



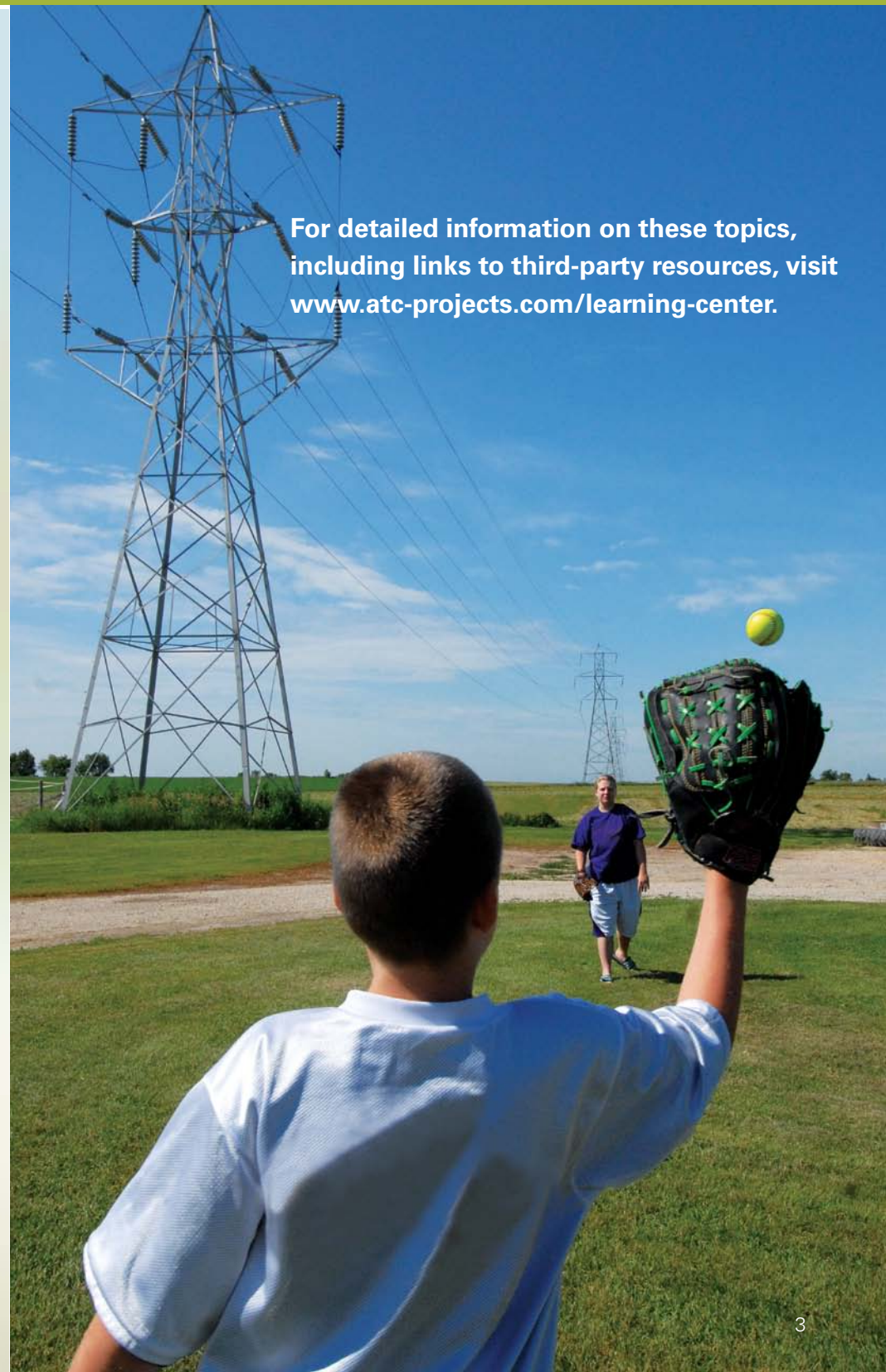
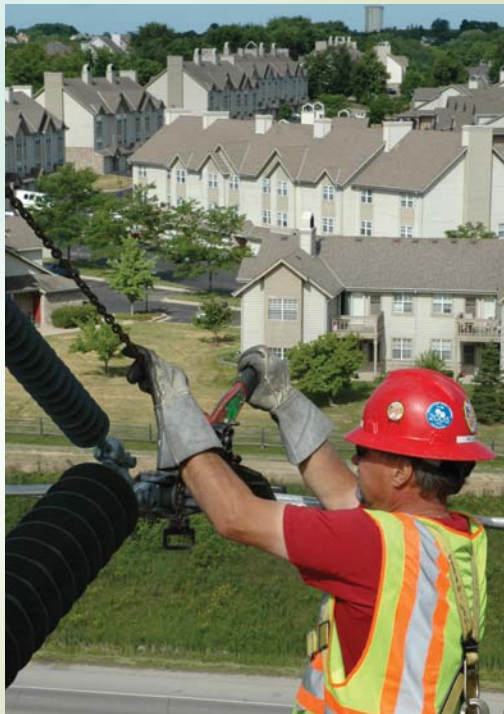
**Quick guide** to living  
and working near electric  
transmission lines



