffs for double protection.

- Elvex ProGuard CU-20R— \$48.
- Husqvarna Pro Forest Helmet System— \$50.
- Peltor Logger— \$50.
- **Eye Protection**—safety glasses with wrap-around lenses or side shields (the mesh visor on the helmet is face protection but not eye protection).
  - Goggles— \$5.
- **Upper Body Protection**—cut resistant ballistic nylon or Kevlar lined vest or shirt.
  - ProVest JE-50— Lightweight, well ventilated, and comfortable. \$78
- **Leg Protection**—either safety pants that have cut resistant ballistic nylon or Kevlar sewn into the whole front of the pants or chaps that have cut resistant ballistic nylon or Kevlar leg pads that strap over work pants.
  - Elvex ProChaps JE-9436— \$100.
  - Husqvarna Pro Forest Wrap Chaps —We liked the Husqvarna chaps slightly more than the Elvex because they wrapped around the lower leg. Otherwise they were very similar, and Elvex makes chaps that do wrap around the lower leg too. \$90.
- **Foot Protection**—boots with a steel toe, non slip soles, and Kevlar protection in the front similar to safety pants or chaps.
  - Cove Chainsaw Boot is a very comfortable Kevlar-lined, steel toed work boot. The Kevlar lining is very important because foot injuries tend to occur right behind the steel toe of traditional work boots. \$300, although Kevlar lined boots are available for about \$150.
- **Hand Protection**—chainsaw gloves or mitts to protect hands from injury; they should have added safety padding on the back of the left hand.



- Husqvarna’s work gloves with Kevlar padding worked quite well. \$20.
- **Shock protection for electric chainsaws—** Ground Fault protected extension cord. \$36.

It is important to remember that chainsaw safety equipment is like seatbelts to a car. The equipment doesn’t mean that accidents and injuries won’t happen, just as seatbelts don’t mean car accidents and injuries won’t happen.

Tree work is among the most hazardous professions, according to John Ball, Professor of Forestry, South Dakota State University. “You are three times more likely to be killed on the job as a tree worker than as a police officer or firefighter. The odds of being killed or seriously injured in any year are about one in 120.” That is for an industry where workers are professionals covered by OSHA regulations and insurance requirements concerning protective clothing, procedures, and training.

Homeowners generally lack the training, experience, and safety equipment of the professional. There won’t be three million chaps, hardhats with visors and earmuffs, vests, and boots sold this year. And it is unfortunate. Using a chainsaw requires hearing protection, eye protection, head protection, upper body protection, leg protection, foot protection, and hand protection.

## The Advantages and Limitations of Electric Chainsaws

The quietest chainsaws are electric. Electric saws don’t have the same cutting speed of high performance gas powered ones, and are of little use to the logger in the woods. They are ideal, however, for the homeowner who occasionally uses a chainsaw. The more powerful electric chainsaws are also sufficient for people seeking to cut (buck up) their own firewood. They are in general 10 decibels quieter than gas powered chainsaws, or half as loud, with some being 20-30 dBA quieter, or 1/4 to 1/8 as loud.

Most residential uses of chainsaws are an extension cord away from an electric outlet. Residential uses are infrequent enough that a slower cutting electric chainsaw is quite sufficient. And running an extension cord is much less inconvenient than driving to the gas station for gas, the hardware store for oil, mixing the two, and spilling some of each on your newly recoated driveway.

Electric chainsaws also are much cleaner and environmentally friendly than gas powered ones, in terms of noise, other pollutants, and energy use. That gas and oil spilled onto the driveway will add to the volatile organic compounds (VOCs) in our atmosphere. Two-cycle engines like those on chainsaws, trimmers, and leafblowers are among the dirtiest internal combustion engines, emitting large amounts of unburned gas and oil. Carbon monoxide, toxins, carcinogens, and greenhouse gases are all emitted by two-cycle engines.

