Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

PUBLIC AFFAIRS

April 21, 2011

In reply refer to: DK-7

Myrtle June Chapman

Ex 6

RE: FOIA Request #BPA-2011-00999-F

Dear Ms. Chapman:

This is a final response to your request for records that you made to the Bonneville Power Administration (BPA) under the Freedom of Information Act (FOIA), 5 U.S.C. 552.

You have requested the following:
Records that reference specific restrictions that apply to parking and roads adjacent to the BPA right-of-way.

Response:
BPA conducted a reasonable search and found one document dated June 1, 1979, that addresses both parking restrictions on the BPA right-of-way and on all adjacent roads.

I appreciate the opportunity to assist you. Please contact Cheri L. Benson, FOIA/Privacy Act Specialist at (503) 230-7305 with any questions about this letter.

Sincerely,

/s/Christina J. Munro

Christina J. Munro
Freedom of Information Act/Privacy Act Officer

Enclosure(s): Responsive Document

June 1, 1979

EOH

Ralph S. Gens, Assistant Administrator
for Engineering and Construction - E

F. G. Schaufelberger, Chief
Branch of System Engineering - EO

Electric Field Strength Policy for BPA's Transmission Lines

Existing guidelines for maximum electric field strengths under and adjacent to BPA transmission lines have been previously established (Bamberg to Schaufelberger, 2-11-75). We have recently reviewed our field strength policy in the light of new research, regulations and our additional operating experience. Based on our review, we find that the previously established guidelines are still valid. We have expanded the guidelines to include areas of higher than normal public exposure, specifically shopping center and commercial/industrial parking lots.

The following levels are maximum field strengths for current designs:

In the right-of-way	9 kV/m
At the edge of the right-of-way	5 kV/m
At road crossings	5 kV/m
At shopping center parking lots	3.5 kV/m
At commercial/industrial parking lots	2.5 kV/m

These levels are measured one meter above the ground at 49°C conductor temperature and maximum operating voltage.

Conductive objects permanently located within or adjacent to the right-of-way and which could couple short-circuit currents in excess of 2.0 mA r.m.s. shall either be grounded or the electric field strength reduced to limit the short-circuit current to 2.0 mA or less. Areas of high public exposure located adjacent to the right-of-way where large conductive objects are temporarily located, such as parking lots, shall have the field strength reduced to limit short-circuit currents to 2.0 mA or less.

Our prime consideration is the health and safety of the public. The maximum electric field strengths were therefore established considering:

1. BPA experience to date
2. Maximum short-circuit current permitted by the National Electrical Safety Code
3. The largest expected vehicle or equipment under and adjacent to the lines

4. Public exposure
5. Biological effects
6. Gasoline ignition
7. Cardiac pacemakers

BPA has had good experience with its present electrostatic policy. Problems arising have been solved by special grounding procedures. It has not been necessary to restrict public access to the right-of-way.

The established electric field strengths reflect induced current limitations resulting from conductive objects under and adjacent to the transmission lines. When such conductive objects are placed in the electric field, induced currents are coupled into the object when such an object is grounded. These currents are referred to as the short circuit currents. When a person provides the current path, the current magnitudes are discussed in terms of (1) primary shock levels (above "let go" threshold), (2) secondary shock levels (involuntary movement or startling effect) and (3) perception level (level at which the current is perceived). In general, applicable short circuit currents associated with these categories are as follows:

Primary shock level:	above 5 mA rms
Secondary shock level:	2-5 mA rms
Perception level:	1-2 mA rms

Short circuit currents from the largest vehicle or equipment anticipated to be exposed are limited to 5 mA rms at 49°C conductor temperature as presently specified in the Seventh Edition National Electrical Safety Code. This is based on the "let go" threshold for a child (6 mA for a woman and 9 mA for a man). The field strengths required to induce these currents in various vehicle sizes for the worst case conditions are listed in Table 1. In addition, secondary shock levels and perception levels are listed. Typical field strength values for BPA lines are shown in Table 2. It should be remembered that all short circuit current values listed in Table 1 are theoretical values for perfectly insulated vehicles. In reality, these current values are the worst case and would rarely occur.

A possible situation where primary shock level currents could be induced in a vehicle under a BPA transmission line would be for a truck, with a single (65-foot total length) or double (75-foot total length) metal enclosed trailers located in the fight-of-way with electric field strengths above 5 kV/m. This type of vehicle is not anticipated in the right-of-way at any location other than a road crossing where field strengths are limited to 5 kV/m.

The largest type of vehicle that would be expected to be exposed to field strengths over 5 kV/m should be a farm-type vehicle or equipment. These vehicles are of a physical size that would not couple short circuit currents above the 5 mA NESC limit in an electric field of 9 kV/m.

Oregon State Energy Citing Council does consider field strength limitations under transmission lines. This maximum level has been established at 9 kV/m.

At the edge of the right-of-way and at road crossing the largest types of vehicles could be expected. Table 1 indicates that field strengths must be limited to 5 kV/m at these locations to both avoid any primary shock hazard and comply with NESC. This also will minimize the possibility of a secondary shock from sedans, pickups and school buses.

At shopping center parking lots, the public exposure is very high. In these lots the expected vehicles are sedans, pickups (with campers). Limiting field strengths to 3.5 kV/m will reasonably assure currents from cars and pickups (with campers) below perception levels.

