Attachment #3 – Policy/Guideline Manual, Structural/Electrical Engineering Branch

4.1 - Addition to Transmission Design Manual, Book 61, Section 1800, Overhead Ground Wire Policy

Overhead Ground Wire Policy for Transmission Lines Rated Less than 500 kV (115 kV, 230 kV, 345 kV)

Transmission lines rated less than 500 kV will normally be equipped with overhead ground wire from each substation for 0.75 km (0.5 mile) or more on 115-kV lines and 1.5 km (1 mile) or more on 230-kV and 345-kV lines. The ground wire will be insulated from the substation dead-end structure and grounded at all subsequent transmission line structures. The ground wire will terminate on either:

a. Suspension structure designed for ground wire dead-ending 0.75 km (0.5 mile) or more for 115-kV lines or 1.5 km (1 mile) or more for 230-kV and 345-kV lines from the substation dead-end structure;

or

b. Dead-end structure 0.75 km (0.5 mile) or more for 115-kV lines or 1.5 km (1 mile) or more for 230-kV and 345-kV lines from the substation dead-end structure.

Line Design Section will determine which of these two schemes is most economical.

Each transmission line structure equipped with overhead ground wire should have a tower footing resistance of 20 ohms or less. The Electrical Design Section will specify grounding to achieve this as closely as possible considering the economic and technical feasibility of doing so.

Overhead Ground Wire Practice for Transmission Lines Rated 500 kV

1. Single-Circuit 500-kV Transmission Lines West of the Cascade Mountain Range

Lightning protection for the first 1.5 km (1 mile) of 500-kV lines outside of a substation will be comparable to that of the station itself. In general, two overhead ground wires will be specified on single-circuit 500-kV transmission lines west of the Cascade Mountain range for 1.5 km (1 mile) or more from each substation. The ground wire will be insulated from the substation dead-end structure, grounded at the first transmission line structure and insulated from subsequent transmission line structures. The ground wire will terminate on a suspension structure designed for ground wire dead-ending 1.5 km (1 mile) or more from the substation or the first dead-end structure approximately 1.5 km (1 mile) or more from the substation dead-end structure. Line Design Section will determine the most economical scheme to use.

