APPENDIX I

EMF/EMI RISK ASSESSMENT STUDY

EMF REPORT FOR
Los Alamitos Multi-Story Building

Prepared For:

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TABLES

FIGURES

1.0 INTRODUCTION

1.1 Purpose

The purpose of this report is to present the results of the UltraSystems Environmental (UltraSystems) program of electromagnetic field (EMF) measurements at the proposed Los Alamitos Multi-Story Building project, located at Los Alamitos High School, 3591 W. Cerritos Avenue, Los Alamitos, California.

1.2 Objectives and Scope

This report is being provided to the Los Alamitos Unified School District (District), to support an Initial Study and Mitigated Negative Declaration (IS/MND). The District proposes to construct a new multi-story building at Los Alamitos High School (proposed project) which is a discretionary action. The building would be located towards the front of the high school, and may involve the partial demolition of the existing administrative building.

The objectives for taking EMF measurements are to determine ambient levels of EMF at and around the existing high school and proposed multi-story building site, and to find and measure the highest and lowest magnetic fields within the area of potential effects.

The scope of the EMF measurements is the electromagnetic environment of the proposed project.

2.0 EMF BACKGROUND INFORMATION

EMF is the expression commonly used when talking about "power-frequency electric and magnetic fields." Power-frequency electric and magnetic fields are a natural consequence of the flow of electricity. The strength of electric and magnetic fields can either be measured using a gaussmeter or estimated using formulas factoring in voltages, currents and system designs.

Electric fields are produced by the voltage on a conductor and rapidly decrease with the distance from the source. The electric field can easily be shielded by trees, fences, buildings and most other structures. The strength of the electric field is a function of system design and the magnitude of the voltage. Electric fields are measured in units of volts per meter (V/m).

Magnetic fields are produced by the current in a conductor. They also rapidly decrease with distance from the source. Magnetic fields are more difficult to shield than electric fields. The strength of the magnetic field is a function of system design and the magnitude of the current. Magnetic fields are measured in units called milligauss (mG). Although the term EMF includes both electric and magnetic fields, the focus of the California EMF Consensus Group and the California Public Utilities Commission in Decision 93-11-013 has been on magnetic fields.[1] These design guidelines are exclusively applied to consideration of magnetic fields. While the fields from power lines depend on load, design and other factors, examples of possible magnetic field levels that could be found near different voltages of power lines are shown in **Table 2-1**.

1 Southern California Edison. EMF Design Guidelines for Electrical Facilities. September 2004.

Table 2-1
EXAMPLE OF POWER-FREQUENCY MAGNETIC FIELDS FROM ELECTRIC POWER LINES

Source of Magnetic Fields	Location of Exposure	Exposure (mG)
500 kilovolt Transmission Line	Edge of Right-of-Way	30
230 kilovolt Transmission Line	Edge of Right-of-Way	14
66 kilovolt Transmission Line	Under the Line	13
12 kilovolt Distribution Line	Under the Line	7

The California Department of Education (CDE) evaluates potential school sites under a range of criteria, including environmental and safety issues. Exposure to power-frequency electric and magnetic fields (EMF) is one of the criteria. CDE has established the following "setback" limits for locating any part of a school site property line near the edge of easements for any electrical power lines rated 50 kV and above:

- 100 feet for 50–133 kV power lines

Note that the two power lines adjacent to the Los Alamitos High School are both 66 kilovolt transmission lines, operated by Southern California Edison. The north–south power line, on the west side of Los Alamitos Avenue, is 120 feet from the school property and 460 feet from the proposed project site. The east–west power line, on the south side of Cerritos Avenue, is 240 feet from the school property and 260 feet from the proposed project site. For both power lines, the proposed project is well beyond the CDE-recommended setback of 100 feet.

The Earth's natural geomagnetic field strength varies between 350 mG and 700 mG over the surface of the planet, while the International Standard limit for continuous exposure is set at 400,000 mG for the general public.[2] Everyone is exposed to a complex mix of weak electric and magnetic fields, both at home and at work, from the generation and transmission of electricity, domestic appliances and industrial equipment, to telecommunications and broadcasting. At low frequencies, external electric and magnetic fields induce small circulating currents within the body. In virtually all ordinary environments, the levels of induced currents inside the body are too small to produce obvious effects. Despite extensive research, to date there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health.[3]

2 Electromagnetic fields and public health. Fact sheet No. 322. World Health Organization. June 2007.
3 What is EMF? World Health Organization. https://www.who.int/peh-emf/about/WhatisEMF/en/index1.html.