## ABOUT ATC

ATC has approximately 50,000 easement agreements with property owners in our service area. These legal easements cross agricultural, commercial, industrial and residential land, including many residential neighborhoods that have been developed near our transmission lines.

ATC real estate and engineering staff are available to help landowners, farmers and workers with questions about living and conducting business near our poles, wires and substations.



For detailed information on these topics, including links to third-party resources, visit [www.atc-projects.com/learning-center](http://www.atc-projects.com/learning-center).

# The science of moving electricity

Our experts are frequently asked if our transmission lines may affect people and animals. Here is a summary of common scientific topics associated with moving electricity.

## Electric and magnetic fields, or EMFs

Any device that uses or carries electricity creates electric and magnetic fields, or EMF. Electric fields are created by voltage, and magnetic fields are created by current flow. The Electric Power Research Institute indicates that, to date, no health effects from transmission line electric fields have been conclusively found or accepted by the scientific community.

Transmission lines produce magnetic fields of varying intensity, measured in units called milligauss (mG).

Many variables affect the strength of a magnetic field around a transmission line:

- The amount of electric current flowing through the wires
- Distance from the wires
- The configuration of the wires

The intensity of a magnetic field is strongest directly under the wires and drops dramatically with distance.



## Scientific research

Most of the discussion and research during the past four decades about the possible human health risks of exposure to electric and magnetic fields has focused on magnetic fields. After years of research, a direct link between magnetic fields and a higher risk of negative health effects has not been firmly established.

## HOUSEHOLD MAGNETIC FIELD LEVELS

(at typical working distance)



**COFFEE MAKER**  
.2 to 3 mG



**TELEVISION**  
<.1 to 1.5 mG



**TOASTER**  
10 to 60 mG



**COMPUTER  
TABLET**  
.1 to .2 mG




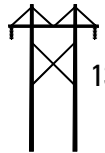

**VACUUM  
CLEANER**  
230 to 1300 mG



**HAIR  
DRYER**  
3 to 1400 mG

Sources: Gauger, Jr., Household Appliance Magnetic Field Survey. IEEE transactions on power apparatus and systems. PA-104.

The intensity of a magnetic field is strongest directly under wires and drops dramatically with distance.

	Voltage	Under wires	Edge of right-of-way*	100 feet away
	69,000 volts	20-25 mG	5-10 mG	.5-12 mG
	138,000 volts	35-40 mG	15-20 mG	.5-12 mG
	345,000 volts	85-100 mG	50-60 mG	.5-15 mG

\*Edge of right-of-way is typically 40 to 75 feet away from centerline on either side, depending on voltage.



## Nuisance shocks and induced voltage

Nuisance shocks are caused when someone who is electrically grounded contacts an object with induced voltage, an electrical charge buildup. Induced voltage may be present in ungrounded objects, such as vehicles or fences near high-voltage transmission lines. While not common, it is more likely that a nuisance shock may occur at higher voltages, such as 345 kilovolts. This phenomenon is not a health or safety hazard and is not the same as direct electrical contact.

Nuisance shocks can be minimized or eliminated when objects and vehicles are grounded.

The severity of these shocks depends on the same factors that impact the amount of induced voltage:

- Power line voltage
- Distance from wires
- Size or length of the object and its orientation to the line
- Object grounding

## Stray voltage/electricity

Stray voltage is the general term used to describe low-level voltages that may occur between surfaces that livestock contact. On a farm, these surfaces may include stanchion pipes, water cups and feeders. Stray voltage is not generally an issue within a typical residential environment.