In addition to harming the environment, these pollutants directly impact the operator, who is basically working with his or her face near the exhaust stream of an internal combustion engine. In 1999-2000, the National Institute of Occupational Safety and Health (NIOSH) investigated the exposure of foresters to chainsaw exhaust at the Turnbull National Wildlife Refuge in Cheney, Washington. NIOSH investigators concluded that exposure to carbon monoxide and carboxyhemoglobin levels in foresters exceeded the limits recommended by NIOSH.

Electric chainsaws do not have emissions for the operator to inhale. Emissions related to electric chainsaws occurred at the power plant, and while power plants are not clean, they are much cleaner and more efficient than two-cycle engines, and much farther removed from the operator’s lungs. As a result, electric chainsaws can be used indoors, in workshops and basements.

Electric chainsaws have a significant weight advantage over gas powered ones, need less servicing and maintenance, are easier to use, and are less expensive. The smaller, lighter-weight electric saws are ideal for those who don’t have a logger’s biceps and forearms. Electric chainsaws are also a good choice for those who don’t religiously remove old gas

from the tank before storing the saw for long periods of time. With no spark plugs to foul or carburetors to adjust, electric chainsaws require less maintenance and less service, and start with the first pull of a finger. There’s no worry about throwing out your shoulder trying to start the electric powered chainsaw. And since electric saws often cost hundreds of dollars less than gas ones, purchasers will have lots of money to buy the needed safety equipment. Gas saws run from \$100-\$600, while electrics run from \$40-\$200.

Some of the time an electric saw saves (maintaining them, going to the gas station, and going to the repair shop for tune-ups) will be lost while cutting wood. *Consumer Reports* notes that electric saws took 2-4 times as long to cut wood as the fastest

### Electric wood splitter.

Country Home Products makes an electric 4-Ton DR® Wood Splitter remarkable for its quiet and splitting ability (there is also a 6-ton version available if you’re splitting larger diameter wood). We tested the splitter on a cord of firewood. It is much quieter than a typical gas engine, and we were very happy with its performance. It measured 59 dBA at 25 feet, one-half to one quarter as loud as a typical gas engine at the same distance. And like other electric equipment, it can be used in garages, sheds, workshops, and basements. The four-ton splitter cost about \$450.

cutting gas powered saw they tested (the Husqvarna 345 at about \$300). *Consumer Reports* did not test the fastest cutting electric chainsaws (the Husqvarna 316 and the Makita UC 4000), however. Our expert judged these superior to the low-end gas powered saws. Moreover, for the homeowner with either a high-end electric or low-end gas model, the sharpness of the chain is more important than the motor type in terms of cutting speed. Extra cutting time can complicate the noise issue if the duration of the noise outweighs the intensity of it. It is important not to purchase an electric saw that is too small for the job. Bucking up firewood, for example, requires the best electric chainsaws and the understanding that high performance is more than just cut speed, but also means not breathing toxic and carcinogenic fumes, and not blasting the neighborhood with noise.

Safety features on electric chainsaws vary (and tend to increase with cost), and NPC was unable to find good data on the safety record of electric vs. gas powered chainsaws. We also did not find good data on the issue of electric shock. All the chainsaws we tested were double insulated and UL listed. Nevertheless, NPC used a ground fault protected extension cord for all tests, which seemed like a very sensible precaution given the lack of data.

Finally, with 18" and shorter bars, electric chainsaws are not going to be used to cut large trees. Since most chainsaw related fatalities occur while cutting down trees, cutting down medium to large trees is best left to professionals anyway. In the case where a quieter electric chainsaw is used to fell a tree, a spotter's warning would more likely be heard by the operator over the noise of an electric chainsaw than a gas powered one, making the operation slightly safer.



NPC chain saw test on a farm near Hardwick, Vermont.