3.0 EMF MEASUREMENT APPROACH

3.1 Study Area

The study area for this analysis includes the existing Los Alamitos High School, plus a 350-foot-wide area surrounding the proposed project. **Figure 3-1** shows the proposed project site and EMF measurement area.

3.2 Test Schedule

UltraSystems performed the onsite EMF measurements on March 8, 2019. Samples were taken during mid-morning while school was in session.

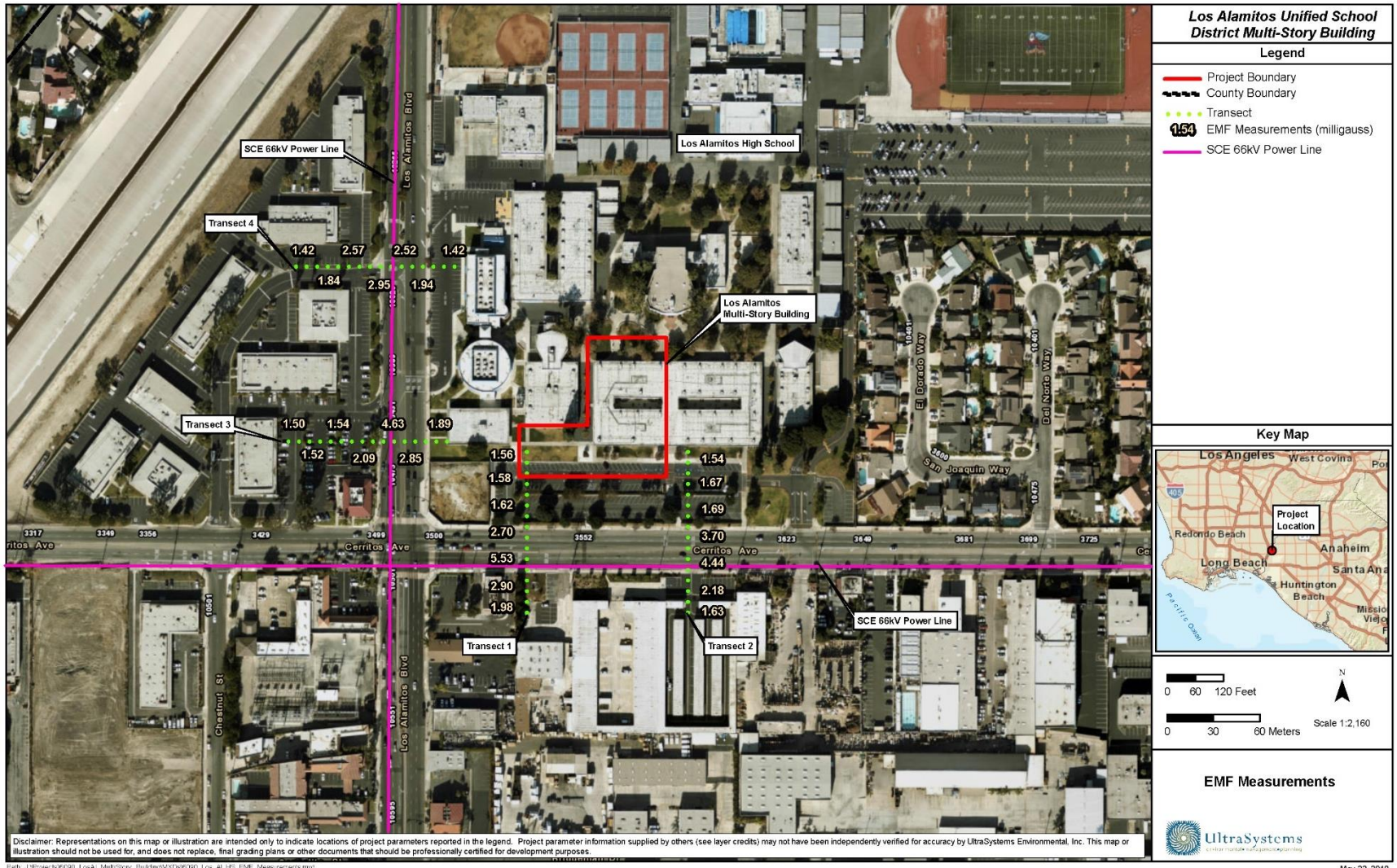
3.3 Test Procedure Overview

The Los Alamitos Multi-Story Building EMF measurements consisted of magnetic field measurements taken at the project's boundary, locations directly underneath the existing power lines, and along four transect lines that connect the project boundary and the power lines. These Southern California Edison (SCE) distribution power lines operate at 66 kilovolts at 60 Hertz.[4]

Magnetic Field Measurements: The measurement team performed and documented magnetic field measurements using a sensitive magnetometer (Tenmars Triaxial ELF Magnetic Field Meter, Model TM-192D). The team measured magnetic field strength in the frequency range of 30 Hertz to 2,000 Hertz using a three-axis magnetometer. The meter was factory-calibrated, has a sample rate of 2.5 times per second, and has an overall accuracy of ± 2.5% at 60 Hertz.

