

**ESTRELLA SUBSTATION AND PASO ROBLES AREA REINFORCEMENT PROJECT
REVISED PRELIMINARY TRANSMISSION MAGNETIC FIELD MANAGEMENT PLAN
FOR ALTERNATIVE PLR-1A**

A. Power Line EMF Field Management Plan

I. General Description of Project

Project Lead: Project Manager, Electric Transmission Maintenance and Construction

Transmission Lines: San Miguel-Union 70 kV line
Union-Paso Robles 70 kV line
San Miguel-Paso Robles 70 kV line
Morro Bay-California Flats 230 kV line

Distribution line underbuild: The underbuilt distribution line voltage is 12 kV for portions of 70 kV line segments.

Scope of Work:

This proposed project includes:

- Approximately 10.5 miles of new overhead double-circuit 70 kV transmission line is proposed to be constructed and operated as part of the alternative alignments for the future Union-Paso Robles 70 kV line and the future San Miguel-Union 70 kV line described in the Final Environmental Impact Report (FEIR) for the project as Alternative PLR-1A, which is identified as part of the “environmentally superior alternative.”
- Approximately six miles of the existing San Miguel-Paso Robles 70 kV transmission line is proposed to be reconducted as part of Alternative PLR-1A .
- The existing Morro Bay-California Flats #2 230 kV transmission line is proposed to be interconnected to the future Estrella Substation. This will require replacing one existing double-circuit 230 kV lattice tower, installing one new double-circuit 230 kV lattice tower and installing (4) new single-circuit 230 kV lattice steel towers.

The ultimate objective of the project is to increase electric reliability in the northern San Luis Obispo County service area by providing an additional 230 kV power source.

The estimated total cost of the Proposed Project is approximately \$105,000,000. Four percent of this estimated total cost is \$4,200,000.

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II. Background: CPUC Decision 93-11-013 and Decision D.06-01-042

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 (EMF) 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. The Consensus Group's 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 were 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 established 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 utilities 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 and follow EMF guidelines to implement the CPUC decision. According to the guidelines, four percent of total project budgeted cost is the benchmark used to determine “low-cost” in implementing EMF mitigation, and mitigation measures

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should achieve incremental magnetic field reductions of at least 15% at the edge of right-of-way (ROW).

III. General Description of Surrounding Land Uses

Land Uses Adjacent to Project Route:

Schools or Daycare: None.

Residential: Eighty-seven structures.

Commercial/Industrial: Two structures.

Recreational: None.

Undeveloped Land and/or Agricultural, Rural: One hundred and seven structures.

IV. No Cost and Low Cost Magnetic Field Mitigation

No Cost Field Reduction

Optimal phase configurations can be used as a field cancellation technique. The phases from one circuit of a multi-circuit line can be used to reduce the field from another circuit, thereby reducing the total magnetic field strength. For this reason, multi-circuit lines may have lower magnetic fields than single circuit lines. Double circuit tower lines considered for optimal phasing:

New double-circuit 70 kV transmission lines (San Miguel & Estrella and Estrella and Paso Robles)

		Base Case Phasing	Proposed Optimal Phasing
Structure 1 to 85	San Miguel-Union Union-Paso Robles	(T,M,B) = ABC (T,M,B) = ABC	(T,M,B) = ABC (T,M,B) = CBA

Segment	Base Case		Optimal phase		Reduction	
	North ROW	South ROW	North ROW	South ROW	North ROW	South ROW
San Miguel-Union and Union-Paso Robles	94.1 mG	94.1 mG	32.8 mG	32.8 mG	65.1.%	65.1.%

The purpose of magnetic field modeling is to evaluate relative effectiveness of various magnetic field reduction measures, not to predict magnetic field levels.

The new 10.5 mile double circuit 70 kV line (i.e., the “San Miguel-Union” 70 kV circuit and the

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“Union-Paso Robles” 70 kV circuit, will be optimally phased.

Priority Areas where Low Cost Measures Should Be Considered

Eighty-seven structures in the residential land use area are considered for magnetic field reduction.

Low Cost Magnetic Field Reduction Options

Reducing magnetic field strength by increasing the distance from the source can be accomplished either by increasing the height or depth of the conductor from ground level. Furthermore, locating the power lines as far away from the edge of the ROW or as close to centerline as possible will result in lower field levels at the edge of the ROW. Calculations are based on normal peak current flow and a minimum conductor height of twenty-nine feet at midspan. Below are calculations showing magnetic field reductions from raising conductor heights an additional 10 feet more than needed to meet clearance requirements:

Segment	Base Case		Raise 10 Feet		Reduction	
	North ROW	South ROW	North ROW	South ROW	North ROW	South ROW
San Miguel-Union and Union-Paso Robles	32.8 mG	32.8 mG	20.3 mG	20.3 mG	38.2%	38.2%

Segment	Base Case		Raise 10 Feet		Reduction	
	West ROW	East ROW	West ROW	East ROW	West ROW	East ROW
San Miguel-Paso Robles 70 kV transmission line reconductoring	35.5 mG	35.9 mG	25.3 mG	25.7 mG	28.6%	28.5%

The purpose of magnetic field modeling is to evaluate relative effectiveness of various magnetic field reduction measures, not to predict magnetic field levels.

