

APPENDIX A

Electric and Magnetic Fields

SECTION A.1

Electric and Magnetic Fields Summary

Electric and Magnetic Fields

The California Public Utilities Commission (CPUC) and the California Department of Health Services (CDHS) have not concluded that exposure to magnetic fields from utility electric facilities is a health hazard. Many reports have concluded that the potential for health effects associated with electric and magnetic field (EMF) exposure is too speculative to allow the evaluation of impacts or the preparation of mitigation measures. EMF is a term used to describe electric and magnetic fields that are created by electric voltage (electric field) and electric current (magnetic field). Power frequency EMF is a natural consequence of electrical circuits, and can be either directly measured using the appropriate measuring instruments or calculated using appropriate information. EMF are present wherever electricity flows: around appliances and power lines, in offices, schools, and homes. Electric fields are invisible lines of force, created by voltage, and are shielded by most materials. Units of measure are volts per meter (V/m). Magnetic fields are invisible lines of force, created by electric current and are not shielded by most materials, such as lead, soil and concrete. Units of measure are Gauss (G) or milliGauss (mG, 111000 of a Gauss). Electric and magnetic field strengths diminish with distance. These fields are low energy, extremely low frequency fields, and should not be confused with high energy or ionizing radiation such as X-rays and gamma rays.

Possible Health Effects

The possible effects of EMF on human health have come under scientific scrutiny. Concern about EMF originally focused on electric fields; however, much of the recent research has focused on magnetic fields. Uncertainty exists as to what characteristics of magnetic field exposure need to be considered to assess human exposure effects. Among the characteristics considered are field intensity, transients, harmonics, and changes in intensity over time. These characteristics may vary from power lines to appliances to home wiring, and this may create different types of exposures. The exposure most often considered is intensity or magnitude of the field. There is a consensus among the medical and scientific communities that there is insufficient evidence to conclude that EMF causes adverse health effects. Neither the medical nor scientific communities have been able to provide any foundation upon which regulatory bodies could establish a standard or level of exposure that is known to be either safe or harmful. Laboratory experiments have shown that magnetic fields can cause biologic changes in living cells, but scientists are not sure whether any risk to human health can be associated with them. Some studies have suggested an association between surrogate measures of magnetic fields and certain cancers while others have not.

California Public Utilities Commission Summary

Background. On January 15, 1991, the CPUC initiated an investigation to consider its role in mitigating the health effects, if any, of electric and magnetic fields from utility facilities and power lines. A working group of interested parties, called the California EMF Consensus Group, was created by the CPUC to advise it on this issue. It consisted of 17 stakeholders representing citizens groups, consumer groups, environmental groups, state agencies, unions, and utilities. The Consensus Group was charged to 1) consider a balanced set of facts and concerns; 2) define near-term research objectives; and 3) develop interim policies and procedures to guide the electric utilities in educating their customers, reducing EMF, and responding to potential health concerns. The Consensus Group's fact-finding process was open to the public, and its report incorporated concerns expressed by the public. Its recommendations were filed with the Commission in March of 1992. In August of 2004, the CPUC opened an Order Instituting Rulemaking to update the Commission's policies and procedures related to electric and magnetic fields emanating from regulated utility facilities. The final decision was issued in D.06-01-042.

Findings. Based on the work of the Consensus Group, written testimony, and evidentiary hearings, the CPUC issued its decision (D.06-01-042) to address public concern about possible EMF health effects from electric utility facilities. The conclusions and findings included the following:

- The body of scientific evidence continues to evolve. However, it is recognized that public concern and scientific uncertainty remain regarding the potential health effects of EMF exposure.
- It is not appropriate to adopt any specific numerical standard in association with EMF until we have a firm scientific basis for adopting any particular value.

Interim Policies. The CPUC's decision specifically requires seven measures. One of these measures that is involved with the Project is as follows:

- No-cost and low-cost steps to reduce EMF. In response to a situation of scientific uncertainty and public concern, the CPUC felt it appropriate for utilities to take no-cost and low-cost measures where feasible to reduce exposure from new or upgraded utility facilities. It directs that no-cost mitigation measures be undertaken, and that low-cost options be implemented through the Project certification process. Four percent of total Project budgeted cost is the benchmark in developing EMF mitigation guidelines, and mitigation measures should achieve some noticeable reductions.

The CPUC will continue to monitor these issues. If new information develops in the future, the CPUC may amend its decision to reflect new scientific evidence.

Exemption Criteria. The CPUC agreed that "Utility management should have reasonable latitude to deviate and modify their guidelines as conditions warrant and as new EMF information is received. However, if the EMF guidelines are to be truly used as guidelines, the utilities should incorporate criteria which justify exempting specific types of projects from the guidelines."