Attachment #4 – BPA Electrical and Biological Effects Review, December 1996

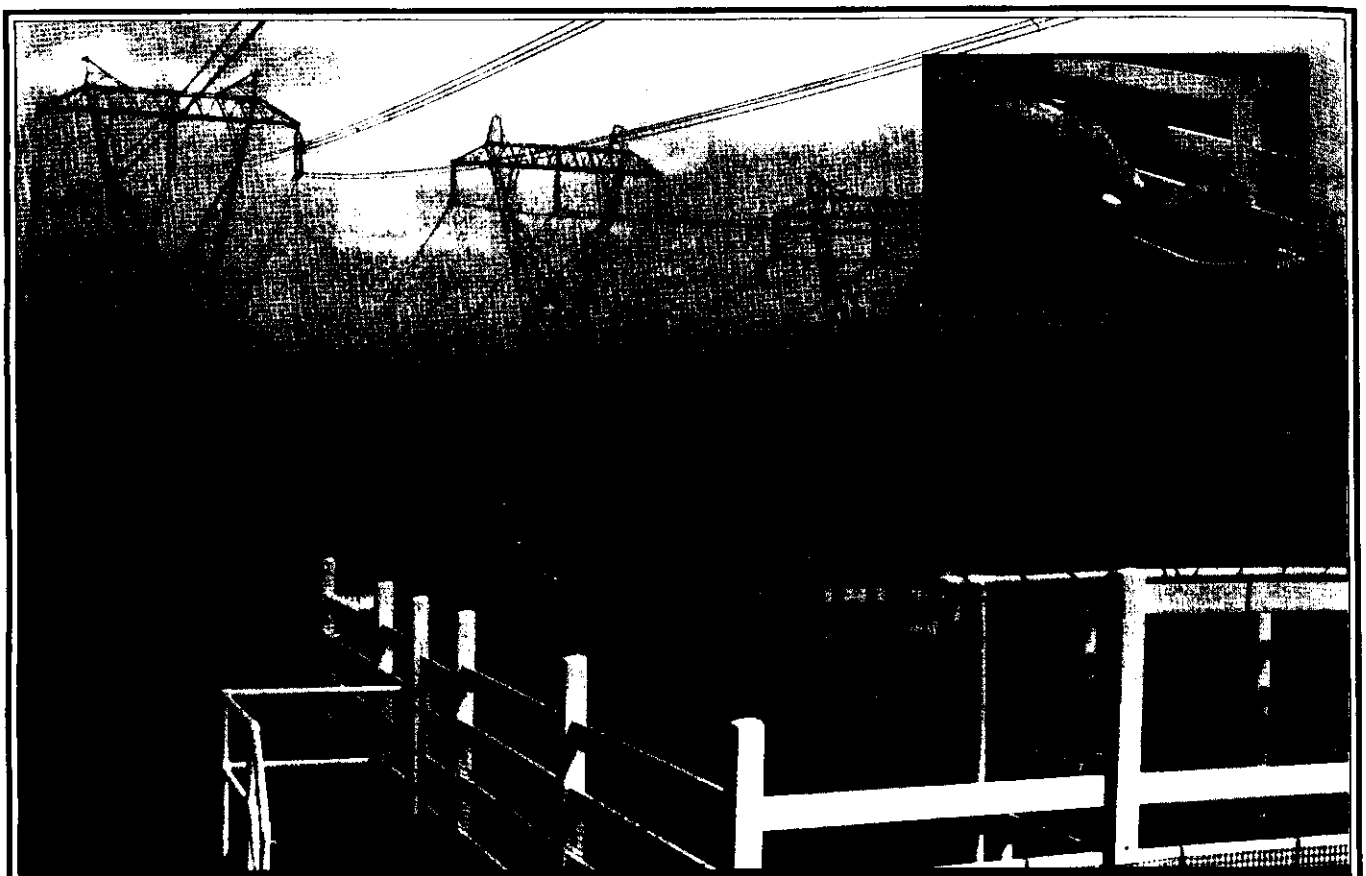

Figure 4.22. Since 1990, studies have been conducted of sheep raised in the EMF from high-voltage transmission lines near the BPA Ostrander substation in Western Oregon. The pens have grounded metal screen floors, and all other parts of the pens are made of plastic to minimize shielding of the electric field. No effects of EMF were found on melatonin, growth, stress, or on reproductive cycles. Followup studies are investigating possible effects on the immune system.

two areas. Through 5.5 years of study, 14 sheep under the line had developed lymphosarcoma or lymphatic leukemia, compared to 17 sheep that developed these conditions in the low exposure group. The difference between the two groups was not statistically significant.

In a study in Canada 16 Holstein cows were exposed to 60-Hz EMF while they were confined to individual stalls in an exposure building (Burchard et al. 1996). The cows were exposed to a vertical electric field of 10 kV/m combined with a magnetic field of 30 μT (300 mG). Exposures lasted for 28 days in two replicates, and the cows served as their own controls during 28-day field off periods.

Analyses of periodic blood samples taken from the cows showed no significant effects of field exposure on levels of serum cortisol or progesterone. Samples of milk taken once per week showed no effects of exposure on uncorrected milk yield. When yield was corrected for 4 percent fat content, a statistically significant increase in yield of 9.1 percent occurred during field exposure. The fat content of the milk increased from 4.06 to 4.43 percent during exposure. The researchers said that the size of the change was biologically important, but it was within the range of normal variability (Burchard et al. 1996)

Although not specifically an effect of EMF from power lines, "stray voltages" on equipment in barns have been found to affect adversely the health and production of dairy cows and other livestock (Gustafson and Albertson 1982). The sources of the voltages, which result in annoying shocks, include ground faults, improper wiring, and unbalanced loads on electrical distribution systems. Methods are available for identifying the sources and for mitigating problems caused by stray voltages (Lefcourt 1991). This issue remains controversial, however, especially with dairy farmers in Minnesota and Wisconsin. In 1996 the Minnesota legislature approved $370,000 for 2 years of a possible 5-year research program on the electrical environment of dairy farms (*EMF Health & Safety Digest* May 1996, pages 12–13).