*The electric motor of the Husqvarna 316 (indicated by arrow), like the Makita UC4000 (not pictured), is in the handle of the saw. These saws are more powerful, quieter, and more expensive than the direct drive saws whose motors are perpendicular to the length of the saw.*

## NPC Chainsaw Test Results

NPC conducted noise tests in the winter of 2004-2005. Fifteen electric and four gas powered saws were tested. Noise levels were measured at the operator's ear to determine hearing protection recommendations, and at 25 feet to gauge the impact of the noise on the community. Each saw was also ranked in terms of the quality of its cut.

Of the chainsaws we tested, **two stand out as exceptional quality saws, and remarkably, they were also the quietest** (except for two small battery powered ones we tested): The **Husqvarna 316** was rated the quietest and the **Makita UC 4000** won the highest subjective cut rating. The Husqvarna also finished a very close second to the Makita for cut quality. The Husqvarna's 71 dBA at 25 feet was remarkable for being the quietest corded saw we tested. At 71 dBA, it was 20–30 dBA less than gas powered saws. Both of these saws were exceptional because of their cut and noise level.

The Husqvarna and Makita are of a very different design than the rest of the saws we tested. Most electric saws are direct drive, meaning an electric motor is placed on the side of the chainsaw and directly powers the chain. They look like a circular saw motor bolted onto a chainsaw. The Husqvarna and Makita use an inline (and in many cases smaller) motor in the handle of the saw. Gears direct the power to the chain. The gearing takes better advantage of the characteristics of electric motors to provide improved performance.

The inline saws have significantly less cooling fan noise than the direct drive saws. For the inline saws, the noise of the chain going around the bar is the dominant noise source, which is quite a remarkable achievement. For the direct drive saws, the dominant noise is the motor/fan. For gas powered chainsaws, the dominant noise is the engine, including exhaust and valve noise.



*In the foreground, chainsaws are lined up in terms of subjective cut. In the background, NPC's Executive Director models chainsaw safety equipment including Husqvarna hardhat and hearing protection, Elvex vest, Husqvarna gloves, Husqvarna chaps, and Cove boots.*

## Subjective Cut Test

NPC's ranking is the subjective impression of the test team concerning the quality of the saw and cut. It is important not to put too much weight on these findings. A saw with a chain that needed sharpening jumped five positions in our test after it was sharpened. It is clear that a less powerful and less expensive saw with a well maintained chain is superior to a more powerful and expensive saw with a poorly maintained chain. In most cases, how often you sharpen the chain will have more to do with your satisfaction than which saw you choose. All of the corded saws are sufficient for occasional suburban uses.

We've ranked the chainsaws into four classes based on their cutting performance: exceptional cutting quality, saws for the typical user, small chainsaws, and battery powered chainsaws.

## Our Picks

**Exceptional Cutting Quality Saws:** For the quietest powerful saw you can't beat the Husqvarna 316. Only the battery powered chainsaws (with a 4.5" bar) were quieter. The Makita UC 4000 is also an excellent choice, with only the Husqvarna and the battery powered chainsaws being quieter. Both these saws are good choices for someone who bucks up their own firewood, who uses it for more than cleaning up the occasional wind damage, who appreciates the quietest tools, or who is a tool snob that wants the best. The Poulan Pro and the Poulan 3.5 HP 16" chainsaws were close in our subjective cut test, and while significantly quieter than gas powered chainsaws, were also significantly louder than the Husqvarna and Makita. They were also more than \$100 less expensive.

**Saws for the Typical User:** These chainsaws didn't perform quite as well as the first four, but don't cost as much either. The Remington 3 HP and the Troybilt were quieter than the Poulans and Craftsmans. Electrolux makes both the Poulans and the Craftsmans, and they are quite similar, although the bars were slightly different. The differences seem to be a matter of preference. We liked the cut of the Poulans slightly better than the equivalent Craftsmans, although the Craftsman's chains were easier to adjust.

**Small Chainsaws:** For occasional use, the Remington 1.5 HP saw performed well in the noise test. If you are shopping for a small saw, however, it might make more sense to buy the Remington Pole Saw. It can reach branches 10-15 feet overhead. The Pole Saw can also be operated as a regular chainsaw. Unfortunately, the Remington Pole Saw was significantly noisier than the other smaller saws.

