3.12 Public Health and Safety

Transmission facilities provide electricity for heating, lighting, and other services essential for public health and safety. These same facilities can potentially harm humans. Contact with transmission lines can injure people and damage aircraft. This section describes public health and safety concerns, such as shocks and noise, related to transmission facilities. More detailed information can be found in Appendix I, *Electrical Effects*.

3.12.1 Electric and Magnetic Fields

For Your Information

Electric and magnetic fields *(EMF) are the two kinds of fields produced around the electric wire or conductor when an electric transmission line or any electric wiring is in operation.*

Current *is the amount of electrical charge flowing through a conductor.*

Transmission lines, like all electrical devices and equipment, produce ***electric and magnetic fields*** (EMF). The voltage, or force that drives the ***current***, is the source of the electric field. Electric fields are expressed in units of volts per meter (V/m) or kilovolts per meter (kV/m). The current, or movement of electrons in a wire, produces the magnetic field. The strength of magnetic field depends on the current, design of the line, and the distance from the line. Field strength decreases rapidly with distance. Electric fields can be reduced significantly by the presence of conducting objects. Thus, inside houses and automobiles, electric fields are lower than outside because of shielding.

Electric and magnetic fields are found around any electrical wiring, including household wiring and electrical appliances and equipment. Throughout a home, the electric field strength from wiring and appliances is typically less than 0.01-kV/m. However, fields of 0.1-kV/m and higher can be found very close to some electrical appliances.

Average magnetic field strength in most homes (away from electrical appliances and home wiring, etc.) is typically less than 2 ***milligauss (mG)***. Very close to appliances carrying high current, fields of tens of hundreds of milligauss can be present. Unlike electric fields, magnetic fields from outside power lines are not reduced in strength by trees and building material. Because of this, transmission lines can be a major source of magnetic field exposure throughout a home located close to the line. Typical electric and magnetic field strengths for some BPA transmission lines are given in Table 3.12-1, *Typical Electric and Magnetic Field Strengths*.

*A **milligauss** is one thousandth of a gauss.*

*A **gauss** is a unit of magnetic induction.*

kV/m = kilovolt per meter
mG = milligauss

Table 3.12-1
Typical Electric and Magnetic Field Strengths

Transmission Lines	Electric Fields (kV/m)	Magnetic Fields (mG)	
		Maximum[1]	Average[2]
115-kV			
Maximum on ROW	1	62	30
Edge of ROW	0.5	14	7
200 feet from center	0.01	1	0.4
230-kV			
Maximum on ROW	2	118	58
Edge of ROW	1.5	40	20
200 feet from center	0.05	4	2
500-kV			
Maximum on ROW	7	183	87
Edge of ROW	3	62	30
200 feet from center	0.3	7	3

[1] Under annual peak load conditions (occurs less than 1 percent of the time)

[2] Under annual average loading conditions

Note: The information above was obtained from a BPA study to characterize nearly 400 transmission lines located in the Pacific Northwest. Based on 1992 data (Sterns , et al.).

There are currently no national standards in the United States for electric and magnetic fields from transmission lines. Some states have established electric and/or magnetic field standards for 60-Hz electric and magnetic fields. The state of Washington does not have limits for either electric or magnetic fields from transmission lines. The BPA has maximum allowable electric fields of 9-kV/m on the ROW and 5-kV/m at the edge of the ROW. The BPA also has maximum allowable electric field strengths of 5-kV/m, 3.5-kV/m, and 2.5-kV/m for road crossings, shopping center parking lots, and commercial/industrial parking lots, respectively.

Both electric and magnetic fields induce currents in conducting objects, including people and animals. The magnitude of the induced current in objects under lines depends on the electric- or magnetic-field strength and the size and shape of the object. The currents induced in people, even from the largest transmission lines are generally too weak to be felt. However, under certain circumstances, contact to a grounded object by a well-insulated person in a high electric field can result in a perceived nuisance shock or spark discharge. Similarly, contact of a grounded person with an ungrounded large conducting object, such as a truck or tractor, in an electric field can result in a perceived nuisance shock due to the induced currents in the object. Transmission lines are designed and built so that such shocks occur infrequently and if they do, are no higher than the nuisance level. Stationary conducting objects such as

metal buildings and fences near transmission lines are grounded to prevent them from being a source of shocks.

