

138-KV DESIGN DATA:

CAPACITY: 200MW
 CONDUCTOR:
 1272 KCMIL ACSR "PHEASANT"
 TYPICAL SPAN LENGTH: 600'
 MAXIMUM SPAN: 700'

NOTES:

1. STRUCTURE DIMENSIONS ARE APPROXIMATE. ACTUAL DIMENSIONS MAY VARY WITH TERRAIN.
2. DRAWING IS NOT TO SCALE.
3. DIMENSIONS ARE TO ATTACHMENT BOLT HOLES

AVIAN-SAFE DESIGN:

1. 138-KV PHASE SPACING AND PHASE-TO-GROUND SPACING EXCEEDS 60".

IBERDROLA RENEWABLES
 TULE WIND PROJECT

FIGURE 1
 138-kV STEEL
 TANGENT POLE CONCEPT

TriAxis
 Engineering, Inc.

PLS-CADD Version 10.40 1:31:22 PM Thursday, February 11, 2010
 Tri-Axis Engineering
 Project Name: 'x:\Iberdrola\tule - San Diego\EMF Calcs\138-kV'

Criteria notes:

NESC Heavy per Rule 250B, Page 161
 Extreme Wind Loading per Rule 250C, Page 161, Coefficients and Gust Response Factors per Equations in Tables 250-2, 250-3
 100 MPH Basic Wind Speed, 3 second Gust Wind Speed, Figure 250-2 Beginning on Page 166
 Extreme Ice 0.5" at 30 Deg. F
 Grade B Construction "Method A" per Table 253-1, Page 173 and Table 261-1A, Page 182
 Tension Limits per RUS TABLE 9-3, Maximum Tension 0 Deg F 20%
 Insulator Strength Reduction per Rule 277, Page 188
 Stringing Loads Calculation - Additional Vertical Loads and Net Longitudinal
 R.S.=500 ft. Max. Span = 550 Ft
 138-kV Insulator Swing Clearance: Everyday - 72" (downlead); Med. Wind - 64"; High Wind - 20" (Ref RUS Bulletin 1724E-200 Table 7-1)
 DOWN GUY WITH GUY STRAIN INSULATORS TO 138-KV MINIMUM CLEARANCE 3 FEET PER NESC TABLE 7-1
 INSULATOR SWING: 138-kV, No wind Clearance=48", Moderate Wind:=30", High Wind=12" (see RUS Table 7-1)

EMF Calculation Notes:

- 1) All calculations based on the EPRI Red Book methods (2nd Edition, 1982 - infinite straight wire with flat earth approximation).
- 2) These approximations are only valid for low frequency (50-60Hz) AC transmission lines.
- 3) Bundles are modeled with an equivalent conductor as per EPRI Red Book 8.3.1.
- 4) The effects of earth return currents (earth resistivity) are ignored when calculating the magnetic field.
- 5) Wire position is determined by the currently displayed weather case.
- 6) Wire height used is the height of the wire where the target point is projected upon it.
- 7) All calculations assume ground is flat with same elevation as that of centerline.

Meter height above centerline ground: 3.28 (ft)
 Cross section offset for graph +/-: 200.00 (ft)
 Result interval for graph: 5.00 (ft)
 Electric field limit: 0.00 (kV/m)
 Magnetic field limit: 0.00 (mG)

EMF Circuit Data:

Set #	Phase #	Conductors Per Phase	Voltage Ph-Ph (kV)	Current (Amps)	Phase Angle (deg)	Bundle Diameter (in)
1	1	1	0	0.000	0	0.000
2	1	1	138	837.000	0	0.000
2	2	1	138	837.000	120	0.000
2	3	1	138	837.000	-120	0.000

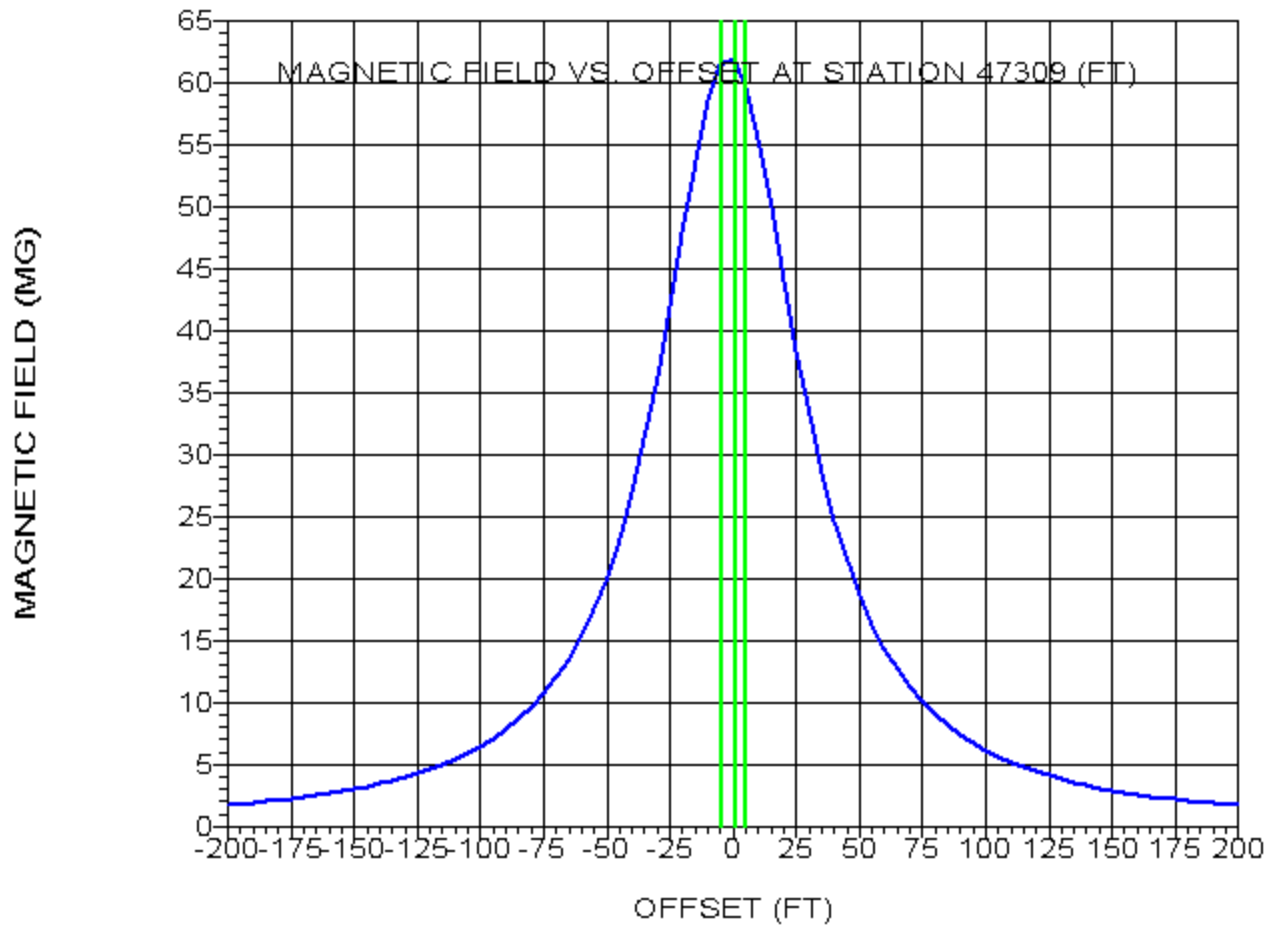
Calculated EMF Circuit Data For Last Point:

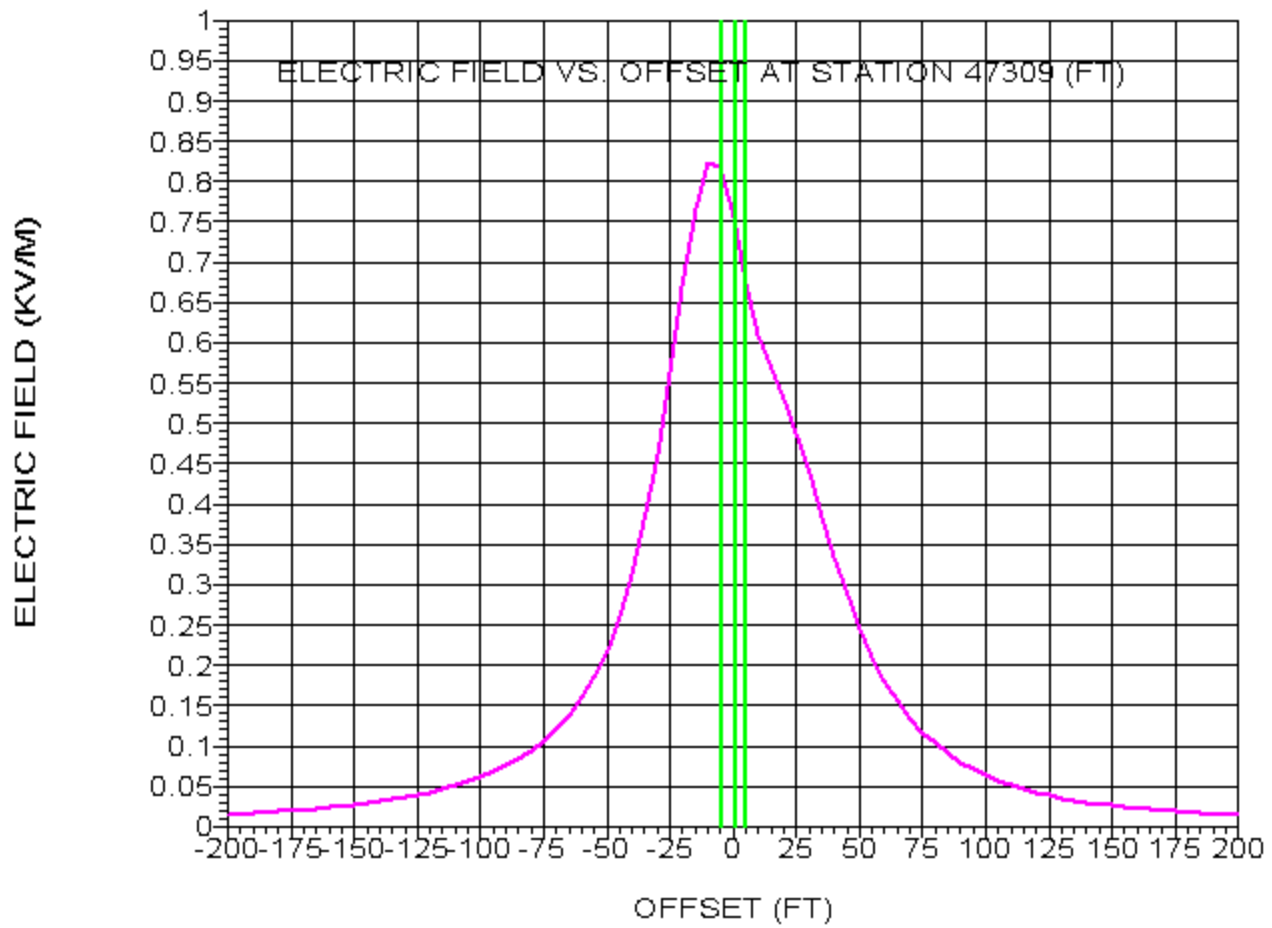
Wire coordinates are printed for the location on the wire closest to the alignment.
 In the case of wires that are not parallel, this may result in different stations
 for the wires and centerline.

Set #	Phase #	Weather Case	Cable Condition	Wind From	Wire X (ft)	Wire Y (ft)	Wire Z (ft)	Wire Station (ft)	Wire Offset (ft)	Eqv. Diameter (in)	Wire Voltage To Gnd. (kV)
1	1	90 Deg F	Max Sag	RS	Left 1430896.56	6719857.12	2215.23	47309.04	0.97	0.528	0
2	1	212 Deg F	Creep	RS	Left 1430902.23	6719857.20	2198.71	47309.04	-4.70	1.382	79.67
2	2	212 Deg F	Creep	RS	Left 1430892.82	6719857.06	2193.71	47309.04	4.70	1.382	79.67
2	3	212 Deg F	Creep	RS	Left 1430902.23	6719857.20	2188.71	47309.04	-4.70	1.382	79.67

Maximum magnetic field of 61.86 (mG) found at station 47309.04, offset 0.00 (ft)

Maximum electric field of 0.823 (kV/m) found at station 47309.04, offset -10.00 (ft)

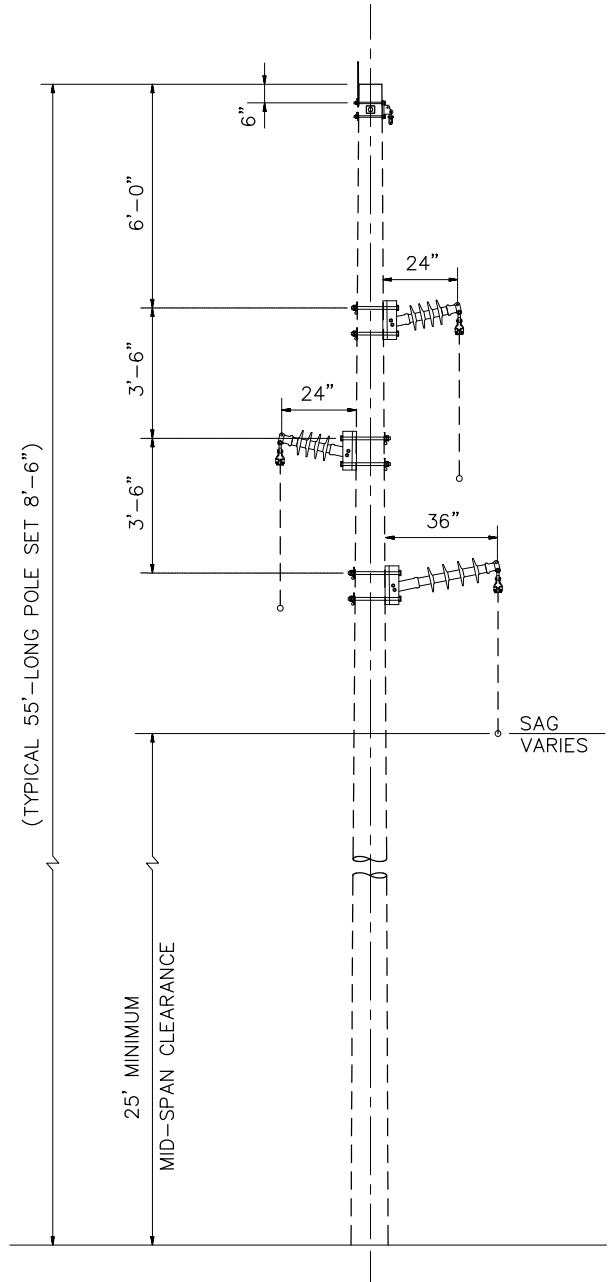




EMF Calculation Results:

Station	Offset	X	Y	Z	B	B B	Phase	B rms	E	E E	E Phase	E Axis	E rms
(ft)	(ft)	(ft)	(ft)	(ft)	Real	Img.	Angle	Res.	Real	Img.	Angle	Angle	Res.
					(mG)	(mG)	(deg)	(mG)	(kV/m)	(kV/m)	(deg)	(deg)	(kV/m)
47309.04	-200.00	1431097.50	6719860.15	2156.58	1.212	1.23733	45.6	1.732	0.015	0.00035	1.4	88.0	0.015
47309.04	-195.00	1431092.50	6719860.08	2156.58	1.274	1.30002	45.6	1.820	0.015	0.00055	2.0	88.0	0.016
47309.04	-190.00	1431087.50	6719860.00	2156.58	1.340	1.36755	45.6	1.915	0.016	0.00078	2.7	87.9	0.016
47309.04	-185.00	1431082.51	6719859.93	2156.58	1.412	1.44043	45.6	2.017	0.017	0.00106	3.5	87.9	0.017
47309.04	-180.00	1431077.51	6719859.85	2156.58	1.490	1.51924	45.6	2.128	0.018	0.00137	4.3	87.8	0.018
47309.04	-175.00	1431072.51	6719859.78	2156.58	1.574	1.60462	45.6	2.248	0.019	0.00174	5.1	87.7	0.019
47309.04	-170.00	1431067.51	6719859.70	2156.58	1.665	1.69733	45.5	2.378	0.021	0.00216	6.0	87.7	0.021
47309.04	-165.00	1431062.51	6719859.63	2156.58	1.765	1.79822	45.5	2.519	0.022	0.00264	6.9	87.6	0.022
47309.04	-160.00	1431057.51	6719859.55	2156.58	1.873	1.90825	45.5	2.674	0.023	0.00321	7.9	87.5	0.023
47309.04	-155.00	1431052.51	6719859.47	2156.58	1.992	2.02856	45.5	2.843	0.025	0.00387	8.9	87.5	0.025
47309.04	-150.00	1431047.51	6719859.40	2156.58	2.121	2.16046	45.5	3.028	0.026	0.00464	9.9	87.4	0.027
47309.04	-145.00	1431042.51	6719859.32	2156.58	2.264	2.30543	45.5	3.231	0.028	0.00553	11.0	87.3	0.029
47309.04	-140.00	1431037.51	6719859.25	2156.58	2.422	2.46526	45.5	3.456	0.030	0.00658	12.2	87.2	0.031
47309.04	-135.00	1431032.51	6719859.17	2156.58	2.595	2.64199	45.5	3.704	0.033	0.00782	13.5	87.1	0.034
47309.04	-130.00	1431027.51	6719859.10	2156.58	2.788	2.83806	45.5	3.979	0.035	0.00927	14.8	87.0	0.036
47309.04	-125.00	1431022.51	6719859.02	2156.58	3.003	3.05631	45.5	4.284	0.038	0.01099	16.3	86.9	0.039
47309.04	-120.00	1431017.51	6719858.94	2156.58	3.242	3.30016	45.5	4.626	0.041	0.01304	17.8	86.8	0.043
47309.04	-115.00	1431012.51	6719858.87	2156.58	3.510	3.57364	45.5	5.009	0.044	0.01548	19.4	86.7	0.047
47309.04	-110.00	1431007.51	6719858.79	2156.58	3.811	3.88163	45.5	5.440	0.048	0.01841	21.2	86.5	0.051
47309.04	-105.00	1431002.51	6719858.72	2156.58	4.151	4.22999	45.5	5.927	0.052	0.02193	23.1	86.4	0.056
47309.04	-100.00	1430997.52	6719858.64	2156.58	4.537	4.62583	45.6	6.479	0.056	0.02620	25.1	86.3	0.062
47309.04	-95.00	1430992.52	6719858.57	2156.58	4.976	5.07785	45.6	7.109	0.061	0.03138	27.3	86.1	0.068
47309.04	-90.00	1430987.52	6719858.49	2156.58	5.478	5.59670	45.6	7.831	0.066	0.03772	29.8	86.0	0.076
47309.04	-85.00	1430982.52	6719858.42	2156.58	6.054	6.19555	45.7	8.662	0.071	0.04553	32.5	85.8	0.085
47309.04	-80.00	1430977.52	6719858.34	2156.58	6.719	6.89073	45.7	9.625	0.077	0.05519	35.5	85.6	0.095
47309.04	-75.00	1430972.52	6719858.26	2156.58	7.491	7.70263	45.8	10.745	0.084	0.06721	38.8	85.4	0.107
47309.04	-70.00	1430967.52	6719858.19	2156.58	8.390	8.65679	45.9	12.055	0.090	0.08226	42.5	85.1	0.122
47309.04	-65.00	1430962.52	6719858.11	2156.58	9.441	9.78526	46.0	13.597	0.095	0.10120	46.7	84.9	0.139
47309.04	-60.00	1430957.52	6719858.04	2156.58	10.674	11.12829	46.2	15.420	0.100	0.12514	51.3	84.6	0.160
47309.04	-55.00	1430952.52	6719857.96	2156.58	12.125	12.73614	46.4	17.585	0.102	0.15548	56.6	84.2	0.186
47309.04	-50.00	1430947.52	6719857.89	2156.58	13.832	14.67076	46.7	20.163	0.101	0.19392	62.5	83.8	0.218
47309.04	-45.00	1430942.52	6719857.81	2156.58	15.835	17.00649	47.0	23.237	0.093	0.24240	69.0	83.3	0.259
47309.04	-40.00	1430937.52	6719857.74	2156.58	18.168	19.82786	47.5	26.893	0.076	0.30280	75.8	82.9	0.311
47309.04	-35.00	1430932.52	6719857.66	2156.58	20.846	23.22057	48.1	31.205	0.050	0.37627	82.4	82.6	0.378
47309.04	-30.00	1430927.52	6719857.58	2156.58	23.840	27.24854	48.8	36.205	0.046	0.46170	84.3	82.5	0.462
47309.04	-25.00	1430922.52	6719857.51	2156.58	27.042	31.90665	49.7	41.824	0.112	0.55327	78.5	83.0	0.562
47309.04	-20.00	1430917.52	6719857.43	2156.58	30.227	37.04067	50.8	47.809	0.217	0.63714	71.2	84.2	0.670
47309.04	-15.00	1430912.52	6719857.36	2156.58	33.039	42.24752	52.0	53.632	0.342	0.68955	63.6	86.1	0.767
47309.04	-10.00	1430907.53	6719857.28	2156.58	35.038	46.82484	53.2	58.483	0.470	0.68113	55.4	88.8	0.823
47309.04	-5.00	1430902.53	6719857.21	2156.58	35.861	49.89359	54.3	61.444	0.575	0.59149	45.8	91.7	0.818
47309.04	0.00	1430897.53	6719857.13	2156.58	35.386	50.74272	55.1	61.863	0.636	0.42831	34.0	273.9	0.757

47309.04	5.00	1430892.53	6719857.05	2156.58	33.776	49.19652	55.5	59.675	0.646	0.23613	20.1	274.3	0.675
47309.04	10.00	1430887.53	6719856.98	2156.58	31.360	45.69029	55.5	55.417	0.610	0.11950	11.1	273.1	0.610
47309.04	15.00	1430882.53	6719856.90	2156.58	28.492	41.00719	55.2	49.934	0.544	0.18863	19.1	272.3	0.568
47309.04	20.00	1430877.53	6719856.83	2156.58	25.469	35.92698	54.7	44.039	0.464	0.26824	30.1	272.7	0.532
47309.04	25.00	1430872.53	6719856.75	2156.58	22.514	31.01365	54.0	38.324	0.382	0.30752	38.8	273.6	0.488
47309.04	30.00	1430867.53	6719856.68	2156.58	19.770	26.57729	53.4	33.124	0.307	0.31379	45.6	274.4	0.438
47309.04	35.00	1430862.53	6719856.60	2156.58	17.309	22.73294	52.7	28.572	0.242	0.29958	51.0	275.1	0.385
47309.04	40.00	1430857.53	6719856.53	2156.58	15.151	19.47885	52.1	24.677	0.189	0.27500	55.5	275.5	0.333
47309.04	45.00	1430852.53	6719856.45	2156.58	13.285	16.75743	51.6	21.385	0.146	0.24665	59.3	275.7	0.287
47309.04	50.00	1430847.53	6719856.37	2156.58	11.685	14.49228	51.1	18.616	0.113	0.21832	62.7	275.8	0.246
47309.04	55.00	1430842.53	6719856.30	2156.58	10.317	12.60718	50.7	16.291	0.086	0.19192	65.8	275.8	0.210
47309.04	60.00	1430837.53	6719856.22	2156.58	9.148	11.03411	50.3	14.333	0.066	0.16824	68.6	275.7	0.181
47309.04	65.00	1430832.53	6719856.15	2156.58	8.148	9.71567	50.0	12.680	0.050	0.14745	71.2	275.5	0.156
47309.04	70.00	1430827.53	6719856.07	2156.58	7.290	8.60475	49.7	11.277	0.038	0.12943	73.7	275.3	0.135
47309.04	75.00	1430822.54	6719856.00	2156.58	6.550	7.66326	49.5	10.081	0.028	0.11389	76.1	275.1	0.117
47309.04	80.00	1430817.54	6719855.92	2156.58	5.910	6.86059	49.3	9.055	0.021	0.10054	78.3	274.9	0.103
47309.04	85.00	1430812.54	6719855.84	2156.58	5.355	6.17222	49.1	8.171	0.015	0.08908	80.4	274.7	0.090
47309.04	90.00	1430807.54	6719855.77	2156.58	4.870	5.57845	48.9	7.405	0.010	0.07921	82.4	274.5	0.080
47309.04	95.00	1430802.54	6719855.69	2156.58	4.445	5.06343	48.7	6.738	0.007	0.07071	84.4	274.3	0.071
47309.04	100.00	1430797.54	6719855.62	2156.58	4.072	4.61433	48.6	6.154	0.004	0.06335	86.2	274.1	0.063
47309.04	105.00	1430792.54	6719855.54	2156.58	3.741	4.22073	48.4	5.640	0.002	0.05697	87.9	274.0	0.057
47309.04	110.00	1430787.54	6719855.47	2156.58	3.448	3.87412	48.3	5.187	0.001	0.05142	88.9	273.8	0.051
47309.04	115.00	1430782.54	6719855.39	2156.58	3.187	3.56750	48.2	4.784	0.002	0.04657	88.1	273.6	0.047
47309.04	120.00	1430777.54	6719855.32	2156.58	2.954	3.29510	48.1	4.426	0.002	0.04232	86.7	273.5	0.042
47309.04	125.00	1430772.54	6719855.24	2156.58	2.745	3.05212	48.0	4.105	0.003	0.03857	85.2	273.3	0.039
47309.04	130.00	1430767.54	6719855.16	2156.58	2.557	2.83456	48.0	3.817	0.004	0.03527	83.8	273.2	0.035
47309.04	135.00	1430762.54	6719855.09	2156.58	2.387	2.63905	47.9	3.558	0.004	0.03234	82.4	273.1	0.033
47309.04	140.00	1430757.54	6719855.01	2156.58	2.233	2.46278	47.8	3.324	0.005	0.02973	81.1	273.0	0.030
47309.04	145.00	1430752.54	6719854.94	2156.58	2.093	2.30332	47.7	3.112	0.005	0.02741	79.8	272.9	0.028
47309.04	150.00	1430747.54	6719854.86	2156.58	1.966	2.15866	47.7	2.920	0.005	0.02533	78.6	272.8	0.026
47309.04	155.00	1430742.54	6719854.79	2156.58	1.849	2.02702	47.6	2.744	0.005	0.02347	77.4	272.7	0.024
47309.04	160.00	1430737.54	6719854.71	2156.58	1.743	1.90692	47.6	2.584	0.005	0.02179	76.3	272.6	0.022
47309.04	165.00	1430732.55	6719854.64	2156.58	1.645	1.79707	47.5	2.437	0.005	0.02027	75.2	272.5	0.021
47309.04	170.00	1430727.55	6719854.56	2156.58	1.556	1.69633	47.5	2.302	0.005	0.01890	74.2	272.4	0.020
47309.04	175.00	1430722.55	6719854.48	2156.58	1.473	1.60375	47.4	2.178	0.005	0.01765	73.2	272.3	0.018
47309.04	180.00	1430717.55	6719854.41	2156.58	1.397	1.51847	47.4	2.063	0.005	0.01652	72.2	272.3	0.017
47309.04	185.00	1430712.55	6719854.33	2156.58	1.326	1.43976	47.4	1.957	0.005	0.01549	71.3	272.2	0.016
47309.04	190.00	1430707.55	6719854.26	2156.58	1.261	1.36695	47.3	1.859	0.005	0.01454	70.4	272.1	0.015
47309.04	195.00	1430702.55	6719854.18	2156.58	1.200	1.29949	47.3	1.769	0.005	0.01368	69.6	272.1	0.015
47309.04	200.00	1430697.55	6719854.11	2156.58	1.143	1.23686	47.3	1.684	0.005	0.01288	68.7	272.0	0.014



DESIGN ASSUMPTIONS:

- 1590 KCMIL "COREOPSIS" AAC
- 280' MAX SPAN

NOTES:

1. STRUCTURE DIMENSIONS ARE APPROXIMATE. ACTUAL DIMENSIONS MAY VARY.
2. DIMENSIONS ARE TO ATTACHMENT HOLES.
3. DRAWING IS NOT TO EXACT SCALE

IBERDROLA
TULE WIND
PROJECT

TYPICAL
34.5-KV HORIZONTAL LINE POST
TANGENT SINGLE-CIRCUIT CONFIGURATION



DSGN MCF DR JHR DATE FEB 2010

FIG 1

PLS-CADD Version 10.40 1:25:06 PM Thursday, February 11, 2010
 Tri-Axis Engineering
 Project Name: 'x:\iberdrola\tule - san diego\emf calcs\34.5 overhead - single circuit

Criteria notes:

NESC Heavy per Rule 250B, Page 161
 Extreme Wind Loading per Rule 250C, Page 161, Coefficients and Gust Response Factors per Equations in Tables 250-2, 250-3
 100 MPH Basic Wind Speed, 3 second Gust Wind Speed, Figure 250-2 Beginning on Page 166
 Grade B Construction "Method A" per Table 253-1, Page 173 and Table 261-1A, Page 182
 Tension Limits per Rule 261H1, Page 179
 Insulator Strength Reduction per Rule 277, Page 188 Should be applied to Insulator Strengths when Modeling Insulators
 2002 NESC C2-2002 Criteria File

EMF Calculation Notes:

- 1) All calculations based on the EPRI Red Book methods (2nd Edition, 1982 - infinite straight wire with flat earth approximation).
- 2) These approximations are only valid for low frequency (50-60Hz) AC transmission lines.
- 3) Bundles are modeled with an equivalent conductor as per EPRI Red Book 8.3.1.
- 4) The effects of earth return currents (earth resistivity) are ignored when calculating the magnetic field.
- 5) Wire position is determined by the currently displayed weather case.
- 6) Wire height used is the height of the wire where the target point is projected upon it.
- 7) All calculations assume ground is flat with same elevation as that of centerline.