**Battery Powered Chainsaws:** The Neuton battery powered saw is a quite remarkable innovation. It is quiet enough that hearing protection is probably not needed. And its 18 volt battery is powerful enough to be an excellent tool for cleaning up small branches (it has a 4.5 inch bar). We showed this saw to several lawn service owners who thought it would be an excellent addition to their trucks, since it would eliminate the need to carry (and start up) a large saw just to clean up small branches, and would save time and money. The Makita 12 Volt had noticeably less power compared to the Neuton, but it comes with a pole saw extension, and its increased versatility as a pole saw more than compensates for its slower cutting speed. The Makita was also quieter than the Neuton. It also costs twice as much.

**Best Buys:** The McCulloch 1.5 HP was the quietest saw for under \$50. The Remington 3.5 HP and the Troybilt 3.5 were the quietest saws for under \$100. The best buy in

terms of an aggregate of price, noise, and cut ratings was the Poulan 2 HP. The best buy in terms of noise and cut ratings was the Husqvarna 316. The best buy for a battery powered chainsaw was the Neuton.

**About the Chainsaw Test**

Our test team consisted of a Vermont logger/farmer and his staff who cut an average of 175 cords of wood each year; a Vermont farmer/writer who cuts about seven cords of wood a year; a chainsaw toting acoustical expert with Resource Systems Group (a noise consulting firm); and NPC’s Executive Director. Tests were conducted while cutting hardwood (maple) firewood. Noise measurements

were made at the operator’s ear and at 25 feet, under both load (cutting) and no load conditions. Ear measurements were made using a 10-second Leq and maximum level, while 25 foot measurements reflect maximum levels. Each chainsaw was subjectively ranked in terms of cutting performance by the team. Then each chainsaw was retested in order of ranking to confirm the subjective cut determinations by each tester. All but two chainsaws were tested fresh out of the box with new chains. The Husqvarna 316 and Remington 1.5 were used for approximately one hour prior to testing. This dulled the blades and allowed us to determine the importance of blade condition on the tests. The Husqvarna chain was then sharpened and reevaluated.

**Chain Saw Noise Levels**

Fuel	Brand	Model	HP	Cost	Subjective Cut Rank	25 foot with load Lmax (dBA)	25 foot no load Lmax (dBA)	Operator with load Leq (dBA)	Operator with load Lmax (dBA)	Operator no load Leq (dBA)	Operator no load Lmax (dBA)
Electric	Makita	Battery		\$198	15	61	61	79	81	79	80
Electric	Neuton	Battery		\$100	14	66	67	83	84	82	83
Electric	Husquavarna	316		\$229	2	71	71	90	92	92	94
Electric	Makita	UC4000		\$199	1	75	77	92	95	93	95
Electric	McCulloch		1.5	\$40	13	77	79	94	98	95	96
Electric	Remington		3	\$85	10	78	80	98	99	97	100
Electric	Remington		1.5	\$55	11	79	81	96	99	93	95
Electric	Troybuilt		3.5	\$90	5	80	82	95	98	94	97
Electric	Poulan		2	\$50	6	81	86	100	102	96	99
Electric	Craftsman		2.5	\$50	9	81	86	101	102	97	97
Electric	Poulan		3.5	\$80	4	81	87	97	100	98	101
Electric	Remington	Pole	1.25	\$110	12	81	87	98	101	97	99
Electric	Craftsman	Saw	3.5	\$80	8	83	86	97	99	98	101
Electric	Poulan		4	\$100	3	83	87	98	101	98	102
Electric	Poulan	Pro	3	\$60	7	84	86	99	101	97	100
Gas	Husquavarna					86	88	102		106	
Gas	Pouland	261				85	92	107	109	109	112
Gas	Jonserud	2775				91	98	111	114	115	117
Gas	Jonserud	Turbo 2171				NA	97	110	114	112	116