The possibility of health effects from long-term exposure to 60-Hz electric or magnetic fields has been researched for several decades. The consensus of scientific panels reviewing this research is that the evidence does not support a causal relationship between electric or magnetic fields and any adverse health outcomes, including childhood cancer, adult cancer, reproductive outcome, or other diseases. However, investigation of a statistical association between magnetic field exposure and childhood leukemia continues. It has not yet been possible to exclude a role for magnetic fields above 4 mG given the small number of persons studied with exposures at these levels and the problems of selecting appropriate control groups. Although uncertainty about possible effects of EMF on health has been considerably reduced in the past few years, concerned individuals can take low or no cost actions to reduce long-term exposures.

The research literature published to date has shown little evidence that exposure to EMF leads to adverse effects on domestic animals, wildlife and plants. (See Appendix J, *Assessment of Research Regarding EMF and Health and Environmental Effects*.)

3.12.2 Noise

3.12.2.1 Transmission Line Noise

Audible noise can be produced by transmission line ***corona***. In a small volume near the surface of the conductors, energy and heat are dissipated. Part of this energy is in the form of small local pressure changes that result in audible noise. Corona-generated audible noise can be characterized as a hissing, crackling sound that under certain conditions is accompanied by a 120-Hz hum.

Corona-generated audible noise is of concern primarily for contemporary lines operating at voltages of 345-kV and higher during foul weather. The conductors of high-voltage transmission lines are designed to be corona-free under ideal conditions. However, a protrusion on the conductor surface – particularly water droplets on or dripping off the conductors – cause electric fields near the conductor surface to exceed corona onset levels, and corona occurs. Therefore, audible noise from transmission lines is generally a foul-weather (wet-conductor) phenomenon. However, during fair weather, insects and dust on the conductors can also serve as sources of corona.

For Your Information

Corona *is an electrical discharge, at the surface of a conductor. A technical definition is included in Chapter 9, (Glossary and Acronyms).*

3.12.2.2 Substation Noise

The Schultz Substation is surrounded by rangeland, with some agricultural land to the south and one rural residence approximately 0.25 to 0.5 mile to the southeast. The site is relatively quiet, and due to the distance from the nearest residence, does not affect the surrounding area.

The Vantage Substation is located east of the Columbia River and is surrounded by open shrub-steppe habitat land and rangeland. As with the Schultz Substation, this site is relatively quiet.

The Midway Substation is located along the northern base of Umtanum Ridge, a short distance south of the Columbia River. The areas to the west, east, and north between the substation and the river are open shrub-steppe habitat land. Like the Schultz and Vantage Substation sites, this site is relatively quiet.

The Hanford Substation is located along the southeast side of the Columbia River. Except for facilities associated with the retired N-Reactor adjacent to the substation site to the north/northeast, the area surrounding the site is open shrub-steppe habitat land. The retired N-Reactor is not operating. The only noise produced is from workers who perform surveillance and maintenance at the site.

Sound varies at the substation sites as a result of weather and other factors such as background noise and the kind of equipment operating and could be higher or lower on any given day or at any given time at these substations.

The site of the new Wautoma Substation is currently an open field. Noise at this site is primarily background noise from wind and weather, with the sound of an occasional truck or automobile on the dirt road or distant Highway 24.

3.12.3 Radio and TV Interference

For Your Information

Electromagnetic interference (EMI) *is high-frequency electrical noise that can cause radio and television interference.*

Corona on transmission line conductors can generate electromagnetic noise in the frequency bands used for radio and television signals. In rare circumstances, corona-generated ***electromagnetic interference*** (***EMI***) can also affect communication systems and sensitive receivers. Interference with electromagnetic signals by corona-generated noise is generally associated with lines operating at voltages of 345-kV or higher. This is especially true of interference with television signals.

Radio reception in the AM broadcast band (535 to 1,604 kilohertz (kHz)) is most often affected by corona-generated EMI. FM radio reception is rarely affected. Generally, only residences very near transmission lines can be affected by radio interference.

Corona-caused television interference occurs during foul weather and is generally of concern only for conventional receivers within about 600 feet of a line. Cable and satellite television receivers are not affected.