## Causes

Stray voltage is a scientific phenomenon associated with on-farm wiring and electrical

connections to utility distribution systems. Both farm systems and utility distribution systems are grounded to the earth to ensure safety and electric reliability. Inevitably, some current flows through the earth at each grounding point and some voltage develops. This voltage is called neutral-to-earth voltage, or NEV. When NEV is found at animal contact points, it is called stray voltage.

Sources of elevated stray voltage may be on-farm, off-farm or a combination of the two. In many cases, there may be more than one source.

## Mitigation

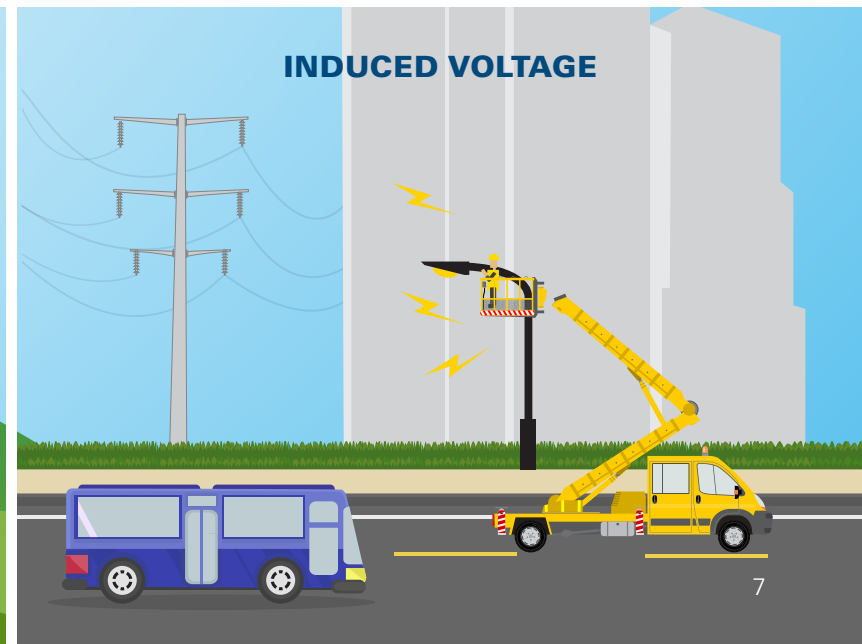
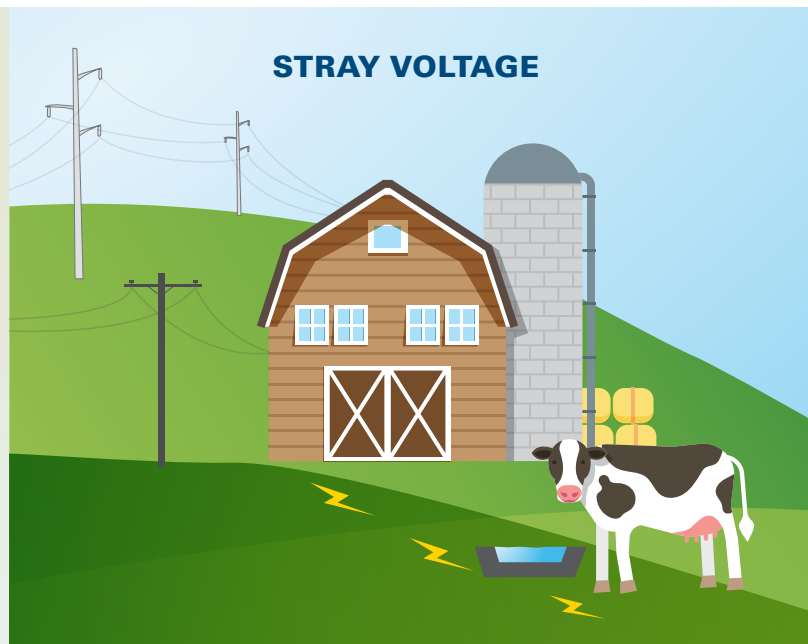
In Wisconsin, the Public Service Commission and the Wisconsin Department of Agriculture, Trade and Consumer Protection have

**QUICK TIP:** Visit <http://datcp.wi.gov/index.aspx> and type **REPS** in the search field for more information on the Rural Electric Power Services Program.

established the Rural Electric Power Services Program to work with farmers in resolving herd health and production problems, and to provide outreach and technical assistance. Many local distribution utilities offer on-site investigations and can recommend steps to correct stray voltage. When transmission and distribution facilities are co-located, ATC works with local distribution companies to investigate and resolve stray voltage sources that may exist.