Meter height above centerline ground: 3.28 (ft)
 Cross section offset for graph +/-: 200.00 (ft)
 Result interval for graph: 5.00 (ft)
 Electric field limit: 0.00 (kV/m)
 Magnetic field limit: 0.00 (mG)

EMF Circuit Data:

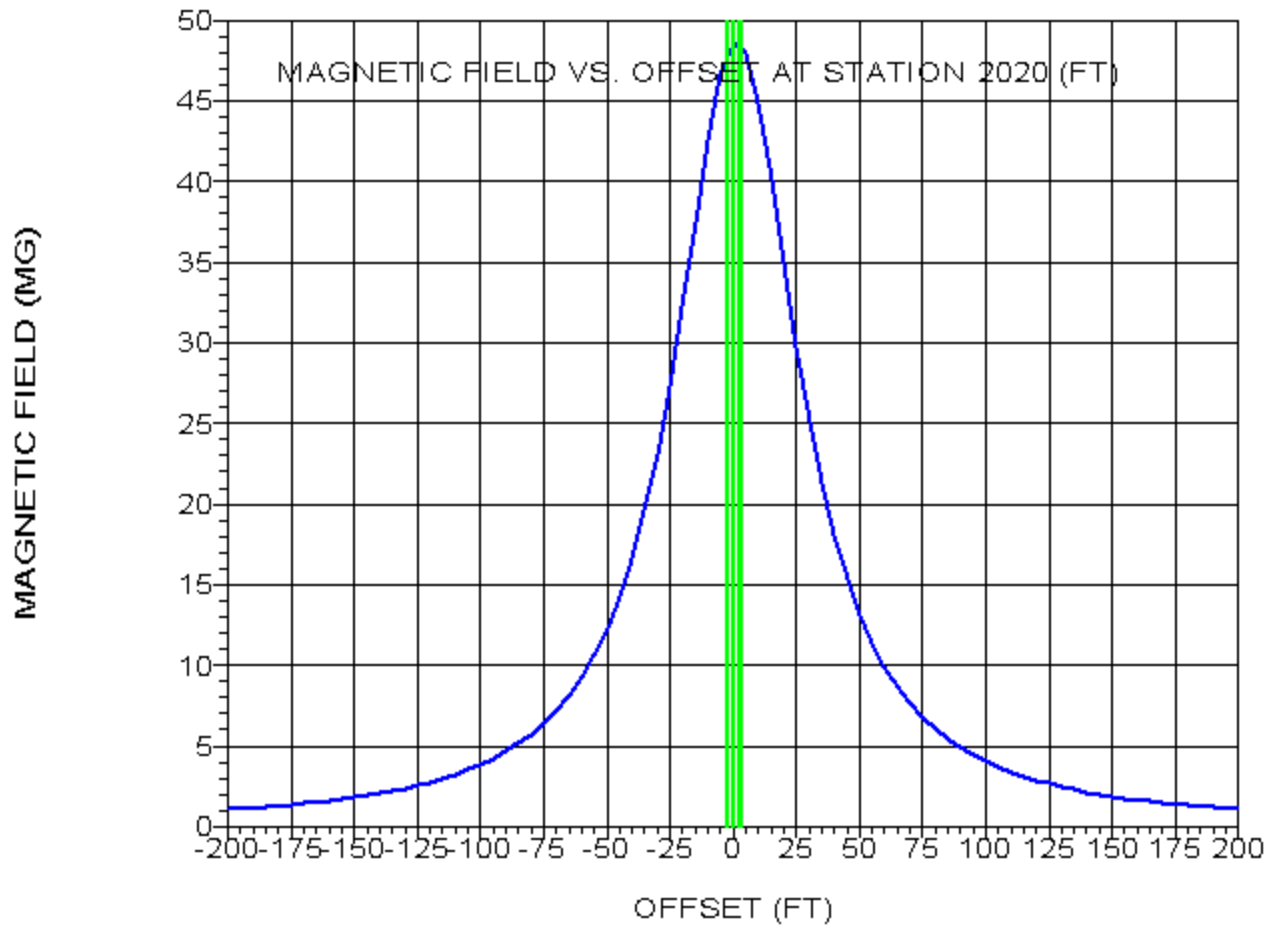
Set #	Phase #	Conductors Per Phase	Voltage Ph-Ph (kV)	Current (Amps)	Phase Angle (deg)	Bundle Diameter (in)
1	1	1	34.5	837.000	0	0.000
1	2	1	34.5	837.000	120	0.000
1	3	1	34.5	837.000	-120	0.000
7	1	1	0	0.000	0	0.000

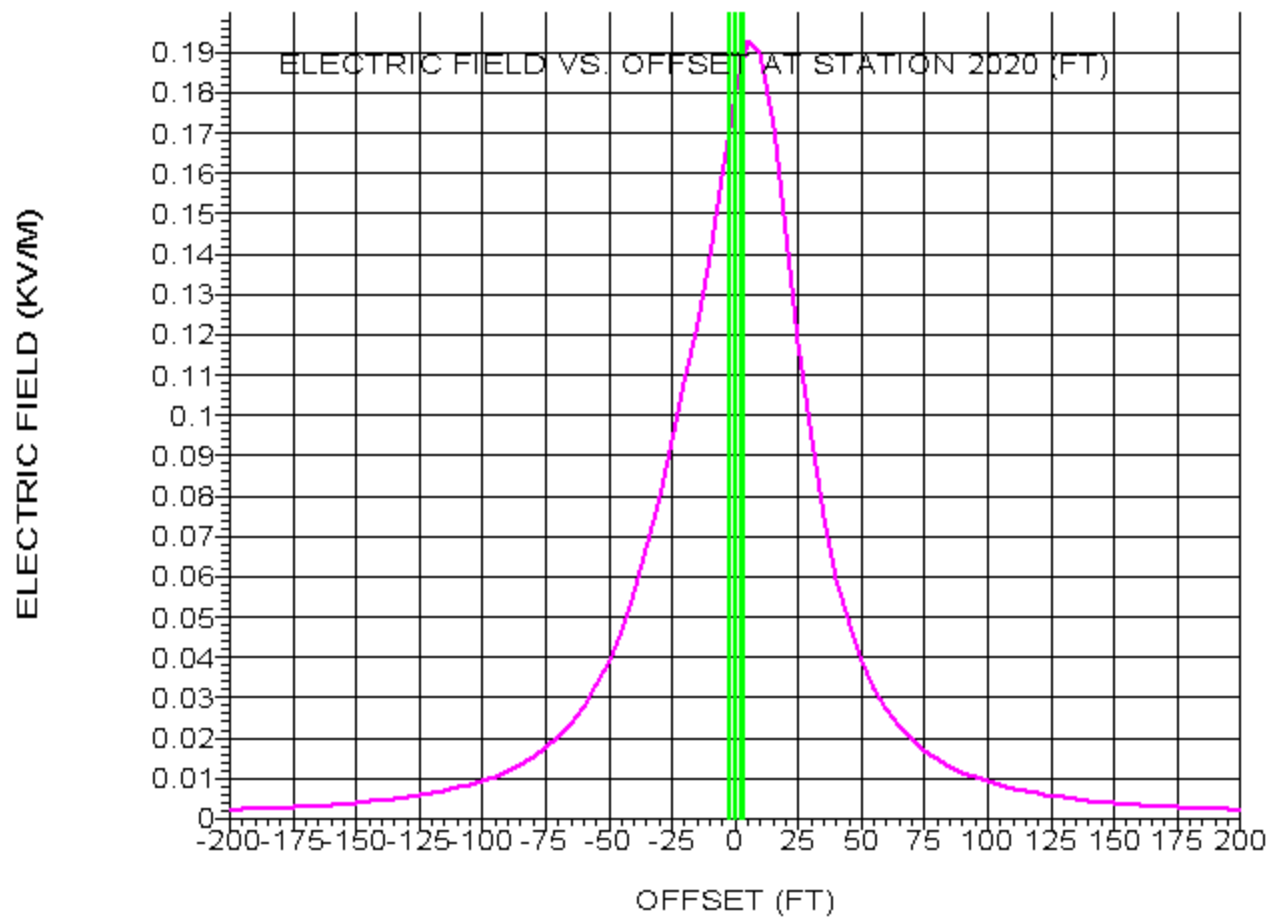
Calculated EMF Circuit Data For Last Point:

Wire coordinates are printed for the location on the wire closest to the alignment.
 In the case of wires that are not parallel, this may result in different stations
 for the wires and centerline.

Set #	Phase #	Weather Case	Cable Condition	Wind From	Wire X (ft)	Wire Y (ft)	Wire Z (ft)	Wire Station (ft)	Wire Offset (ft)	Eqv. Diameter (in)	Wire Voltage To Gnd. (kV)
1	1	Maximum Operating	Max Sag	RS Left	1690481.60	207856.02	2591.80	2019.78	2.39	1.454	19.92
1	2	Maximum Operating	Max Sag	RS Left	1690476.80	207855.99	2588.30	2019.78	-2.41	1.454	19.92
1	3	Maximum Operating	Max Sag	RS Left	1690482.64	207856.03	2585.26	2019.78	3.43	1.454	19.92
7	1	120 Deg F	Max Sag	RS Left	1690479.21	207856.01	2600.95	2019.78	0.00	0.646	0

Maximum magnetic field of 48.61 (mG) found at station 2019.78, offset 0.00 (ft)
 Maximum electric field of 0.193 (kV/m) found at station 2019.78, offset 5.00 (ft)

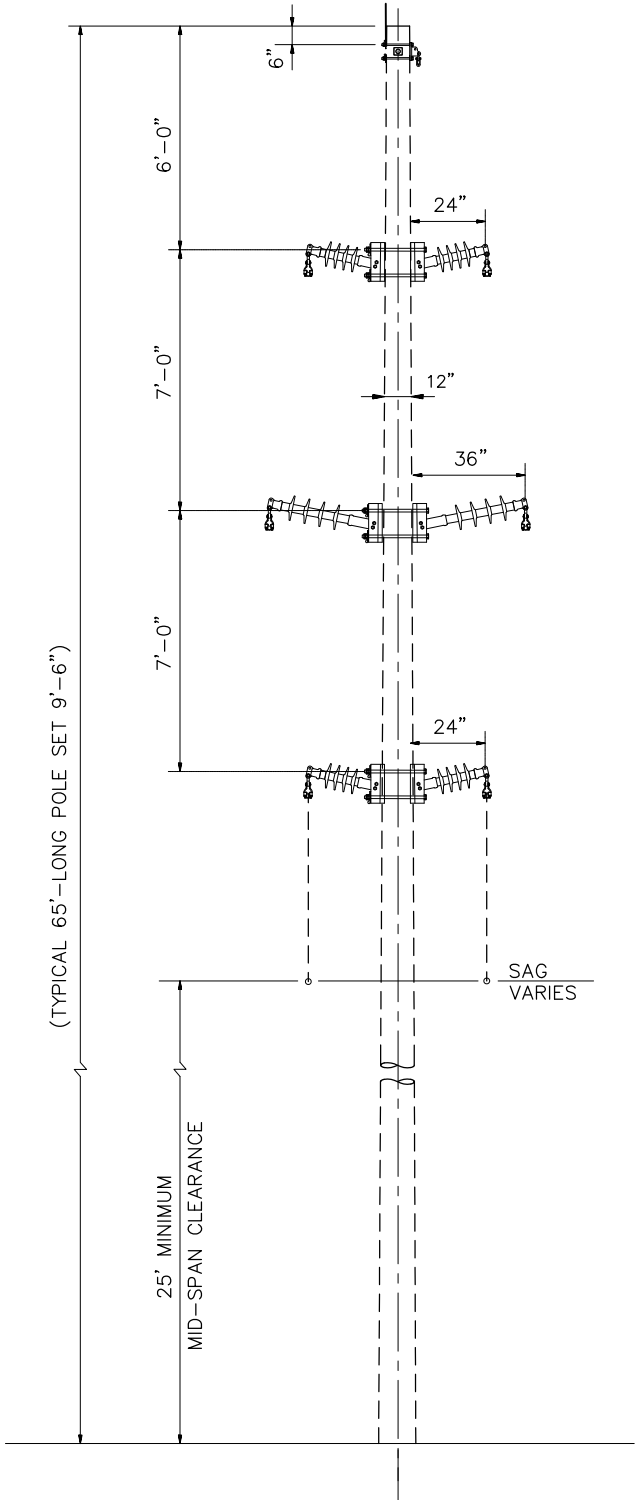




EMF Calculation Results:

Station	Offset	X	Y	Z	B	B B Phase	B rms	E	E E Phase	E Axis	E rms		
(ft)	(ft)	(ft)	(ft)	(ft)	Real	Img.	Angle	Res.	Real	Img.	Angle	Angle	Res.
					(mG)	(mG)	(deg)	(mG)	(kV/m)	(kV/m)	(deg)	(deg)	(kV/m)
2019.78	-200.00	1690279.22	207854.83	2555.25	0.704	0.76368	47.3	1.039	0.001	0.00180	60.9	268.0	0.002
2019.78	-195.00	1690284.22	207854.86	2555.25	0.740	0.80243	47.3	1.091	0.001	0.00192	61.6	267.9	0.002
2019.78	-190.00	1690289.22	207854.89	2555.25	0.778	0.84419	47.3	1.148	0.001	0.00204	62.4	267.9	0.002
2019.78	-185.00	1690294.21	207854.92	2555.25	0.819	0.88926	47.4	1.209	0.001	0.00218	63.3	267.8	0.002
2019.78	-180.00	1690299.21	207854.95	2555.25	0.863	0.93802	47.4	1.275	0.001	0.00233	64.2	267.7	0.003
2019.78	-175.00	1690304.21	207854.98	2555.25	0.911	0.99086	47.4	1.346	0.001	0.00250	65.1	267.7	0.003
2019.78	-170.00	1690309.21	207855.01	2555.25	0.963	1.04825	47.4	1.423	0.001	0.00268	66.0	267.6	0.003
2019.78	-165.00	1690314.21	207855.04	2555.25	1.019	1.11072	47.5	1.508	0.001	0.00288	67.0	267.5	0.003
2019.78	-160.00	1690319.21	207855.07	2555.25	1.081	1.17889	47.5	1.599	0.001	0.00310	68.1	267.4	0.003
2019.78	-155.00	1690324.21	207855.10	2555.25	1.148	1.25345	47.5	1.700	0.001	0.00335	69.2	267.4	0.004
2019.78	-150.00	1690329.21	207855.13	2555.25	1.222	1.33524	47.5	1.810	0.001	0.00363	70.3	267.3	0.004
2019.78	-145.00	1690334.21	207855.16	2555.25	1.302	1.42519	47.6	1.931	0.001	0.00394	71.6	267.2	0.004
2019.78	-140.00	1690339.21	207855.18	2555.25	1.391	1.52441	47.6	2.064	0.001	0.00428	72.8	267.0	0.004
2019.78	-135.00	1690344.21	207855.21	2555.25	1.489	1.63421	47.7	2.211	0.001	0.00467	74.1	266.9	0.005
2019.78	-130.00	1690349.21	207855.24	2555.25	1.598	1.75611	47.7	2.374	0.001	0.00511	75.5	266.8	0.005
2019.78	-125.00	1690354.21	207855.27	2555.25	1.719	1.89193	47.7	2.556	0.001	0.00561	77.0	266.7	0.006
2019.78	-120.00	1690359.21	207855.30	2555.25	1.854	2.04382	47.8	2.759	0.001	0.00618	78.5	266.5	0.006
2019.78	-115.00	1690364.21	207855.33	2555.25	2.004	2.21438	47.8	2.987	0.001	0.00683	80.1	266.4	0.007
2019.78	-110.00	1690369.21	207855.36	2555.25	2.174	2.40669	47.9	3.243	0.001	0.00757	81.8	266.2	0.008
2019.78	-105.00	1690374.21	207855.39	2555.25	2.365	2.62454	48.0	3.533	0.001	0.00843	83.6	266.0	0.008
2019.78	-100.00	1690379.21	207855.42	2555.25	2.582	2.87251	48.1	3.862	0.001	0.00942	85.4	265.8	0.009
2019.78	-95.00	1690384.21	207855.45	2555.25	2.828	3.15623	48.1	4.238	0.001	0.01057	87.3	265.6	0.011
2019.78	-90.00	1690389.21	207855.48	2555.25	3.110	3.48265	48.2	4.669	0.000	0.01192	88.5	265.4	0.012
2019.78	-85.00	1690394.21	207855.51	2555.25	3.435	3.86041	48.3	5.167	0.001	0.01350	87.5	265.2	0.014
2019.78	-80.00	1690399.21	207855.54	2555.25	3.810	4.30034	48.5	5.746	0.001	0.01535	85.3	264.9	0.015
2019.78	-75.00	1690404.21	207855.57	2555.25	4.247	4.81606	48.6	6.421	0.002	0.01755	82.9	264.7	0.018
2019.78	-70.00	1690409.21	207855.59	2555.25	4.758	5.42488	48.7	7.216	0.003	0.02015	80.2	264.4	0.020
2019.78	-65.00	1690414.21	207855.62	2555.25	5.359	6.14885	48.9	8.157	0.005	0.02323	77.4	264.2	0.024
2019.78	-60.00	1690419.21	207855.65	2555.25	6.071	7.01619	49.1	9.278	0.008	0.02688	74.3	263.9	0.028
2019.78	-55.00	1690424.21	207855.68	2555.25	6.919	8.06308	49.4	10.625	0.011	0.03117	71.0	263.6	0.033
2019.78	-50.00	1690429.21	207855.71	2555.25	7.934	9.33562	49.6	12.251	0.015	0.03616	67.3	263.4	0.039
2019.78	-45.00	1690434.21	207855.74	2555.25	9.152	10.89195	50.0	14.226	0.021	0.04181	63.3	263.3	0.047
2019.78	-40.00	1690439.21	207855.77	2555.25	10.616	12.80322	50.3	16.632	0.029	0.04794	58.8	263.3	0.056
2019.78	-35.00	1690444.21	207855.80	2555.25	12.373	15.15167	50.8	19.562	0.040	0.05403	53.7	263.4	0.067
2019.78	-30.00	1690449.21	207855.83	2555.25	14.461	18.02067	51.3	23.105	0.054	0.05894	47.6	263.7	0.080
2019.78	-25.00	1690454.21	207855.86	2555.25	16.898	21.46837	51.8	27.321	0.072	0.06066	40.2	264.3	0.094
2019.78	-20.00	1690459.21	207855.89	2555.25	19.650	25.47160	52.4	32.170	0.093	0.05614	31.0	265.0	0.108
2019.78	-15.00	1690464.21	207855.92	2555.25	22.586	29.83149	52.9	37.417	0.117	0.04246	19.9	265.4	0.123
2019.78	-10.00	1690469.21	207855.95	2555.25	25.438	34.06431	53.2	42.514	0.139	0.02670	10.8	265.3	0.139
2019.78	-5.00	1690474.21	207855.98	2555.25	27.792	37.37813	53.4	46.578	0.154	0.04979	17.9	265.0	0.159
2019.78	0.00	1690479.21	207856.01	2555.25	29.165	38.89290	53.1	48.614	0.156	0.09451	31.2	266.2	0.180

2019.78	5.00	1690484.21	207856.03	2555.25	29.191	38.10876	52.5	48.004	0.142	0.13247	42.9	268.9	0.193
2019.78	10.00	1690489.21	207856.06	2555.25	27.827	35.26065	51.7	44.918	0.116	0.15134	52.5	92.2	0.190
2019.78	15.00	1690494.21	207856.09	2555.25	25.412	31.16391	50.8	40.211	0.084	0.14999	60.7	95.0	0.171
2019.78	20.00	1690499.21	207856.12	2555.25	22.466	26.71320	49.9	34.904	0.054	0.13500	68.0	97.0	0.145
2019.78	25.00	1690504.21	207856.15	2555.25	19.452	22.52250	49.2	29.760	0.031	0.11424	75.0	98.2	0.118
2019.78	30.00	1690509.21	207856.18	2555.25	16.658	18.87469	48.6	25.174	0.014	0.09321	81.4	98.6	0.094
2019.78	35.00	1690514.21	207856.21	2555.25	14.211	15.82956	48.1	21.272	0.006	0.07459	85.6	98.6	0.075
2019.78	40.00	1690519.21	207856.24	2555.25	12.134	13.33836	47.7	18.032	0.007	0.05921	82.8	98.3	0.060
2019.78	45.00	1690524.21	207856.27	2555.25	10.399	11.31552	47.4	15.368	0.010	0.04694	77.4	97.9	0.048
2019.78	50.00	1690529.21	207856.30	2555.25	8.959	9.67322	47.2	13.185	0.012	0.03731	72.0	97.4	0.039
2019.78	55.00	1690534.21	207856.33	2555.25	7.766	8.33458	47.0	11.392	0.013	0.02982	66.9	96.9	0.032
2019.78	60.00	1690539.21	207856.36	2555.25	6.774	7.23668	46.9	9.913	0.013	0.02398	62.1	96.5	0.027
2019.78	65.00	1690544.21	207856.39	2555.25	5.947	6.32968	46.8	8.685	0.012	0.01942	57.8	96.1	0.023
2019.78	70.00	1690549.21	207856.42	2555.25	5.252	5.57462	46.7	7.659	0.012	0.01584	53.8	95.7	0.020
2019.78	75.00	1690554.21	207856.45	2555.25	4.665	4.94119	46.6	6.796	0.011	0.01301	50.1	95.3	0.017
2019.78	80.00	1690559.21	207856.47	2555.25	4.167	4.40579	46.6	6.064	0.010	0.01076	46.8	95.0	0.015
2019.78	85.00	1690564.21	207856.50	2555.25	3.741	3.95001	46.6	5.440	0.009	0.00895	43.7	94.8	0.013
2019.78	90.00	1690569.21	207856.53	2555.25	3.374	3.55934	46.5	4.905	0.009	0.00749	40.8	94.5	0.011
2019.78	95.00	1690574.21	207856.56	2555.25	3.057	3.22232	46.5	4.442	0.008	0.00630	38.2	94.3	0.010
2019.78	100.00	1690579.21	207856.59	2555.25	2.782	2.92983	46.5	4.040	0.007	0.00533	35.8	94.1	0.009
2019.78	105.00	1690584.21	207856.62	2555.25	2.540	2.67455	46.5	3.689	0.007	0.00453	33.5	93.9	0.008
2019.78	110.00	1690589.21	207856.65	2555.25	2.329	2.45057	46.5	3.380	0.006	0.00386	31.4	93.7	0.007
2019.78	115.00	1690594.21	207856.68	2555.25	2.141	2.25306	46.5	3.108	0.006	0.00331	29.4	93.5	0.007
2019.78	120.00	1690599.21	207856.71	2555.25	1.976	2.07810	46.4	2.867	0.005	0.00284	27.6	93.4	0.006
2019.78	125.00	1690604.21	207856.74	2555.25	1.828	1.92244	46.4	2.653	0.005	0.00245	25.9	93.3	0.006
2019.78	130.00	1690609.21	207856.77	2555.25	1.696	1.78337	46.4	2.461	0.005	0.00212	24.2	93.1	0.005
2019.78	135.00	1690614.21	207856.80	2555.25	1.577	1.65867	46.4	2.289	0.004	0.00184	22.7	93.0	0.005
2019.78	140.00	1690619.21	207856.83	2555.25	1.471	1.54643	46.4	2.134	0.004	0.00160	21.3	92.9	0.004
2019.78	145.00	1690624.21	207856.86	2555.25	1.374	1.44508	46.4	1.994	0.004	0.00139	19.9	92.8	0.004
2019.78	150.00	1690629.21	207856.88	2555.25	1.287	1.35327	46.4	1.867	0.004	0.00121	18.6	92.7	0.004
2019.78	155.00	1690634.21	207856.91	2555.25	1.207	1.26985	46.4	1.752	0.003	0.00106	17.4	92.6	0.004
2019.78	160.00	1690639.21	207856.94	2555.25	1.135	1.19383	46.4	1.647	0.003	0.00092	16.2	92.5	0.003
2019.78	165.00	1690644.21	207856.97	2555.25	1.069	1.12438	46.4	1.551	0.003	0.00081	15.1	92.4	0.003
2019.78	170.00	1690649.21	207857.00	2555.25	1.008	1.06077	46.5	1.464	0.003	0.00071	14.1	92.4	0.003
2019.78	175.00	1690654.21	207857.03	2555.25	0.953	1.00236	46.5	1.383	0.003	0.00062	13.1	92.3	0.003
2019.78	180.00	1690659.21	207857.06	2555.25	0.902	0.94861	46.5	1.309	0.003	0.00054	12.2	92.2	0.003
2019.78	185.00	1690664.21	207857.09	2555.25	0.854	0.89903	46.5	1.240	0.002	0.00047	11.2	92.2	0.002
2019.78	190.00	1690669.21	207857.12	2555.25	0.811	0.85322	46.5	1.177	0.002	0.00041	10.4	92.1	0.002
2019.78	195.00	1690674.21	207857.15	2555.25	0.770	0.81080	46.5	1.118	0.002	0.00036	9.6	92.0	0.002
2019.78	200.00	1690679.21	207857.18	2555.25	0.733	0.77145	46.5	1.064	0.002	0.00031	8.8	92.0	0.002



DESIGN ASSUMPTIONS:

- 1590 KCMIL "COREOPSIS" AAC
- 280' MAX SPAN

NOTES:

1. STRUCTURE DIMENSIONS ARE APPROXIMATE. ACTUAL DIMENSIONS MAY VARY.
2. DIMENSIONS ARE TO ATTACHMENT HOLES.
3. DRAWING IS NOT TO EXACT SCALE

IBERDROLA
TULE WIND
PROJECT

TYPICAL
34.5-KV HORIZONTAL LINE POST
TANGENT DOUBLE-CIRCUIT CONFIGURATION

TriAxis
Engineering, Inc.

DSGN MCF DR JHR DATE FEB 2010

FIG 2

PLS-CADD Version 10.40 4:15:00 PM Thursday, February 11, 2010
 Tri-Axis Engineering
 Project Name: 'x:\iberdrola\tule - san diego\emf calcs\34.5-kv overhead - double circuit\pebble springs_old2.DON'

Criteria notes:

NESC Heavy per Rule 250B, Page 161
 Extreme Wind Loading per Rule 250C, Page 161, Coefficients and Gust Response Factors per Equations in Tables 250-2, 250-3
 100 MPH Basic Wind Speed, 3 second Gust Wind Speed, Figure 250-2 Beginning on Page 166
 EXTREME ICE 1.75 IN RADIAL
 Grade B Construction "Method A" per Table 253-1, Page 173 and Table 261-1A, Page 182
 Tension Limits per RUS (REA BULLETIN 1724E-200, TABLE 9-2, PAGE 9-9)
 Insulator Strength Reduction per Rule 277, Page 188 Should be applied to Insulator Strengths when Modeling Insulators
 2002 NESC C2-2002 Criteria File for PLS-CADD Created December 21, 2001

EMF Calculation Notes:

- 1) All calculations based on the EPRI Red Book methods (2nd Edition, 1982 - infinite straight wire with flat earth approximation).
- 2) These approximations are only valid for low frequency (50-60Hz) AC transmission lines.
- 3) Bundles are modeled with an equivalent conductor as per EPRI Red Book 8.3.1.
- 4) The effects of earth return currents (earth resistivity) are ignored when calculating the magnetic field.
- 5) Wire position is determined by the currently displayed weather case.
- 6) Wire height used is the height of the wire where the target point is projected upon it.
- 7) All calculations assume ground is flat with same elevation as that of centerline.