Spark gaps on distribution lines and on low-voltage transmission lines are a more common source of radio and television interference than is corona from high-voltage transmission lines. This gap-type interference is primarily a fair-weather phenomenon caused by loose hardware and wires.

3.12.4 Toxic and Hazardous Materials

Minimal amounts of hazardous waste result from routine maintenance procedures performed on substation equipment and transmission lines. The type and volume of waste such as oily rags, minor leaks from vehicles, etc., depend on maintenance procedures.

The areas with the most human activities, specifically the YTC, the Wahluke Slope, and the Hanford Site are most likely to have hazardous materials issues.

The military conducts live-fire training and maneuvers at the YTC. Hazardous materials that might be encountered along the proposed routes through the YTC include live and spent ammunition, unexploded ordnance, petroleum products, and other military chemicals or explosives.

The Wahluke Slope, excluding the Hanford Reach National Monument, supports an intensive agricultural area. Hazardous materials that may be encountered in this area are related to agricultural operations, and include pesticides, fertilizers, and petroleum products. Pesticides and fertilizers may be encountered in their bulk form in storage or illegal disposal sites, in the form of spills, or after they have been applied to crops.

The Hanford Site includes retired radioactive material production facilities and active research and radioactive waste management facilities. These areas are well characterized because of the locations within the Hanford Site that are being considered for this proposal; therefore, radioactive materials should not be unexpectedly encountered.

Hazardous materials could be encountered anywhere along the proposed route and could include such things as illegally dumped waste, drug lab chemicals, spilled petroleum products, pesticides, and other wastes.

The 500-kV Schultz Substation has no transformers on site. A small amount of oil is in the power circuit breaker compressors and in the series capacitor cans. Contaminated oil, or polychlorinated biphenyl (PCB), may be present in the power circuit breakers and capacitor cans. There is no oil spill containment system for this substation, but BPA does have a Spill Prevention Control and Countermeasure Plan that puts in place protocols and procedures for response in case a spill or leak occurs.

The 500-kV Hanford Substation also has no transformers on site. Similar to the Schultz Substation, a small amount of oil is in the power circuit breaker compressors and in the shunt capacitor cans. PCBs may be in the compressors, but no PCBs are present in the shunt capacitor. This substation site also has a diesel tank that runs an engine generator. There is no oil spill containment system at this substation, but like Schultz Substation, BPA has a Spill Prevention Control and Countermeasure Plan in case a spill or leak occurs.

The 230/500-kV Vantage Substation includes a number of transformers on site that may contain PCBs. There are also two oil tanks on site. Unlike the Schultz and Hanford Substations, this substation does have an oil spill containment system in place for the two 500-kV transformer banks on site. It also has a Spill Prevention Control and Countermeasure Plan.

3.12.5 Fire

Numerous wildfires have occurred on private and public land in and around the proposed routes over the past several years. They may have been caused by human actions such as vehicle ignitions from roads, unattended campfires, burning of adjacent agricultural lands and arson, or by natural causes such as lightning.

Between 1980 and 1997, six wildfires were either started on or threatened public land in the Saddle Mountain Management Area. The cause of these fires ranged from lightning strikes to equipment use and railroad operations (BLM, 1997). Fires from similar causes have also affected the Saddle Mountain Unit of the Hanford Reach National Monument.

Due to the nature and intensity of the training that occurs at the YTC, the incidence of fire is higher on YTC land than on adjacent lands. The risk of fires at the YTC is largely dependent on the intensity, duration, and season of training activities taking place. The use of tracers and pyrotechnic devices as well as live-firing activities increases the fire risk (U.S. Army, 1996). Fire management is addressed in the management plan for the YTC (U.S. Army, 1996).

The Hanford Reach National Monument was established in June 2000. A Fire Management Plan has been completed that will provide for the perpetuation of natural conditions and processes within the monument/refuge, while managing wildlife fire to protect life, property, and cultural resources. This plan will help reduce hazards associated with unplanned fire events (USDOI/USFWS, 2001).

Farmers throughout the state, including those in central Washington near the line segments, burn agricultural fields to remove the remaining plant material after harvest and prepare for planting the next crop. To meet the requirements of the Washington State Clean Air Act of 1991, a statewide agricultural burning permit program has been implemented. This program includes permit conditions on when burns may occur and what materials may be burned (WAC 173-430). BPA does not expect to conduct any outdoor burning.