*Stray voltage is most often associated with on-farm wiring.*

*Induced voltage may be present in ungrounded objects, such as vehicles near high-voltage transmission lines.*



# Living near transmission lines

**Tens of thousands of people live near our facilities.**

**Common topics of interest include:**

## **Implantable medical devices**

According to the Public Service Commission of Wisconsin, pacemakers and Implantable Cardioverter Defibrillators can be affected by electromagnetic interference, or EMI. Their literature states: "Transmission lines are only one of a number of external EMI sources. Exposure to magnetic fields produced by transmission lines generally will not affect pacemakers and implantable defibrillators." Please read the PSC's Environmental Impacts of Transmission Lines brochure, available in the library at [psc.wi.gov](http://psc.wi.gov), for more information on this and other topics. You should also discuss any concerns with your health care provider.

## **Ice shedding**

It is possible for ice to collect on transmission lines during weather events. Ice shedding may cause ice from lines to fall to the ground.

## **Noise**

Line noise can occur, is weather dependent, and if present, is typically noticeable at higher voltages. Decibel ratings for 345-kV transmission lines have been

measured at around 50 decibels within 200 feet of the line. Noise is increased in humid weather, and newer lines become more quiet over time. A rating in the 50s is considered relatively quiet. After 200 feet, it blends in with the surroundings.

## **Placing structures in rights-of-way**

Residences, swimming pools and structures, such as sheds, signs, deer stands and playground equipment, are not permitted in rights-of-way without prior written consent from ATC.

## **Property values**

Home buyers consider many variables, some highly subjective, when making purchasing decisions. Generally speaking, peer-reviewed, published studies confirm that property values are derived from many factors, and that the presence of a transmission line plays a minor role in determining property values. These scientific studies and literature reviews of such studies find that transmission lines have little effect on most property values.



## **Radio, TV, communication interference**

Transmission lines may interfere with AM receivers, TV receivers, amateur radio receivers, aircraft communications receivers and specialized devices such as radio astronomy antennas. If you experience any interference that you suspect is caused by ATC transmission facilities, please contact ATC. When feasible, we work to mitigate any interference.

## **Trees and landscaping**

To help ensure public safety and the safe and reliable operation of the electric transmission system, ATC removes incompatible vegetation from the right-of-way. Tall-growing trees and other vegetation near power lines can be hazardous to public and worker safety. Incompatible vegetation also can threaten electric service reliability and risk damage to the electric system. Dense, incompatible vegetation also is removed because it can impede access for crews to inspect, maintain and repair lines.



**Between 1996 and 2003, the number and severity of transmission grid failures increased as a result of vegetation contacts with high-voltage power lines. A widespread power outage in 2003, caused in part by a tree contacting a line, affected 50 million people in the eastern United States and Canada. The federal government responded by developing mandatory reliability standards requiring transmission utilities to establish vegetation management programs with the goal of preventing outages caused by trees and vegetation.**



## Farming near transmission lines

ATC has standards and guidance for a variety of agricultural land use topics, which are available at [www.atc-projects.com/learning-center](http://www.atc-projects.com/learning-center) and in our Guide to Agricultural Use in American Transmission Co. Rights-of-Way brochure. Please review these resources and contact ATC if you have questions about the following topics:

- Conservation Reserve Program land
- Crops
- Electric fields, equipment and nuisance shocks
- Fences
- Fires and field burning
- GPS and communication equipment
- Irrigation systems and wells
- Livestock
- Manure pits and spreading
- Organic farming
- Property or crop damage
- Soil compaction
- Trees and landscaping



### Planting near power lines

ATC's vegetation management program does not prohibit all plantings in the right-of-way. Transmission line corridors cultivated with low-growing vegetation are most compatible with the operation and maintenance of a high-voltage transmission line and can provide habitat for pollinators and other wildlife. Visit [www.atc-GrowSmart.com](http://www.atc-GrowSmart.com) to learn more and review our planting guide.

### **Fence construction, location**

Our staff will help identify an appropriate type of fence for the location and ensure that the design complies with the terms of the easement and ATC policies.

### **Overhead clearance**

When operating machinery that extends vertically, such as sprayers, augers, elevators and fertilizer applicators, remember that additional clearance may be needed beyond the standard 14-foot vehicle height. Maintain proper clearance from the highest point on your equipment to the wires above. Use a spotter to keep an eye on how far tall equipment is from the wires. Also avoid refueling any vehicles within the right-of-way.