Utilities may use the following guidelines to determine those specific types of projects that will be exempt from no/low cost field reduction:

1. Operation, repair, maintenance replacement or minor alteration of existing structures: facilities or equipment.
2. Restoration or rehabilitation of deteriorated or damaged structures, facilities or equipment to meet current standards of public safety.
3. Addition of safety devices.
4. Replacement or reconstruction of existing structures and facilities on the same site and for the same purpose as the replaced structure or facility.
5. Emergency restoration projects.
6. Re-conductoring projects except when structures are reframed or reconfigured.
7. Projects located on land under the jurisdiction of the Forest Service, Bureau of Land Management or other governmental agency.
8. Privately owned tree farms.
9. Agricultural land within the Williamson Act.
10. Areas not suited to residential/commercial development. Such areas might include steep slopes, areas subject to flooding or areas without access to public facilities.

The intent of the exemption criteria is to exclude two types of projects. The first type of projects are those that either replace or make minor additions or modifications to existing facilities. This will include pole replacements or relocations less than 2,000 feet in length. Those projects where more than 2,000 feet of line is relocated or reconstructed or where the circuit is reinsulated or reconfigured should be considered for low cost magnetic field management techniques.

The second type projects are those located in undeveloped areas.

EMF Reduction. Utilities must use the following Guidelines in the application of no and low cost steps to reduce magnetic field strengths:

1. Take low cost steps to reduce fields from new and upgraded facilities in accordance with CPUC decision D.06-01-042 on EMF.
2. No cost measures will be implemented when available and practical.
3. Mitigation measures should not compromise the reliability, operation, safety or maintenance of the system.
4. Total cost of mitigation measures should not exceed 4 percent of the total cost of the Project.

5. Mitigation measures should have a noticeable reduction in the magnetic field level approximately 15 percent or more.

In accordance with CPUC Decision No. 93-11-013 and 06-01-042, Pacific Gas and Electric Company (PG&E) will incorporate “no cost” and “low cost” magnetic field reduction steps in the proposed power line and substation facilities. The following measures would be included to reduce the magnetic field strength levels from electric power facilities:

For the Hollister Tower Segment (seven mile segment north of Lagunitas Switches, existing Moss Landing- Salinas – Soledad 115 kV ROW)

- Raise the height of the line on four of the five towers in the residential land use area by five feet. This is to be achieved by installing horizontal post insulators on suspension towers. The fifth tower is a transposition tower and cannot be modified through this method or any other method that would not increase the massiveness of the tower.
- Given that lines are optimally phased, existing phasing would be maintained to reduce magnetic levels.

For the Hollister Pole Segment (nine mile segment, east of the Hollister Tower Segment, existing Hollister No. 1 115 kV ROW)

- Phases of the new Hollister 115 kV line would be arranged for minimum magnetic field at the edge of the ROW. Phases would be arranged C-B-A (Top, Middle, Bottom)
- For the Hollister No. 1 115 kV line maintain the existing configuration, A-B-C (Top, Middle, Bottom).

APPENDIX A.2

Electric and Magnetic Fields Field Management Plan for the Proposed Project

TRANSMISSION MAGNETIC BASIC FIELD MANAGEMENT PLAN HOLLISTER 115 KV POWER LINE RECONDUCTORING PROJECT

I. General Description of Project

Project Lead: Project Manager, Electric Transmission Maintenance and Construction

Transmission Lines: Moss Landing - Salinas - Soledad 115 kV Power Line (both circuits) between Lagunitas Switches and Anzar Junction, and the Hollister No. 1 115 kV Power Line between a point near Anzar Junction and Hollister Substation

Distribution Line Underbuild: 12 kV and 21 kV on part of the Hollister No. 1 line.

Scope of Work:

Reconductor approximately 7 miles of the double-circuit Moss Landing - Salinas - Soledad 115 kV Power Line from the Lagunitas Switches (Tower 37/232) to near Anzar Junction (Tower 30/196) with 477 kcmil ACSS/Flicker conductor, and replace most existing steel towers with new steel towers.

Reconductor approximately 9 miles of the Hollister No. 1 115 kV Power Line and add a second 115 kV circuit on the same line segment.

TRANSMISSION MAGNETIC BASIC FIELD MANAGEMENT PLAN HOLLISTER 115 KV POWER LINE RECONDUCTORING PROJECT

II. BACKGROUND: CPUC DECISION 93-11-013 AND EMF POLICY

On January 15, 1991, the CPUC initiated an investigation to consider its role in mitigating the health effects, if any, of electric and magnetic fields from utility facilities and power lines. A working group of interested parties, called the California EMF Consensus Group, was created by the CPUC to advise it on this issue. It consisted of 17 stakeholders representing citizens groups, consumer groups, environmental groups, state agencies, unions, and utilities. The Consensus Group's fact-finding process was open to the public, and its report incorporated concerns expressed by the public. Its recommendations were filed with the Commission in March 1992.