Meter height above centerline ground: 3.28 (ft)
 Cross section offset for graph +/-: 200.00 (ft)
 Result interval for graph: 5.00 (ft)
 Electric field limit: 0.00 (kV/m)
 Magnetic field limit: 0.00 (mG)

EMF Circuit Data:

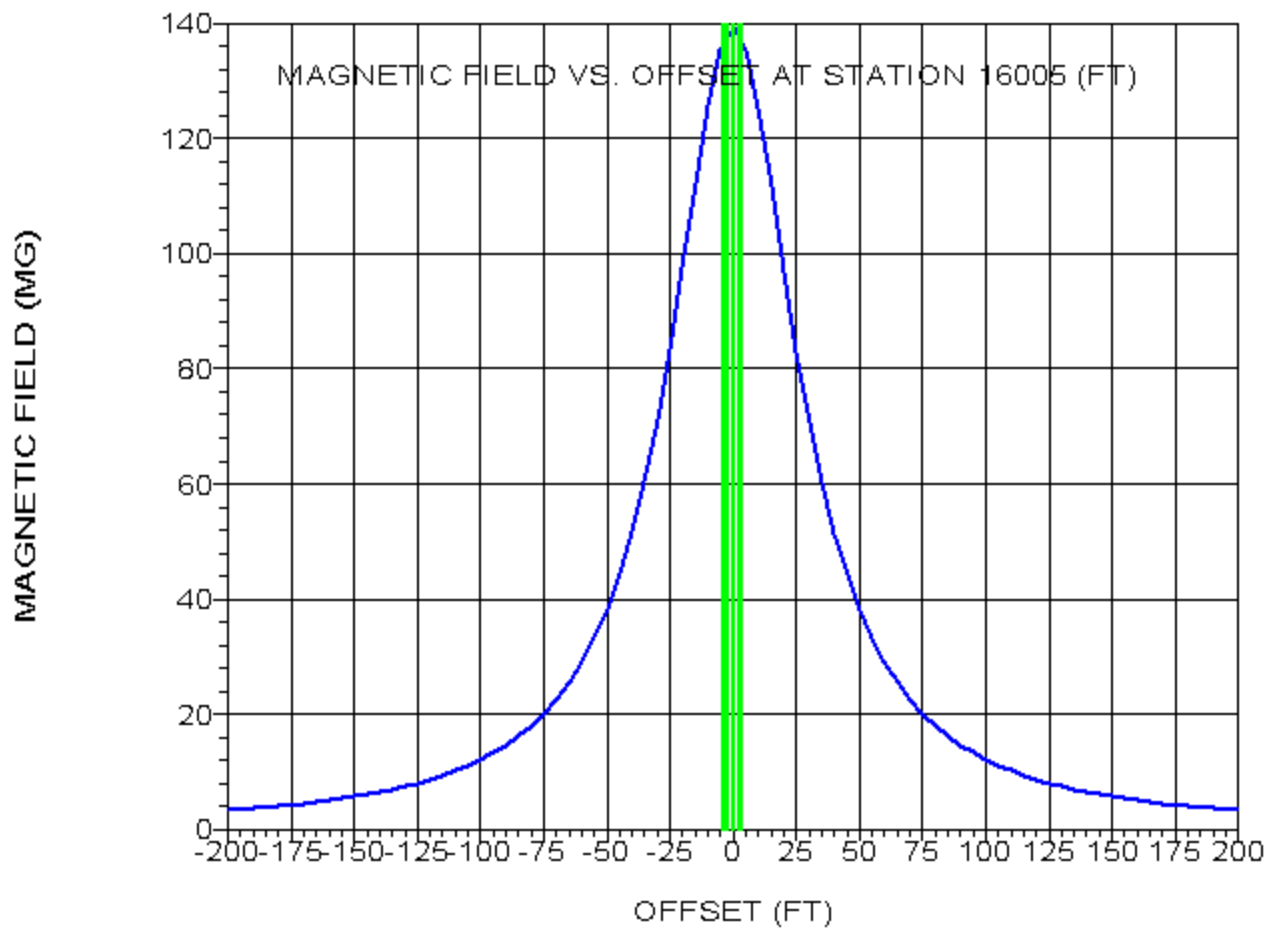
Set #	Phase #	Conductors Per Phase	Voltage Ph-Ph (kV)	Current (Amps)	Phase Angle (deg)	Bundle Diameter (in)
1	1	1	35	837.000	0	0.000
2	1	1	35	837.000	120	0.000
3	1	1	35	837.000	-120	0.000
4	1	1	35	837.000	-120	0.000
5	1	1	35	837.000	120	0.000
6	1	1	35	837.000	0	0.000
7	1	1	0	0.000	0	0.000

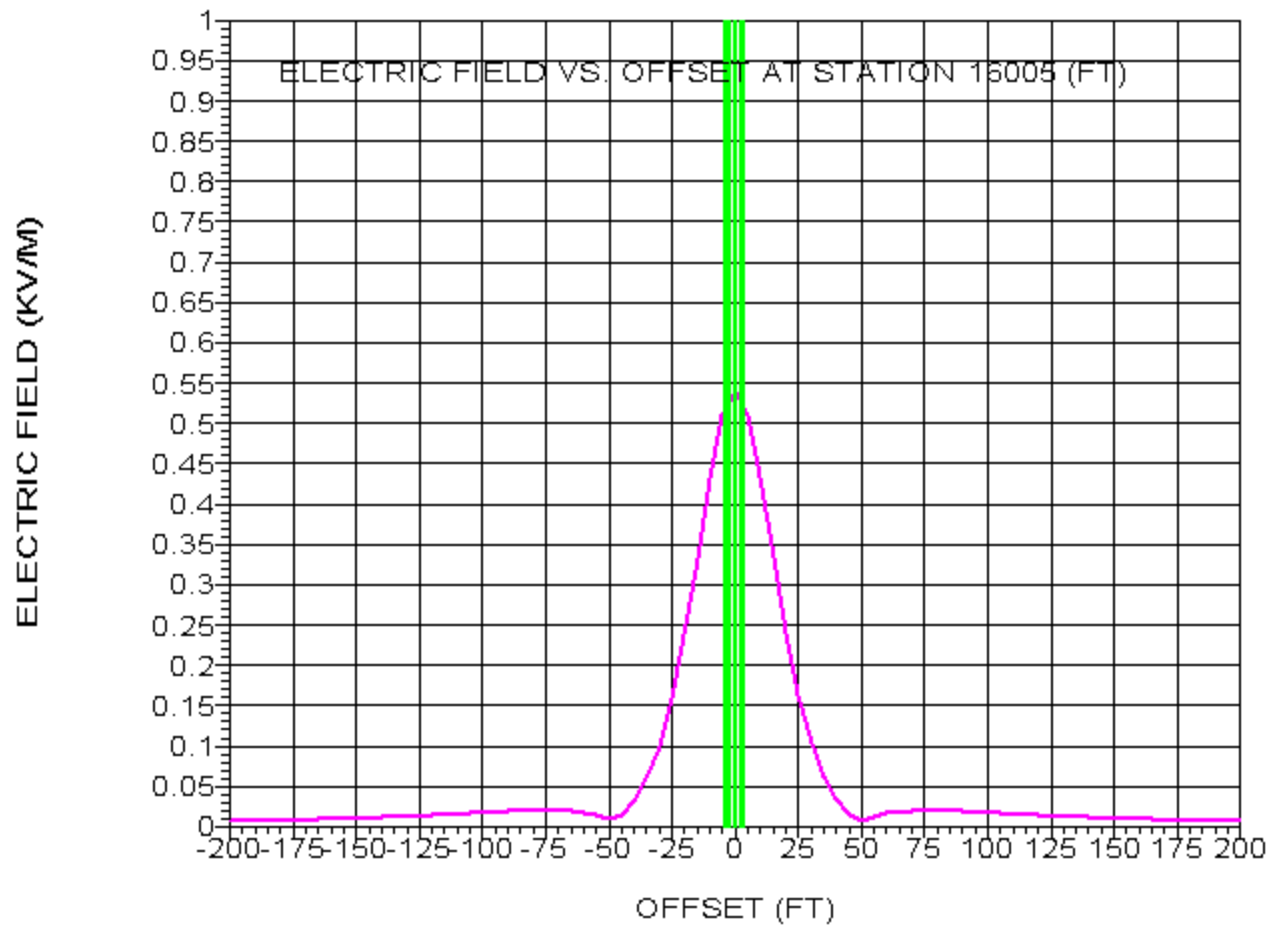
Calculated EMF Circuit Data For Last Point:

Wire coordinates are printed for the location on the wire closest to the alignment.
 In the case of wires that are not parallel, this may result in different stations
 for the wires and centerline.

Set #	Phase #	Weather Case	Cable Condition	Wind From	Wire X (ft)	Wire Y (ft)	Wire Z (ft)	Wire Station (ft)	Wire Offset (ft)	Eqv. Diameter (in)	Wire Voltage To Gnd. (kV)
1	1	212 Deg F	Max Sag	RS	Left 8290798.66	734456.22	711.84	16005.40	-2.45	1.454	20.21
2	1	212 Deg F	Max Sag	RS	Left 8290798.60	734457.26	705.05	16005.40	-3.48	1.300	20.21
3	1	212 Deg F	Max Sag	RS	Left 8290798.65	734456.30	697.82	16005.40	-2.52	1.300	20.21
4	1	212 Deg F	Max Sag	RS	Left 8290798.90	734451.26	698.24	16005.40	2.52	1.300	20.21
5	1	212 Deg F	Max Sag	RS	Left 8290798.95	734450.30	705.69	16005.40	3.48	1.300	20.21
6	1	212 Deg F	Max Sag	RS	Left 8290798.90	734451.34	712.38	16005.40	2.45	1.454	20.21
7	1	90 Deg F	Max Sag	RS	Left 8290798.78	734453.78	721.75	16005.40	0.00	0.646	0

Maximum magnetic field of 139.02 (mG) found at station 16005.40, offset 0.00 (ft)
 Maximum electric field of 0.541 (kV/m) found at station 16005.40, offset 0.00 (ft)

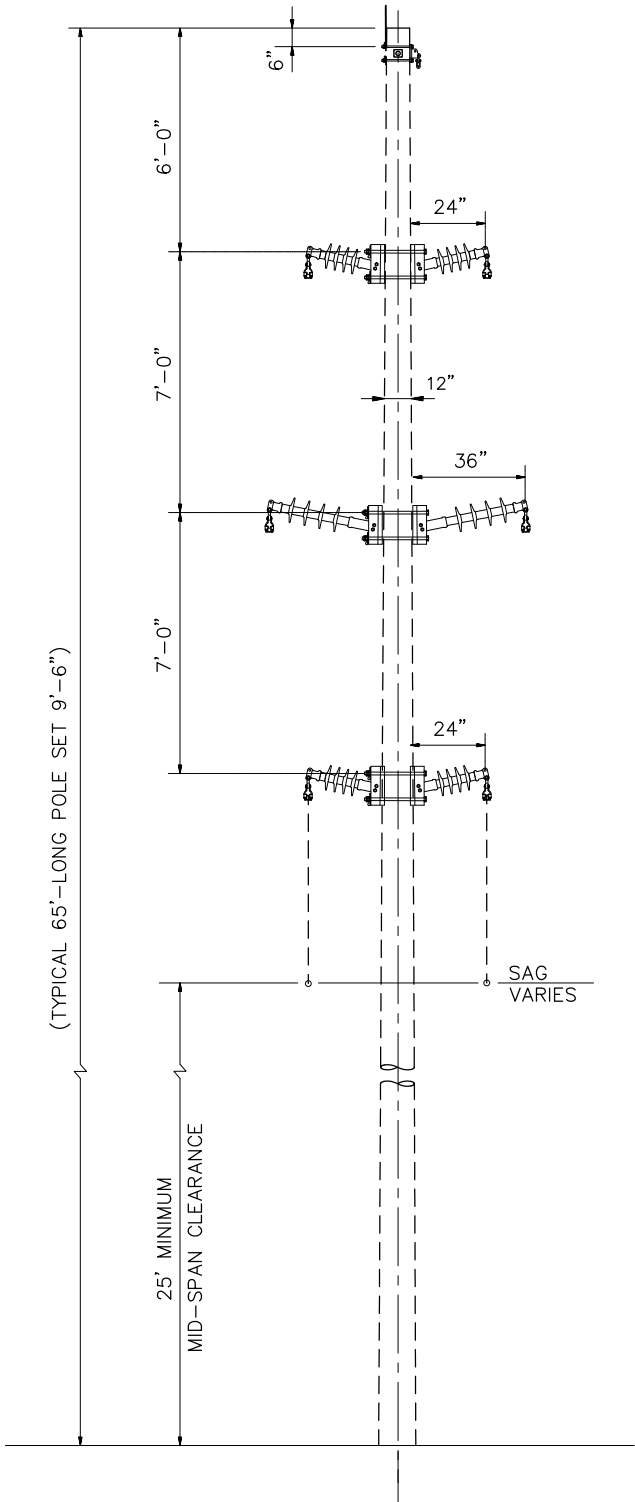




EMF Calculation Results:

Station	Offset	X	Y	Z	B	B B Phase	B rms	E	E E Phase	E Axis	E rms		
(ft)	(ft)	(ft)	(ft)	(ft)	Real	Img.	Res.	Real	Img.	Angle	Angle	Res.	
					(mG)	(mG)	(mG)	(kV/m)	(kV/m)	(deg)	(deg)	(kV/m)	
16005.40	-200.00	8290788.90	734653.54	670.09	2.781	1.71179	31.6	3.266	0.006	0.00201	18.9	88.3	0.006
16005.40	-195.00	8290789.15	734648.54	670.09	2.921	1.79891	31.6	3.431	0.006	0.00211	18.9	88.3	0.006
16005.40	-190.00	8290789.40	734643.55	670.09	3.072	1.89280	31.6	3.609	0.006	0.00221	18.9	88.3	0.007
16005.40	-185.00	8290789.64	734638.55	670.09	3.236	1.99418	31.6	3.801	0.007	0.00231	18.9	88.2	0.007
16005.40	-180.00	8290789.89	734633.56	670.09	3.412	2.10387	31.7	4.008	0.007	0.00242	18.9	88.2	0.007
16005.40	-175.00	8290790.14	734628.57	670.09	3.603	2.22278	31.7	4.233	0.007	0.00254	18.9	88.2	0.008
16005.40	-170.00	8290790.38	734623.57	670.09	3.810	2.35197	31.7	4.477	0.008	0.00267	18.9	88.1	0.008
16005.40	-165.00	8290790.63	734618.58	670.09	4.035	2.49265	31.7	4.743	0.008	0.00281	18.9	88.1	0.009
16005.40	-160.00	8290790.88	734613.59	670.09	4.280	2.64621	31.7	5.032	0.009	0.00295	18.9	88.1	0.009
16005.40	-155.00	8290791.13	734608.59	670.09	4.548	2.81425	31.7	5.349	0.009	0.00311	18.9	88.0	0.010
16005.40	-150.00	8290791.37	734603.60	670.09	4.842	2.99862	31.8	5.696	0.010	0.00328	18.9	88.0	0.010
16005.40	-145.00	8290791.62	734598.60	670.09	5.165	3.20148	31.8	6.077	0.010	0.00345	18.9	88.0	0.011
16005.40	-140.00	8290791.87	734593.61	670.09	5.520	3.42537	31.8	6.497	0.011	0.00364	18.9	88.0	0.011
16005.40	-135.00	8290792.11	734588.62	670.09	5.913	3.67323	31.8	6.961	0.011	0.00385	18.9	87.9	0.012
16005.40	-130.00	8290792.36	734583.62	670.09	6.348	3.94858	31.9	7.476	0.012	0.00406	18.9	87.9	0.013
16005.40	-125.00	8290792.61	734578.63	670.09	6.832	4.25553	31.9	8.049	0.013	0.00429	18.9	87.9	0.013
16005.40	-120.00	8290792.85	734573.63	670.09	7.371	4.59905	32.0	8.688	0.013	0.00453	18.9	87.9	0.014
16005.40	-115.00	8290793.10	734568.64	670.09	7.976	4.98502	32.0	9.405	0.014	0.00478	18.8	87.9	0.015
16005.40	-110.00	8290793.35	734563.65	670.09	8.655	5.42060	32.1	10.212	0.015	0.00504	18.8	88.0	0.016
16005.40	-105.00	8290793.59	734558.65	670.09	9.422	5.91442	32.1	11.124	0.016	0.00530	18.7	88.0	0.016
16005.40	-100.00	8290793.84	734553.66	670.09	10.291	6.47705	32.2	12.160	0.016	0.00555	18.6	88.1	0.017
16005.40	-95.00	8290794.09	734548.66	670.09	11.282	7.12147	32.3	13.342	0.017	0.00579	18.5	88.3	0.018
16005.40	-90.00	8290794.33	734543.67	670.09	12.416	7.86374	32.3	14.697	0.018	0.00598	18.3	88.5	0.019
16005.40	-85.00	8290794.58	734538.68	670.09	13.720	8.72387	32.4	16.259	0.019	0.00612	18.0	88.8	0.020
16005.40	-80.00	8290794.83	734533.68	670.09	15.229	9.72700	32.6	18.071	0.019	0.00614	17.6	89.3	0.020
16005.40	-75.00	8290795.07	734528.69	670.09	16.985	10.90491	32.7	20.184	0.020	0.00598	17.0	90.0	0.021
16005.40	-70.00	8290795.32	734523.69	670.09	19.038	12.29802	32.9	22.664	0.019	0.00555	15.9	91.2	0.020
16005.40	-65.00	8290795.57	734518.70	670.09	21.453	13.95808	33.0	25.594	0.019	0.00472	14.2	93.1	0.019
16005.40	-60.00	8290795.81	734513.71	670.09	24.310	15.95158	33.3	29.076	0.017	0.00336	11.3	96.6	0.017
16005.40	-55.00	8290796.06	734508.71	670.09	27.707	18.36411	33.5	33.240	0.014	0.00233	9.7	103.4	0.014
16005.40	-50.00	8290796.31	734503.72	670.09	31.764	21.30533	33.9	38.247	0.009	0.00546	31.4	116.3	0.009
16005.40	-45.00	8290796.56	734498.73	670.09	36.621	24.91403	34.2	44.292	0.008	0.01249	57.6	50.4	0.014
16005.40	-40.00	8290796.80	734493.73	670.09	42.439	29.36082	34.7	51.605	0.020	0.02396	50.3	61.9	0.031
16005.40	-35.00	8290797.05	734488.74	670.09	49.379	34.84273	35.2	60.434	0.041	0.04189	45.5	67.8	0.059
16005.40	-30.00	8290797.30	734483.74	670.09	57.568	41.55723	35.8	71.000	0.072	0.06926	43.8	251.3	0.100
16005.40	-25.00	8290797.54	734478.75	670.09	67.019	49.63181	36.5	83.396	0.115	0.10956	43.6	253.8	0.159
16005.40	-20.00	8290797.79	734473.76	670.09	77.495	58.97443	37.3	97.383	0.170	0.16554	44.2	256.1	0.237
16005.40	-15.00	8290798.04	734468.76	670.09	88.306	69.02666	38.0	112.083	0.235	0.23614	45.2	78.7	0.333
16005.40	-10.00	8290798.28	734463.77	670.09	98.139	78.50903	38.7	125.678	0.299	0.31192	46.2	81.9	0.432
16005.40	-5.00	8290798.53	734458.77	670.09	105.156	85.47019	39.1	135.510	0.348	0.37319	47.0	85.8	0.511
16005.40	0.00	8290798.78	734453.78	670.09	107.632	87.99537	39.3	139.025	0.367	0.39725	47.3	90.0	0.541