### **Materials/equipment in rights-of-way**

Do not store or pile materials or equipment within the right-of-way without prior approval from ATC.

### **Irrigation systems and wells**

Improper irrigation installation may cause shocks. Before installing an irrigation system near an ATC transmission facility, contact ATC to discuss your plans. Also keep in mind that wells are not permitted in the right-of-way.



### **Nuisance shocks**

Electric fields from transmission lines can cause induced voltage and current on insufficiently grounded equipment that is near 345-kV transmission lines. Induced voltage can cause nuisance shocks to people who touch the equipment while standing on the ground, but can be minimized by installing a grounding strap or chain on the equipment, or simply by parking farther away from the line.

### **Burning near rights-of-way**

Fire under the wires or within the right-of-way can be dangerous. If you plan to burn near an ATC right-of-way, contact ATC to learn proper burning methods and to inform ATC of when the burn will take place.

### **GPS navigation**

Major manufacturers of GPS navigation systems have not found any degradation of the GPS signal as a direct result of transmission lines.

### **Animal pens**

ATC discourages animal pens or confinements beneath our transmission lines. ATC performs low-flying helicopter inspections each year and may use helicopters with aerial saws to manage vegetation. If areas near the transmission lines are

fenced for animal confinement purposes, it is possible for animals to be startled and/or injured during helicopter inspections.

### **Manure pits**

Due to the various access, clearance and other issues associated with manure pits, they typically are not permitted within ATC rights-of-way.

### **Property and crop damage payments**

If ATC maintenance or construction activities cause compaction or rutting or damages drain tile or crops, ATC will pay you a reasonable amount for damages caused by ATC when activities are completed. The USDA Custom Rate Guide is used as a guideline for crop damage payments.

## **Stray voltage investigations**

**If you think stray voltage may be an issue on your property, contact your local electric utility. The local utilities and ATC work together on individual investigations to better understand the interactions between both systems where the local transmission line configuration is parallel to the distribution neutral system.**



# Working safely near poles, wires and substations

## Clearances

The Occupational Safety and Health Administration requires minimum safe working clearances based on transmission line voltage.

If you plan to work or operate machinery under ATC transmission lines, ensure you know the required OSHA clearance, which must be maintained at all times.

The height of the wires above ground may vary depending on the voltage of the line, type of structure and span length of the line on your property.

When electric usage is high, wires can sag creating insufficient clearances. High electric usage can be related to hot weather, extreme cold weather or non-weather conditions, such as cranberry or corn harvesting season. Clearances also can fluctuate during a given day as electric usage peaks.



## STAY AWAY FROM DOWNED POWER LINES

Transmission infrastructure is relatively robust, but if you encounter a downed power line here are a few safety tips:

- If you see a downed line, always assume it is live. You cannot tell if it is energized just by looking at it.
- Move away from it and anything touching it with shuffling, small steps. Keep your feet together and on the ground at all times to minimize the potential for a shock.
- Do not attempt to move a downed power line or anything else in contact with it by using an object such as a broom or stick.
- Do not touch or step in water near a downed power line.



## WORKER SAFETY AT-A-GLANCE

- When operating machinery that extends vertically, remember that additional clearance is needed beyond the truck height. Maintain proper clearance from the highest point on your equipment to the transmission line above. Use a spotter to keep an eye on how far tall equipment is from the wires.
- Do not store material or equipment within the right-of-way without prior approval.
- Electric fields from transmission lines can cause induced voltage on insufficiently grounded equipment that is near 345-kV transmission lines. This is more common when larger vehicles and equipment are parked on asphalt or dry rock. People who touch equipment while standing on the ground may receive a nuisance shock until they stop touching the equipment. This can be minimized by installing a grounding strap or chain on equipment or parking away from the line.
- Avoid refueling vehicles within the right-of-way.





**ATC owns, operates, builds and maintains the high-voltage electric transmission system that helps meet the electric needs of approximately five million people in parts of Wisconsin, Michigan, Minnesota and Illinois.**

**We are regulated by the Federal Energy Regulatory Commission, North American Electric Reliability Corporation and the states in our service area. We also work with state natural resource and environmental quality departments, the U.S. Fish and Wildlife Service and the Army Corps of Engineers when building new projects or upgrading existing facilities. We are a member of the Midcontinent Independent System Operator regional transmission organization, which oversees the regional electric grid.**



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August 2023