4 https://www.arcgis.com/home/webmap/viewer.html/transmissionlines.

Figure 3-1
EMF MEASUREMENT AREA



4.0 MEASUREMENT RESULTS AND CONCLUSIONS

4.1 Section Overview

In this section, tables are provided for magnetic field measurement data. The magnetic fields are identified, including amplitude of emission, measurement location, measurement distance from school, and measurement distance from existing power lines.

4.2 Magnetic Field Measurement Results

In **Table 3-1** through **Table 3-4**, the measurement sites and levels of magnetic field are presented. The highest levels of EMF are shown to correlate to locations that are directly underneath the power lines. These amplitude values represent the highest peak level of EMF found at the power-frequency of 60 Hertz. Along Transect 1, the EMF strength diminishes by approximately 71% as one goes from the power line to the school, which is 240 feet away. The other three transects showed similar results, with EMF values decreasing as measurement locations moved from the power lines to the school.

Table 3-1
MAGNETIC FIELD – TRANSECT 1

Reading	EMF Measurement (milligauss)	Distance from School (feet)	Distance from Power Line (feet)	GPS Location (Start to End)
1	1.98	320	96	33.810148 N, –118.071351 W
2	2.90	285	40	
3	5.53	240	0	
4	2.70	175	65	
5	1.62	120	130	
6	1.58	60	182	
7	1.58	0	245	33.810927 N, –118.071177 W

Table 3-2
MAGNETIC FIELD – TRANSECT 2

Reading	EMF Measurement (milligauss)	Distance from School	Distance from Power Line	GPS Location (Start to End)
1	1.63	340	105	33.810103 N, –118.070035 W
2	2.18	290	50	
3	4.44	230	0	
4	3.70	180	60	
5	1.69	115	125	
6	1.67	60	175	
7	1.54	0	220	33.810904 N, –118.070152 W

Table 3-3
MAGNETIC FIELD – TRANSECT 3

Reading	EMF Measurement (milligauss)	Distance from School	Distance from Power Line	GPS Location (Start to End)
1	1.50	340	210	33.810907 N, –118.072203 W
2	1.52	280	160	
3	1.54	230	110	
4	2.09	180	60	
5	4.63	120	0	
6	2.85	80	40	
7	1.89	25	105	33.810910 N, –118.071599 W

Table 3-4
MAGNETIC FIELD – TRANSECT 4

Reading	EMF Measurement (milligauss)	Distance from School	Distance from Power Line	GPS Location (Start to End)
1	1.42	360	200	33.811390 N, –118.072153 W
2	1.84	300	145	
3	2.57	240	60	
4	2.95	160	0	
5	1.52	130	45	
6	1.94	90	75	
7	1.42	24	130	33.811384 N, –118.071509 W

4.3 Measurement Conclusions

EMF measurement along all four transects produced almost the same results. The electromagnetic field environment between the proposed project and the adjacent power lines shows a uniform reduction of EMF as the distance from the power lines increases. This is due to the highly dissipative effect that distance has on electromagnetic field strength, since the force from the power line's magnetic field varies inversely by the cube of distance ($F = 1/d^3$).[5]

Within the general area of the school is an array of overhead power lines and radio transmission towers that produce a constant source of EMF throughout the vicinity. The ambient magnetic B-field measurement at 60 Hertz was approximately 1.6 milligauss (see **Table 3-1** through **Table 3-4**). This background EMF value corresponds to the field strength at the school, which is between 120 feet and 240 feet from the existing power lines.

The proposed project activity will not occur closer to the power lines than the existing school buildings are currently, and neither student enrollment nor faculty and staff employment will increase because of the proposed project. Because the EMF produced by the power lines dissipates to a level similar to the general ambient level of EMF at the existing school, the project will not result in an increased exposure of students, faculty or staff to EMF.

5 Extremely Low Frequency Radiation/Power Lines. 3/6/2019. http://hps.org/hpspublications/articles/elfinfosheet.html.