16005.40	5.00	8290799.02	734448.79	670.09	104.889	85.30938	39.1	135.201	0.348	0.37387	47.0	94.2	0.511
16005.40	10.00	8290799.27	734443.79	670.09	97.711	78.28398	38.7	125.203	0.299	0.31347	46.3	97.9	0.433
16005.40	15.00	8290799.52	734438.80	670.09	87.845	68.83564	38.1	111.602	0.235	0.23849	45.4	101.1	0.335
16005.40	20.00	8290799.76	734433.80	670.09	77.080	58.85878	37.4	96.983	0.172	0.16829	44.4	283.7	0.240
16005.40	25.00	8290800.01	734428.81	670.09	66.679	49.58683	36.6	83.096	0.117	0.11228	43.8	285.9	0.162
16005.40	30.00	8290800.26	734423.82	670.09	57.303	41.56146	36.0	70.788	0.074	0.07167	44.0	288.2	0.103
16005.40	35.00	8290800.50	734418.82	670.09	49.178	34.87538	35.3	60.289	0.043	0.04389	45.5	111.3	0.061
16005.40	40.00	8290800.75	734413.83	670.09	42.287	29.40704	34.8	51.507	0.022	0.02554	49.8	116.5	0.033
16005.40	45.00	8290801.00	734408.83	670.09	36.507	24.96470	34.4	44.226	0.009	0.01371	57.8	126.3	0.015
16005.40	50.00	8290801.25	734403.84	670.09	31.677	21.35538	34.0	38.203	0.008	0.00632	39.2	65.7	0.008
16005.40	55.00	8290801.49	734398.85	670.09	27.640	18.41104	33.7	33.211	0.012	0.00246	11.3	74.9	0.012
16005.40	60.00	8290801.74	734393.85	670.09	24.258	15.99434	33.4	29.057	0.016	0.00287	10.4	82.5	0.016
16005.40	65.00	8290801.99	734388.86	670.09	21.412	13.99640	33.2	25.581	0.018	0.00426	13.6	86.3	0.018
16005.40	70.00	8290802.23	734383.87	670.09	19.006	12.33208	33.0	22.656	0.019	0.00518	15.6	88.4	0.019
16005.40	75.00	8290802.48	734378.87	670.09	16.959	10.93504	32.8	20.179	0.019	0.00567	16.8	89.7	0.020
16005.40	80.00	8290802.73	734373.88	670.09	15.209	9.75362	32.7	18.068	0.019	0.00589	17.5	90.5	0.020
16005.40	85.00	8290802.97	734368.88	670.09	13.703	8.74738	32.6	16.257	0.018	0.00591	18.0	91.1	0.019
16005.40	90.00	8290803.22	734363.89	670.09	12.402	7.88453	32.4	14.696	0.018	0.00581	18.3	91.4	0.019
16005.40	95.00	8290803.47	734358.90	670.09	11.270	7.13989	32.4	13.342	0.017	0.00564	18.5	91.6	0.018
16005.40	100.00	8290803.71	734353.90	670.09	10.282	6.49342	32.3	12.160	0.016	0.00543	18.7	91.8	0.017
16005.40	105.00	8290803.96	734348.91	670.09	9.413	5.92900	32.2	11.125	0.015	0.00519	18.8	91.9	0.016
16005.40	110.00	8290804.21	734343.91	670.09	8.648	5.43361	32.1	10.213	0.014	0.00495	18.9	92.0	0.015
16005.40	115.00	8290804.45	734338.92	670.09	7.969	4.99668	32.1	9.406	0.014	0.00471	18.9	92.0	0.015
16005.40	120.00	8290804.70	734333.93	670.09	7.366	4.60952	32.0	8.689	0.013	0.00447	19.0	92.0	0.014
16005.40	125.00	8290804.95	734328.93	670.09	6.827	4.26497	32.0	8.050	0.012	0.00423	19.0	92.1	0.013
16005.40	130.00	8290805.19	734323.94	670.09	6.344	3.95710	32.0	7.477	0.012	0.00401	19.0	92.0	0.012
16005.40	135.00	8290805.44	734318.94	670.09	5.909	3.68095	31.9	6.962	0.011	0.00380	19.0	92.0	0.012
16005.40	140.00	8290805.69	734313.95	670.09	5.517	3.43238	31.9	6.498	0.010	0.00361	19.0	92.0	0.011
16005.40	145.00	8290805.93	734308.96	670.09	5.162	3.20787	31.9	6.078	0.010	0.00342	19.0	92.0	0.010
16005.40	150.00	8290806.18	734303.96	670.09	4.840	3.00444	31.8	5.696	0.009	0.00324	19.0	92.0	0.010
16005.40	155.00	8290806.43	734298.97	670.09	4.546	2.81958	31.8	5.350	0.009	0.00308	19.0	91.9	0.009
16005.40	160.00	8290806.68	734293.98	670.09	4.278	2.65110	31.8	5.033	0.008	0.00293	19.0	91.9	0.009
16005.40	165.00	8290806.92	734288.98	670.09	4.033	2.49715	31.8	4.743	0.008	0.00278	19.0	91.9	0.009
16005.40	170.00	8290807.17	734283.99	670.09	3.808	2.35611	31.7	4.478	0.008	0.00265	19.0	91.8	0.008
16005.40	175.00	8290807.42	734278.99	670.09	3.601	2.22660	31.7	4.234	0.007	0.00252	19.0	91.8	0.008
16005.40	180.00	8290807.66	734274.00	670.09	3.410	2.10740	31.7	4.009	0.007	0.00241	19.0	91.8	0.007
16005.40	185.00	8290807.91	734269.01	670.09	3.234	1.99745	31.7	3.801	0.007	0.00229	19.0	91.7	0.007
16005.40	190.00	8290808.16	734264.01	670.09	3.071	1.89583	31.7	3.609	0.006	0.00219	19.0	91.7	0.007
16005.40	195.00	8290808.40	734259.02	670.09	2.920	1.80172	31.7	3.431	0.006	0.00209	19.0	91.7	0.006
16005.40	200.00	8290808.65	734254.02	670.09	2.780	1.71441	31.7	3.266	0.006	0.00200	19.0	91.7	0.006



DESIGN ASSUMPTIONS:

- 1590 KCMIL "COREOPSIS" AAC
- 280' MAX SPAN

NOTES:

1. STRUCTURE DIMENSIONS ARE APPROXIMATE. ACTUAL DIMENSIONS MAY VARY.
2. DIMENSIONS ARE TO ATTACHMENT HOLES.
3. DRAWING IS NOT TO EXACT SCALE

IBERDROLA
TULE WIND
PROJECT

TYPICAL
34.5-KV HORIZONTAL LINE POST
TANGENT DOUBLE-CIRCUIT CONFIGURATION

TriAxis
Engineering, Inc.

DSGN MCF DR JHR DATE FEB 2010

FIG 2

PLS-CADD Version 10.40 4:00:54 PM Thursday, February 11, 2010
 Tri-Axis Engineering
 Project Name: 'x:\iberdrola\tule - san diego\emf calcs\34.5-kv overhead - double circuit'

Criteria notes:

NESC Heavy per Rule 250B, Page 161
 Extreme Wind Loading per Rule 250C, Page 161, Coefficients and Gust Response Factors per Equations in Tables 250-2, 250-3
 100 MPH Basic Wind Speed, 3 second Gust Wind Speed, Figure 250-2 Beginning on Page 166
 EXTREME ICE 1.75 IN RADIAL
 Grade B Construction "Method A" per Table 253-1, Page 173 and Table 261-1A, Page 182
 Tension Limits per RUS (REA BULLETIN 1724E-200, TABLE 9-2, PAGE 9-9)
 Insulator Strength Reduction per Rule 277, Page 188 Should be applied to Insulator Strengths when Modeling Insulators
 2002 NESC C2-2002 Criteria File for PLS-CADD Created December 21, 2001

EMF Calculation Notes:

- 1) All calculations based on the EPRI Red Book methods (2nd Edition, 1982 - infinite straight wire with flat earth approximation).
- 2) These approximations are only valid for low frequency (50-60Hz) AC transmission lines.
- 3) Bundles are modeled with an equivalent conductor as per EPRI Red Book 8.3.1.
- 4) The effects of earth return currents (earth resistivity) are ignored when calculating the magnetic field.
- 5) Wire position is determined by the currently displayed weather case.
- 6) Wire height used is the height of the wire where the target point is projected upon it.
- 7) All calculations assume ground is flat with same elevation as that of centerline.

Meter height above centerline ground: 3.28 (ft)
 Cross section offset for graph +/-: 200.00 (ft)
 Result interval for graph: 5.00 (ft)
 Electric field limit: 0.00 (kV/m)
 Magnetic field limit: 0.00 (mG)

EMF Circuit Data:

Set #	Phase #	Conductors Per Phase	Voltage Ph-Ph (kV)	Current (Amps)	Phase Angle (deg)	Bundle Diameter (in)
1	1	1	35	837.000	0	0.000
2	1	1	35	837.000	120	0.000
3	1	1	35	837.000	-120	0.000
4	1	1	35	837.000	0	0.000
5	1	1	35	837.000	120	0.000
6	1	1	35	837.000	-120	0.000
7	1	1	0	0.000	0	0.000

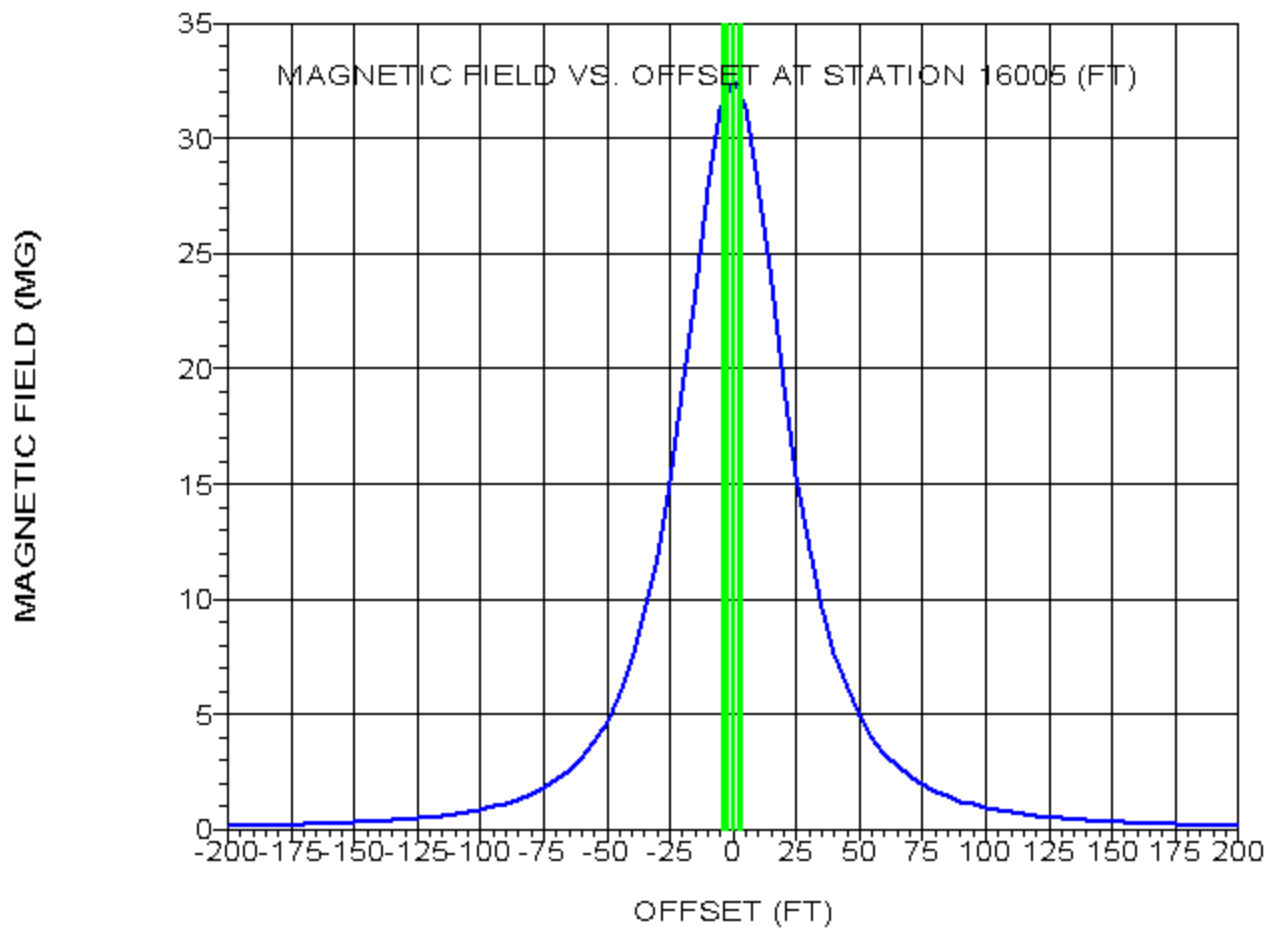
Calculated EMF Circuit Data For Last Point:

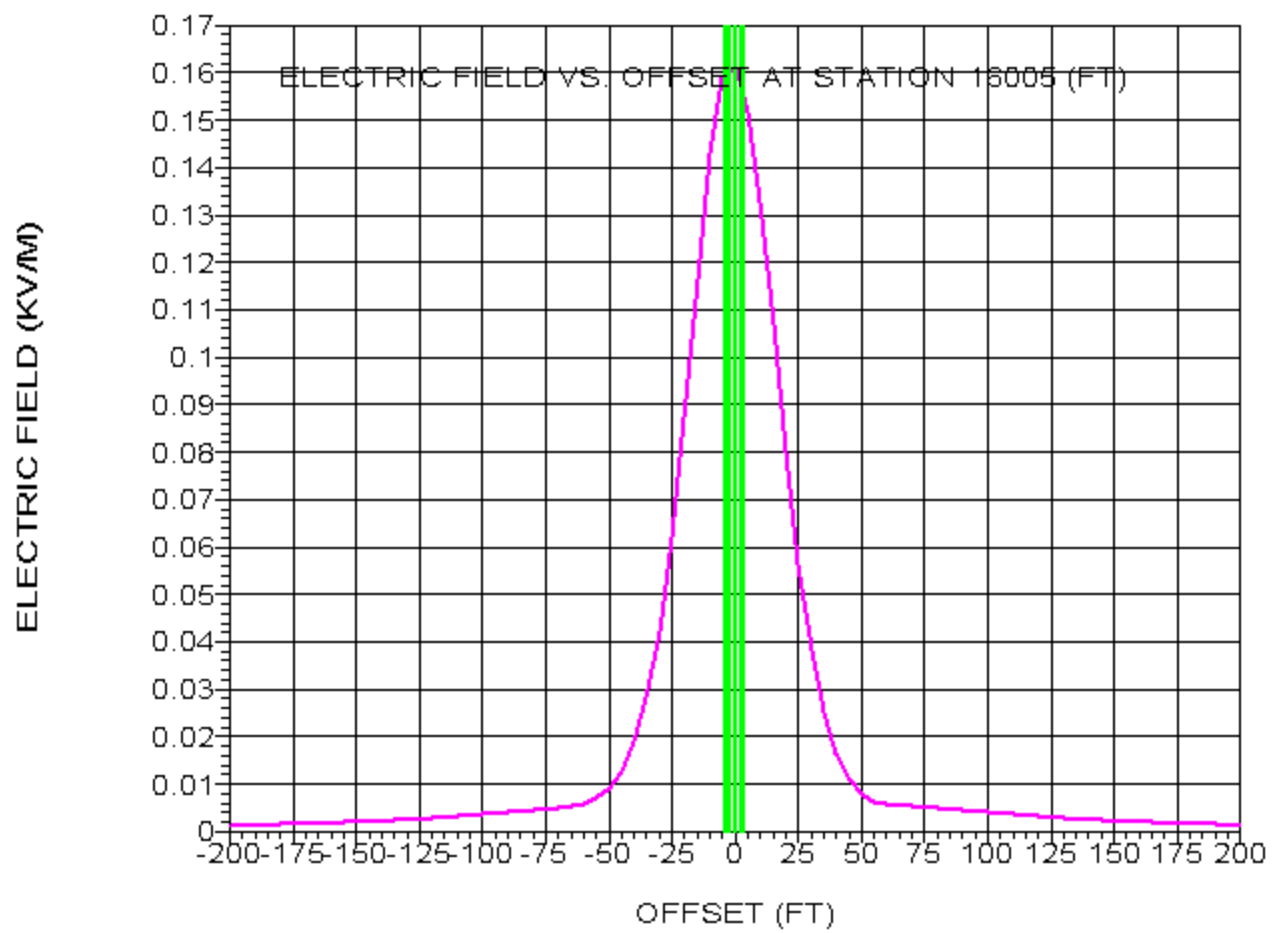
Wire coordinates are printed for the location on the wire closest to the alignment.
 In the case of wires that are not parallel, this may result in different stations
 for the wires and centerline.

Set #	Phase #	Weather Case	Cable Condition	Wind From	Wire X (ft)	Wire Y (ft)	Wire Z (ft)	Wire Station (ft)	Wire Offset (ft)	Eqv. Diameter (in)	Wire Voltage To Gnd. (kV)
1	1	212 Deg F	Max Sag	RS	Left 8290798.66	734456.22	711.84	16005.40	-2.45	1.454	20.21
2	1	212 Deg F	Max Sag	RS	Left 8290798.60	734457.26	705.05	16005.40	-3.48	1.300	20.21
3	1	212 Deg F	Max Sag	RS	Left 8290798.65	734456.30	697.82	16005.40	-2.52	1.300	20.21
4	1	212 Deg F	Max Sag	RS	Left 8290798.90	734451.26	698.24	16005.40	2.52	1.300	20.21
5	1	212 Deg F	Max Sag	RS	Left 8290798.95	734450.30	705.69	16005.40	3.48	1.300	20.21
6	1	212 Deg F	Max Sag	RS	Left 8290798.90	734451.34	712.38	16005.40	2.45	1.454	20.21
7	1	90 Deg F	Max Sag	RS	Left 8290798.78	734453.78	721.75	16005.40	0.00	0.646	0

Maximum magnetic field of 32.58 (mG) found at station 16005.40, offset 0.00 (ft)

Maximum electric field of 0.161 (kV/m) found at station 16005.40, offset 0.00 (ft)

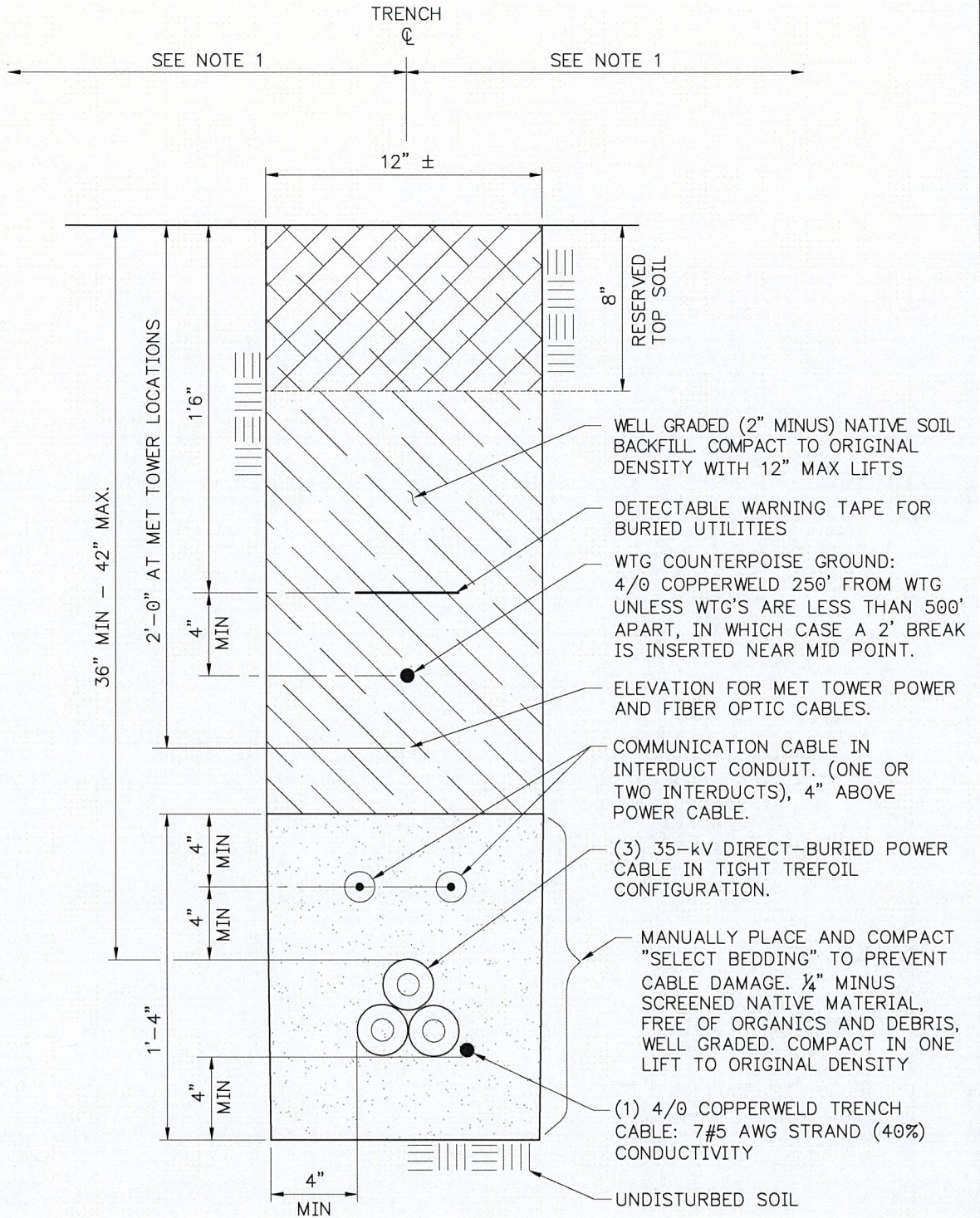




EMF Calculation Results:

Station	Offset	X	Y	Z	B	B B Phase	B rms	E	E E Phase	E Axis	E rms		
(ft)	(ft)	(ft)	(ft)	(ft)	Real	Img.	Angle	Res.	Real	Img.	Angle	Angle	Res.
					(mG)	(mG)	(deg)	(mG)	(kV/m)	(kV/m)	(deg)	(deg)	(kV/m)
16005.40	-200.00	8290788.90	734653.54	670.09	0.057	0.12296	65.2	0.136	0.001	0.00096	52.9	88.3	0.001
16005.40	-195.00	8290789.15	734648.54	670.09	0.061	0.13116	64.9	0.145	0.001	0.00100	52.5	88.3	0.001
16005.40	-190.00	8290789.40	734643.55	670.09	0.066	0.14016	64.6	0.155	0.001	0.00104	52.1	88.2	0.001
16005.40	-185.00	8290789.64	734638.55	670.09	0.072	0.15006	64.4	0.166	0.001	0.00108	51.7	88.2	0.001
16005.40	-180.00	8290789.89	734633.56	670.09	0.078	0.16099	64.1	0.179	0.001	0.00113	51.3	88.2	0.001
16005.40	-175.00	8290790.14	734628.57	670.09	0.085	0.17307	63.8	0.193	0.001	0.00118	50.9	88.1	0.002
16005.40	-170.00	8290790.38	734623.57	670.09	0.093	0.18647	63.4	0.208	0.001	0.00123	50.5	88.1	0.002
16005.40	-165.00	8290790.63	734618.58	670.09	0.102	0.20137	63.1	0.226	0.001	0.00129	50.1	88.1	0.002
16005.40	-160.00	8290790.88	734613.59	670.09	0.112	0.21801	62.7	0.245	0.001	0.00135	49.6	88.0	0.002
16005.40	-155.00	8290791.13	734608.59	670.09	0.124	0.23664	62.4	0.267	0.001	0.00141	49.2	88.0	0.002
16005.40	-150.00	8290791.37	734603.60	670.09	0.137	0.25757	62.0	0.292	0.001	0.00148	48.7	87.9	0.002
16005.40	-145.00	8290791.62	734598.60	670.09	0.152	0.28118	61.6	0.320	0.001	0.00155	48.2	87.9	0.002
16005.40	-140.00	8290791.87	734593.61	670.09	0.169	0.30791	61.2	0.351	0.001	0.00163	47.7	87.9	0.002
16005.40	-135.00	8290792.11	734588.62	670.09	0.189	0.33830	60.8	0.388	0.002	0.00171	47.3	87.8	0.002
16005.40	-130.00	8290792.36	734583.62	670.09	0.212	0.37300	60.4	0.429	0.002	0.00180	46.8	87.8	0.002
16005.40	-125.00	8290792.61	734578.63	670.09	0.239	0.41280	59.9	0.477	0.002	0.00190	46.4	87.8	0.003
16005.40	-120.00	8290792.85	734573.63	670.09	0.270	0.45869	59.5	0.532	0.002	0.00200	46.0	87.8	0.003
16005.40	-115.00	8290793.10	734568.64	670.09	0.307	0.51187	59.0	0.597	0.002	0.00211	45.6	87.7	0.003
16005.40	-110.00	8290793.35	734563.65	670.09	0.351	0.57384	58.6	0.673	0.002	0.00223	45.3	87.7	0.003
16005.40	-105.00	8290793.59	734558.65	670.09	0.403	0.64648	58.1	0.762	0.002	0.00236	45.2	87.7	0.003
16005.40	-100.00	8290793.84	734553.66	670.09	0.464	0.73217	57.6	0.867	0.002	0.00251	45.2	87.8	0.004
16005.40	-95.00	8290794.09	734548.66	670.09	0.539	0.83393	57.1	0.993	0.003	0.00267	45.4	87.8	0.004
16005.40	-90.00	8290794.33	734543.67	670.09	0.629	0.95562	56.6	1.144	0.003	0.00286	46.0	87.9	0.004
16005.40	-85.00	8290794.58	734538.68	670.09	0.739	1.10226	56.1	1.327	0.003	0.00308	47.1	87.9	0.004
16005.40	-80.00	8290794.83	734533.68	670.09	0.875	1.28037	55.7	1.551	0.003	0.00335	48.9	88.0	0.004
16005.40	-75.00	8290795.07	734528.69	670.09	1.043	1.49855	55.2	1.826	0.003	0.00368	51.8	88.0	0.005
16005.40	-70.00	8290795.32	734523.69	670.09	1.253	1.76815	54.7	2.167	0.003	0.00413	56.3	87.7	0.005
16005.40	-65.00	8290795.57	734518.70	670.09	1.519	2.10434	54.2	2.595	0.002	0.00474	62.8	86.9	0.005
16005.40	-60.00	8290795.81	734513.71	670.09	1.857	2.52747	53.7	3.136	0.002	0.00562	71.5	85.0	0.006
16005.40	-55.00	8290796.06	734508.71	670.09	2.291	3.06488	53.2	3.827	0.001	0.00694	80.5	81.9	0.007
16005.40	-50.00	8290796.31	734503.72	670.09	2.854	3.75329	52.8	4.715	0.002	0.00898	79.8	78.5	0.009
16005.40	-45.00	8290796.56	734498.73	670.09	3.588	4.64143	52.3	5.867	0.004	0.01220	72.2	76.0	0.013
16005.40	-40.00	8290796.80	734493.73	670.09	4.552	5.79243	51.8	7.367	0.007	0.01733	66.6	74.9	0.019
16005.40	-35.00	8290797.05	734488.74	670.09	5.818	7.28376	51.4	9.322	0.012	0.02547	64.1	74.8	0.028
16005.40	-30.00	8290797.30	734483.74	670.09	7.474	9.19985	50.9	11.853	0.018	0.03815	64.4	75.3	0.042
16005.40	-25.00	8290797.54	734478.75	670.09	9.609	11.60737	50.4	15.068	0.024	0.05703	66.9	76.4	0.062
16005.40	-20.00	8290797.79	734473.76	670.09	12.273	14.49709	49.7	18.994	0.028	0.08297	71.3	78.2	0.087
16005.40	-15.00	8290798.04	734468.76	670.09	15.399	17.68137	48.9	23.447	0.026	0.11395	77.4	80.9	0.116
16005.40	-10.00	8290798.28	734463.77	670.09	18.672	20.68291	47.9	27.864	0.018	0.14256	82.7	84.3	0.143
16005.40	-5.00	8290798.53	734458.77	670.09	21.436	22.75744	46.7	31.264	0.035	0.15682	77.3	87.9	0.159
16005.40	0.00	8290798.78	734453.78	670.09	22.853	23.21924	45.5	32.579	0.071	0.14763	64.4	90.9	0.161