In August 2004 the CPUC began a proceeding known as a "rulemaking" (R.04-08-020) to explore whether changes should be made to existing CPUC policies and rules concerning EMF from electric transmission lines and other utility facilities.

Through a series of hearings and conferences, the Commission evaluated the results of its existing EMF mitigation policies and addressed possible improvements in implementation of these policies. The CPUC also explored whether new policies are warranted in light of recent scientific findings on the possible health effects of EMF exposure.

The CPUC completed the EMF rulemaking in January 2006 and presented these conclusions in Decision D.06-01-042:

- The CPUC affirmed its existing policy of requiring no-cost and low-cost mitigation measures to reduce EMF levels from new utility transmission lines and substation projects.
- The CPUC adopted rules and policies to improve utility design guidelines for reducing EMF, and provides for a utility workshop to implement these policies and standardize design guidelines.
- Despite numerous studies, including one ordered by the Commission and conducted by the California Department of Health Services, the CPUC stated "we are unable to determine whether there is a significant scientifically verifiable relationship between EMF exposure and negative health consequences."
- The CPUC said it will "remain vigilant" regarding new scientific studies on EMF, and if these studies indicate negative EMF health impacts, the Commission will reconsider its EMF policies and open a new rulemaking if necessary.

In response to a situation of scientific uncertainty and public concern, the decision specifically requires PG&E to consider "no-cost" and "low-cost" measures, where feasible, to reduce exposure from new or upgraded utility facilities. It directs that no-cost mitigation measures be undertaken, and that low-cost options, when they meet certain guidelines for field reduction and cost, be adopted through the project certification process. PG&E was directed to develop, submit

TRANSMISSION MAGNETIC BASIC FIELD MANAGEMENT PLAN HOLLISTER 115 KV POWER LINE RECONDUCTORING PROJECT

and follow EMF guidelines to implement the CPUC decision. Four percent of total project budgeted cost is the benchmark in implementing EMF mitigation, and mitigation measures should achieve incremental magnetic field reductions of at least 15%.

III. ELECTRIC AND MAGNETIC FIELDS (EMF)

EMF is a term used to describe electric and magnetic fields that are created by electric voltage (electric field) and electric current (magnetic field). Power frequency EMF is a natural consequence of electrical circuits, and can be either directly measured using the appropriate measuring instruments or calculated using appropriate information.

Electric fields are present whenever voltage exists on a wire, and are not dependent on current. The magnitude of the electric field is primarily a function of the configuration and operating voltage of the line and decreases with the distance from the source (line). The electric field can be shielded (i.e., the strength can be reduced) by any conducting surface, such as trees, fences, walls, buildings, and most types of structures. The strength of an electric field is measured in volts per meter (V/m) or kilovolts per meter (kV/m).

Magnetic fields are present whenever current flows in a conductor, and are not dependent on the voltage of the conductor. The strength of these fields also decreases with distance from the source. However, unlike electric fields, most common materials have little shielding effect on magnetic fields.

The magnetic field strength is a function of both the current on the conductor and the design of the system. Magnetic fields are measured in units called Gauss. However, for the low levels normally encountered near electric utility facilities, the field strength is expressed in a much smaller unit, the milliGauss (mG), which is one thousandth of a Gauss.

Power frequency EMF are present wherever electricity is used. This includes not only utility transmission lines, distribution lines, and substations, but also the building wiring in homes, offices, and schools, and in the appliances and machinery used in these locations. Magnetic field intensities from these sources can range from below 1 mG to above 1,000 mG (1 Gauss).

Magnetic field strengths diminish with distance. Fields from compact sources (i.e., those containing coils such as small appliances and transformers) drop off with distance "r" from the source by a factor of $1/r^3$. For three-phase power lines with balanced currents, the magnetic field strength drops off at a rate of $1/r^2$. Fields from unbalanced currents, which flow in paths such as neutral or ground conductors, fall off inversely proportional to the distance from the source, $1/r$. Conductor spacing and configuration also affect the rate at which the magnetic field strength decreases, as well as the presence of other sources of electricity. The magnetic field levels of PG&E's power lines will vary with customer demand.

Magnetic field strengths for typical transmission power line loads at the edge of rights-of-way are approximately 10 to 90 mG.

TRANSMISSION MAGNETIC BASIC FIELD MANAGEMENT PLAN HOLLISTER 115 KV POWER LINE RECONDUCTORING PROJECT

IV. No Cost and Low Cost Magnetic Field Mitigation

Base Case Phasing:

From Lagunitas Switches to Tower 34/222:

Moss Landing - Salinas - Soledad #1 Phasing is A-C-B (top to bottom)

Moss Landing - Salinas - Soledad #2 Phase is B-C-A (top to bottom).