In commercial/industrial parking lots, large trucks would be expected, and the personnel exposure is relatively high. A secondary shock level criterion is established for these applications because (1) controls over operation and activities in the lots can be enforced and (2) working personnel are adults whose secondary shock levels are generally higher. An electric field strength of 2.5 kV/m would limit currents to levels slightly above 2.0 mA (Table 1). This would minimize secondary shock hazard for working personnel. Each application must be reviewed and controls/restrictions such as gasoline refueling, storage of flammable material, object height limitations, larger objects than assumed, etc., be part of the Easement Agreement. Similar controls/restrictions need to be identified in BPA's response to Permit Requests.

BPA's operating experience indicates that electric fields up to 9 kV/m have no adverse impact on plants, animals, or people. In addition, biological studies sponsored by BPA since 1974 show that such fields have no apparent adverse biological effects. However, neither the operating experience nor the studies can fully answer all the questions raised in recent years about possible physiological effects due to long-term exposure to electric fields producing induced currents below perception levels. A large number of laboratory studies have been initiated in recent years to investigate these kinds of effects. This body of knowledge is continually reviewed by the Biological Studies Task Team. To date, this review indicates a very low probability that transmission line electric fields pose a biological hazard.

At least two studies have shown that electric fields of the strength produced by transmission lines can affect certain kinds of cardiac pacemakers. The monopolar pacemaker lead configuration, where the case of the pacemaker is one of the electrodes, is the most susceptible to 60-Hz interference. It is believed that this type of lead configuration involves only a small percentage of the total pacemakers currently in use. Electromagnetic interference can cause those pacemakers to revert to an asychronous mode. Differences of opinion exist among cardiologists on the significance of such reversions.

Reports of transmission lines affecting pacemakers are very rare. Although it appears unlikely fields of 9 kV/m could result in any serious effects to wearers of pacemakers, it seems prudent to continue to inform the public that a possibility for effects exists.

The probability that gasoline ignition could occur while refueling a vehicle within the right-of-way is remote based on BPA's operating experience and studies conducted by BPA and others. Because there is a very small probability that it could occur, gasoline refueling should be prohibited within the BPA right-of-way in Easement Agreements. Furthermore such controls and restrictions should be included in BPA's response to Permit Requests. BPA also needs to continue to caution the public against gasoline refueling near transmission lines.

BPA and others are conducting R&D to determine the electrostatic and biological effects of fields in excess of 9 kV/m. These studies may serve as the basis for establishing higher maximum field strengths on the right-of-way for future BPA transmission line designs.

JUN 13 1979

2 Enclosures:
Tables 1 and 2

Approved:

JUN 13 1979

Assistant Administrator for Engineering and Construction | Date

JBrunke/EYasuda:cln:see

cc:
R. S. Gens - E
S. A. Annestrand - ER
C. O'Connor - OH
J. L. Jones - EN
T. Kornelis - EL
J. O. Hooson - EHA
C. F. Clark - ET
Area Managers - OK, OP, OS, OW
Official File - EOH
R. Foleen - A
J. N. O'Neal - O
S. E. Efferding - S
D. L. Jackson - SI
Area Engineers
V. L. Chartier - ER
Members of Engineering Review Board

Table One

Currents Induced into Vehicles from A-C Electric Fields

Vehicle	Short Circuit Current mA/(kV/m)	Minimum Field Strength (kV/m) to Produce			Short Circuit Current (mA) in a Field of:			
		Perception (1mA)	Secondary Shock (2mA)	Primary Shock (5mA)	9 kV/m	5 kV/m	3.5 kV/m	2.5 kV/m
Sedan	0.11	9.1	18.2	45.5	1.0	0.9	0.4	0.3
Pickup - with camper	0.28	3.6	7.1	17.9	2.5	1.4	1.0	0.7
School bus - 28 ft.	0.33	3.0	6.1	15.2	3.0	1.7	1.2	0.8
Truck - 28 ft. flatbed	0.2	5.0	10.0	25.0	1.8	1.0	0.7	0.5
Truck - 28 ft. - covered van	0.5	2.0	4.0	10.0	4.5	2.5	1.8	1.3
Truck - 65 ft. single trailer	0.92	1.1	2.2	5.4	8.3	4.6	3.2	2.3
Truck - 75 ft. double trailer	0.98	1.0	2.0	5.1	8.8	4.9	3.4	2.5

JHBrunke
6-11-79

Table Two

CALCULATED ELECTRIC FIELD STRENGTHS FOR EXISTING LINES
(Maximum Operating Voltage, 49°C Conductor Temperature)

Voltage	Configuration	Conductor	R.O.W. Width	Electric Field Strength (kV/m) R.O.W. Maximum	R.O.W. Edge	Max. Over Road
345 kV	Flat Single Circuit - K5	Chukar	140'	4.8	2.0	2.0
500	Delta Single Circuit - M3	2-Chukar	125'	7.6	2.8	3.5
500	Delta Single Circuit - M17	3-Bunting	135'	8.9	2.9	4.1
500	Flat Single Circuit - M12	2.5" ASCR	140'	7.0	3.4	3.4
500	Flat Single Circuit - M7	2-Chukar	160'	8.9	3.6	4.3
500	Double Delta Double Circuit M14 (B+ / A+ C+ ; B+ / A+ C+)	3-Bunting	165'	8.0	3.2	4.4
500	Stacked Double Circuit-O9M (B+ A+ C+ ; +B +C +A)	3-Chukar	135'	9.4	1.6	4.9
500	Stacked Double Circuit-19M (Same phase sequence as-O9M)		125'	9.0	1.6	4.9
500	Delta 100" Design - M23	3-Bunting	105'	8.0	3.5	3.7

JHBrunke