No Cost and Low Cost Magnetic Field Mitigation Measures

The following tables identifies the no cost and low cost field mitigation measures for each line segment, including the reasoning for each, and the estimated cost to adopt the measure.

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ESTRELLA SUBSTATION AND PASO ROBLES AREA REINFORCEMENT PROJECT						
Project Segment (Pole/Tower ID #)	Location (Street, Area)	Adjacent Land Use	Reduction Measure Considered	Measure Adopted?	Reason(s) if not adopted	Estimated Cost to Adopt
San Miguel-Paso Robles 70 kV transmission line reconductoring						
6/111 to 7/125A		Residential	Raise Conductor 10 Feet	Yes		\$81,600
			Optimal Phasing	Yes		
7/126 to 7/125		Agriculture				
7/128 to 9/147		Residential	Raise Conductor 10 Feet	Yes		\$127,500
			Optimal Phasing	Yes		
9/148 to 9/151		Unpopulated				
9/152 to 9/161		Residential	Raise Conductor 10 Feet	Yes		\$51,000

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Project Segment (Pole/Tower ID #)	Location (Street, Area)	Adjacent Land Use	Reduction Measure Considered	Measure Adopted?	Reason(s) if not adopted	Estimated Cost to Adopt
New double-circuit 70 kV transmission lines (San Miguel & Union and Union and Paso Robles)						
1 to 12		Agriculture				
13 to 14	Branch Rd and Hwy 46	Residential	Raise Conductor 10 Feet	Yes		\$12,300
			Optimal Phasing	Yes		
15 to 38		Agriculture				
39 to 46	Jardine Rd and Tower Rd	Residential	Raise Conductor 10 Feet	Yes		\$49,200
			Optimal Phasing	Yes		
47 to 52		Agriculture				
53 to 56		Residential	Raise Conductor 10 Feet	Yes		\$24,600
			Optimal Phasing	Yes		
57		Agriculture				
58 to 59		Residential	Raise Conductor 10 Feet	Yes		\$12,300
			Optimal Phasing	Yes		
60 to 95	Wellsona Rd	Agriculture				
96 to 97		Residential	Raise Conductor 10 Feet	Yes		\$12,300
98 to 99		Agriculture				
100 to 101		Residential	Raise Conductor 10 Feet	Yes		\$12,300
102		Agriculture				
103 to 106		Residential	Raise Conductor 10 Feet	Yes		\$24,600
107 to 111		Agriculture				
112 to 113		Residential	Raise Conductor 10 Feet	Yes		\$12,300
114 to 117		Agriculture				
118 to 122		Residential	Raise Conductor 10 Feet	Yes		\$30,750
123 to 124		Agriculture				
125 to 126	Mine/Quarry	Commercial/Industrial				
127 to 131		Residential	Raise Conductor 10 Feet	Yes		\$30,750
132 to 133		Agriculture				

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Morro Bay-Gates #2 230 kV interconnection to Estrella Substation						
23/96A, 1A, 2A		Agriculture				
23/97, 1B, 2B		Agriculture				

This FMP proposes to raise the height of eighty-seven structures in the residential land use area by ten feet taller than required for meeting clearance requirements. The estimated cost of this mitigation is \$481,500.

V. Conclusion - Field Reduction Options Selected

The double circuits San Miguel & Estrella and Estrella and Paso Robles will be optimally phased.

New double-circuit 70 kV transmission lines (San Miguel & Estrella and Estrella and Paso Robles)

		Base Case Phasing	Proposed Optimal Phasing
Structure 1 to 85	San Miguel & Estrella	(T,M,B) = ABC	(T,M,B) = ABC
	Estrella and Paso Robles	(T,M,B) = ABC	(T,M,B) = CBA

This FMP proposes to raise the height of eighty-seven structures in the residential land use area by ten feet taller than required for meeting clearance requirements. The estimated cost of this mitigation is \$481,500.

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B. Substation EMF Checklist

Union Substation Scope of Work:

Build a new 70 kV substation to support ultimate site plan of six (6) BAAH bays and associated disconnect switches in three (3) BAAH bays. Install control and battery buildings to house required equipment protection and monitoring equipment.

No.	No Cost and Low Cost Magnetic Field Reduction Measures Evaluated for a Substation Project	Measures Adopted? (Yes/No)	Reason(s) if not Adopted
1	Keep high current devices, transformers, and capacitors, reactors away from the substation property lines.	Yes	
2	For underground duct banks, the minimum distance should be 12 feet from the adjacent property lines or as close to 12 feet as practical.	Yes	
3	Locate new substations close to existing power lines to the extent practical.	Yes	
4	Increase the substation property boundary to the extent practical.	Yes	

VI. References

California Public Utilities Commission. 1993. Order instituting investigation on the Commission’s own motion to develop policies and procedures for addressing the potential health effects of electric and magnetic fields of utility facilities. Decision 93-11-013, November 2, 1993

California Public Utilities Commission. 2006. Order Instituting Rulemaking to update the Commission’s policies and procedures related to electromagnetic fields emanating from regulated utility facilities. Decision 06-01-042, January 26, 2006.

Pacific Gas & Electric Company. 2006. EMF Design Guidelines for Electrical Facilities.