From Tower 34/222 to Tower 31/208:

Moss Landing - Salinas - Soledad #1 Phasing is B-A-C (top to bottom)

Moss Landing - Salinas - Soledad #2 Phase is C-A-B (top to bottom).

From Tower 31/208 to Anzar Junction (Tower 30/196):

Moss Landing - Salinas - Soledad #1 Phasing is C- B-A (top to bottom)

Moss Landing - Salinas - Soledad #2 Phase is A-B-C (top to bottom)

The lines are optimally phased. The existing phasing will be maintained to reduce magnetic field levels.

Base Case Phasing:

Hollister No. 1 115 kV line: ABC (Top, Middle, Bottom).

New Hollister 115 kV circuit: ABC (Top, Middle, Bottom).

Optimally Phase Circuits:

The phases of the new Hollister 115 kV line will be arranged for minimum magnetic field level at the edge of the right of way. The phases will be arranged CBA (Top, Middle, Bottom).

The phases of the Hollister No. 1 115 kV line will remain in the same configuration. The phases are arranged ABC (Top, Middle, Bottom).

No Cost Field Reduction

The phases of the new Hollister 115 kV line will be arranged for minimum magnetic field level at the edge of the right of way. The phases will be arranged CBA (Top, Middle, Bottom). The phases of the Hollister No. 1 115 kV line will remain in the same configuration. The phases are arranged ABC (Top, Middle, Bottom).

**TRANSMISSION MAGNETIC BASIC FIELD MANAGEMENT PLAN
HOLLISTER 115 KV POWER LINE RECONDUCTORING PROJECT**



Figure 1 - Moss Landing - Salinas - Soledad 115 kV Power Lines near residential land use.

TRANSMISSION MAGNETIC BASIC FIELD MANAGEMENT PLAN HOLLISTER 115 KV POWER LINE RECONDUCTORING PROJECT

V. General Description of Surrounding Land Uses

Moss Landing - Salinas - Soledad 115 kV Power Lines

Schools or Daycare: None.

Residential: Five towers.

Commercial/Industrial: None.

Recreational: None.

Agricultural, Rural, and Undeveloped Land: Thirty-four towers.

Hollister No. 1 115 kV Power Line

Schools or Daycare: None.

Residential: Thirteen poles.

Commercial/Industrial: None.

Recreational: None.

Agricultural, Rural, and Undeveloped Land: One hundred fifty-one poles.

Priority Areas where Low Cost Measures are to be Applied

The five towers in the residential land use area are considered for magnetic field reduction.

VI. Conclusion - Field Reduction Options Selected

Moss Landing - Salinas - Soledad 115 kV Power Lines

This FMP proposes to raise the height of the line on four of the five towers in the residential land use area by five feet. Horizontal post insulators will be installed on the suspension towers within the residential section to raise the conductor heights 5 feet. The towers are located in the City of San Juan Bautista south of State Highway 156 (see Figure 1). The fifth tower is a transposition tower (on which the conductors are rearranged), and cannot be modified through this method or any other method that would not substantially increase the massiveness of the tower.

Hollister No. 1 115 kV Power Line

This FMP proposes the phases of the new **Hollister 115 kV line** will be arranged for minimum magnetic field level at the edge of the right of way. The phases will be arranged **CBA** (Top, Middle, Bottom). The phases of the **Hollister No. 1 115 kV line** will remain in the same configuration. The phases are arranged **ABC** (Top, Middle, Bottom).

CERTIFICATE OF SERVICE BY HAND DELIVERY

I, the undersigned, state that I am a citizen of the United States and am employed in the City and County of San Francisco; that I am over the age of eighteen (18) years and not a party to the within cause; and that my business address is 77 Beale Street, B30A, San Francisco, California 94105

On November 23, 2009, I served a true copy of:

**APPLICATION OF PACIFIC GAS AND ELECTRIC COMPANY
FOR A PERMIT TO CONSTRUCT THE HOLLISTER 115 kV POWER LINE
RECONDUCTORING PROJECT**

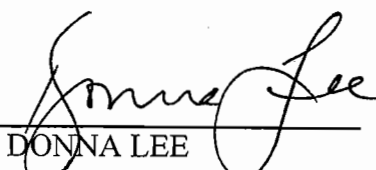
by hand delivery, addressed to:

Jenny Au
Division of Ratepayer Advocates
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

Monisha Gangopadhyay
Energy Division
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

I certify and declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed on this 23rd day of November, 2009 at San Francisco, California.


DONNA LEE