16005.40	5.00	8290799.02	7344448.79	670.09	22.398	21.91214	44.4	31.334	0.099	0.11781	50.0	93.5	0.152
16005.40	10.00	8290799.27	7344443.79	670.09	20.285	19.31704	43.6	28.012	0.107	0.08040	36.9	96.4	0.133
16005.40	15.00	8290799.52	734438.80	670.09	17.273	16.17863	43.1	23.666	0.096	0.04794	26.5	99.4	0.107
16005.40	20.00	8290799.76	734433.80	670.09	14.124	13.10091	42.8	19.265	0.076	0.02575	18.7	101.9	0.080
16005.40	25.00	8290800.01	734428.81	670.09	11.300	10.40866	42.7	15.363	0.055	0.01309	13.4	103.8	0.057
16005.40	30.00	8290800.26	734423.82	670.09	8.963	8.20257	42.5	12.150	0.038	0.00704	10.6	105.1	0.038
16005.40	35.00	8290800.50	734418.82	670.09	7.110	6.45957	42.3	9.606	0.025	0.00484	11.0	106.0	0.025
16005.40	40.00	8290800.75	734413.83	670.09	5.670	5.10774	42.0	7.632	0.016	0.00447	15.7	106.0	0.016
16005.40	45.00	8290801.00	734408.83	670.09	4.558	4.06696	41.7	6.109	0.010	0.00471	25.4	104.5	0.011
16005.40	50.00	8290801.25	734403.84	670.09	3.698	3.26591	41.4	4.934	0.006	0.00505	39.7	100.4	0.008
16005.40	55.00	8290801.49	734398.85	670.09	3.030	2.64695	41.1	4.024	0.004	0.00530	55.7	95.4	0.006
16005.40	60.00	8290801.74	734393.85	670.09	2.507	2.16559	40.8	3.313	0.002	0.00543	69.3	92.3	0.006
16005.40	65.00	8290801.99	734388.86	670.09	2.094	1.78829	40.5	2.754	0.001	0.00543	78.7	91.2	0.006
16005.40	70.00	8290802.23	734383.87	670.09	1.765	1.49001	40.2	2.310	0.001	0.00533	84.6	91.2	0.005
16005.40	75.00	8290802.48	734378.87	670.09	1.501	1.25213	39.8	1.954	0.000	0.00517	87.9	91.4	0.005
16005.40	80.00	8290802.73	734373.88	670.09	1.286	1.06077	39.5	1.667	0.000	0.00496	88.2	91.6	0.005
16005.40	85.00	8290802.97	734368.88	670.09	1.110	0.90550	39.2	1.432	0.000	0.00473	87.3	91.9	0.005
16005.40	90.00	8290803.22	734363.89	670.09	0.965	0.77849	38.9	1.239	0.000	0.00449	86.6	92.0	0.004
16005.40	95.00	8290803.47	734358.90	670.09	0.844	0.67378	38.6	1.080	0.000	0.00424	86.3	92.2	0.004
16005.40	100.00	8290803.71	734353.90	670.09	0.742	0.58682	38.3	0.946	0.000	0.00400	86.2	92.2	0.004
16005.40	105.00	8290803.96	734348.91	670.09	0.657	0.51408	38.1	0.834	0.000	0.00376	86.4	92.3	0.004
16005.40	110.00	8290804.21	734343.91	670.09	0.584	0.45284	37.8	0.739	0.000	0.00354	86.6	92.3	0.004
16005.40	115.00	8290804.45	734338.92	670.09	0.522	0.40095	37.5	0.658	0.000	0.00333	86.9	92.3	0.003
16005.40	120.00	8290804.70	734333.93	670.09	0.468	0.35673	37.3	0.589	0.000	0.00313	87.2	92.3	0.003
16005.40	125.00	8290804.95	734328.93	670.09	0.422	0.31884	37.1	0.529	0.000	0.00294	87.6	92.3	0.003
16005.40	130.00	8290805.19	734323.94	670.09	0.382	0.28619	36.8	0.477	0.000	0.00277	88.0	92.3	0.003
16005.40	135.00	8290805.44	734318.94	670.09	0.347	0.25792	36.6	0.432	0.000	0.00261	88.5	92.2	0.003
16005.40	140.00	8290805.69	734313.95	670.09	0.316	0.23333	36.4	0.393	0.000	0.00246	88.9	92.2	0.002
16005.40	145.00	8290805.93	734308.96	670.09	0.289	0.21184	36.3	0.358	0.000	0.00232	89.3	92.2	0.002
16005.40	150.00	8290806.18	734303.96	670.09	0.265	0.19299	36.1	0.328	0.000	0.00219	89.6	92.1	0.002
16005.40	155.00	8290806.43	734298.97	670.09	0.244	0.17638	35.9	0.301	0.000	0.00207	89.7	92.1	0.002
16005.40	160.00	8290806.68	734293.98	670.09	0.225	0.16169	35.8	0.277	0.000	0.00196	89.3	92.0	0.002
16005.40	165.00	8290806.92	734288.98	670.09	0.208	0.14866	35.6	0.255	0.000	0.00186	88.9	92.0	0.002
16005.40	170.00	8290807.17	734283.99	670.09	0.192	0.13705	35.5	0.236	0.000	0.00176	88.6	92.0	0.002
16005.40	175.00	8290807.42	734278.99	670.09	0.179	0.12667	35.4	0.219	0.000	0.00167	88.2	91.9	0.002
16005.40	180.00	8290807.66	734274.00	670.09	0.166	0.11738	35.2	0.203	0.000	0.00159	87.8	91.9	0.002
16005.40	185.00	8290807.91	734269.01	670.09	0.155	0.10902	35.1	0.189	0.000	0.00151	87.5	91.9	0.002
16005.40	190.00	8290808.16	734264.01	670.09	0.145	0.10149	35.0	0.177	0.000	0.00144	87.1	91.8	0.001
16005.40	195.00	8290808.40	734259.02	670.09	0.136	0.09468	34.9	0.165	0.000	0.00137	86.8	91.8	0.001
16005.40	200.00	8290808.65	734254.02	670.09	0.127	0.08851	34.9	0.155	0.000	0.00131	86.5	91.7	0.001



NOTES:

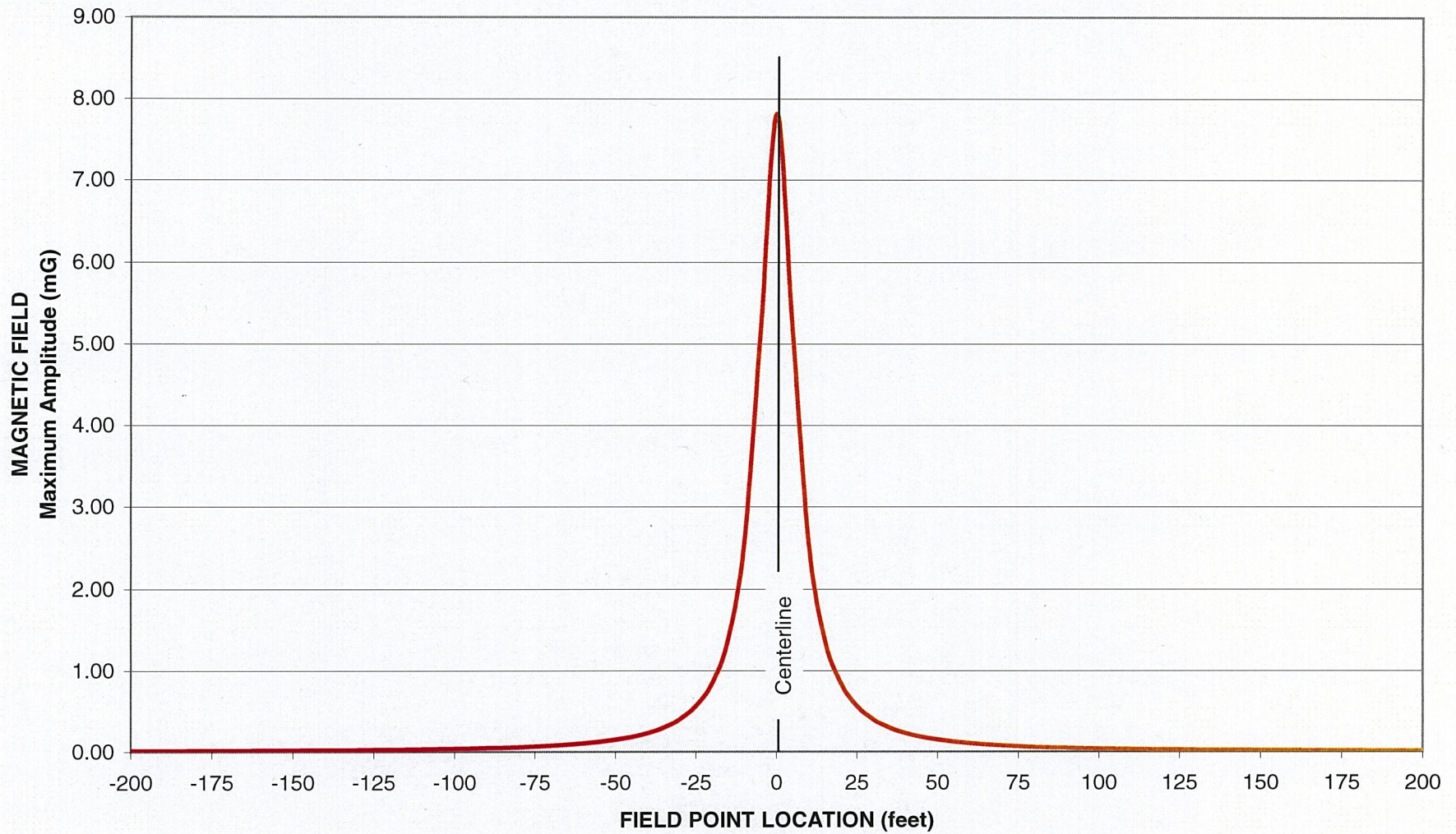
1. EACH 3-PHASE CABLE TRENCH SHALL BE SEPARATED FROM ALL OTHER CABLE TRENCHES BY 10'-6" MINIMUM, CENTERLINE-TO-CENTERLINE UNLESS OTHERWISE NOTED ON DRAWINGS.
2. ROCKS SHALL NOT COME IN CONTACT WITH CABLES.

IBERDROLA RENEWABLES
TULE WIND PROJECT

FIGURE 2
DIRECT BURIED 34.5-KV
UNDERGROUND CABLE
TRENCH DETAIL

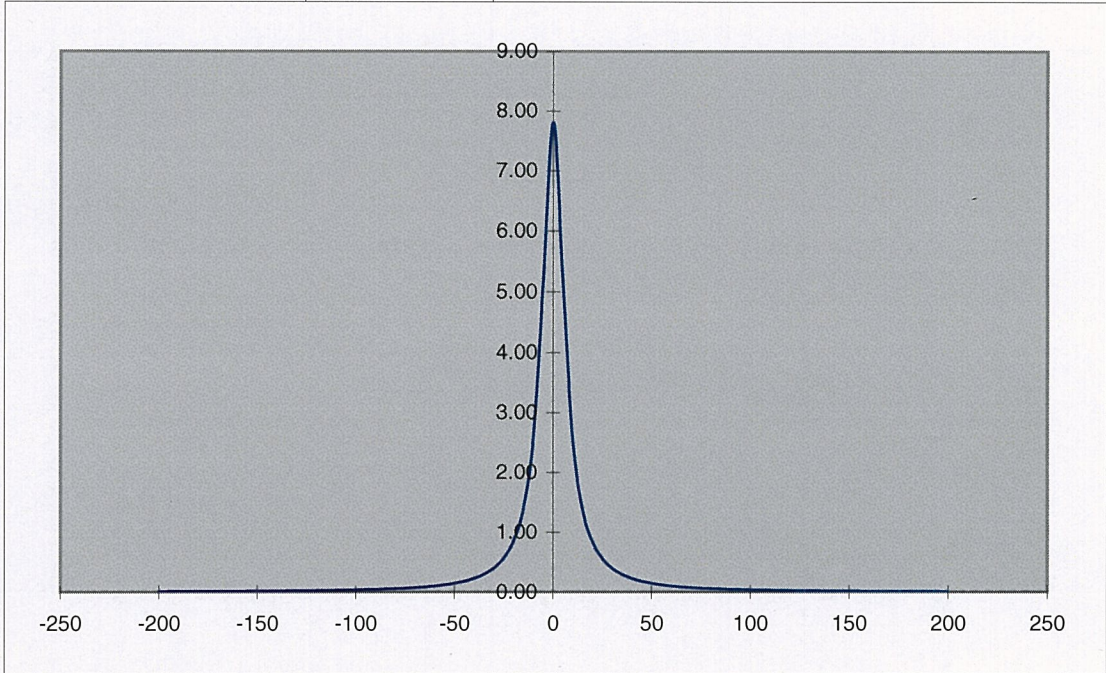
TriAxis
Engineering, Inc.

**34.5-kV, UNDERGROUND COLLECTION
60Hz MAGNETIC FIELD AT 1 METER FROM GRADE (in milli-Gauss)**



Graph 8-M 34kVUG MFIELD.xls

Bundle	x-feet	y-feet	amps	phase
1	0.0	-3.6	335.0	0.0
2	-0.1	-3.7	335.0	120.0
3	0.1	-3.7	335.0	240.0
4	-6.0	-3.0	0.0	240.0
5	-5.9	-3.1	0.0	120.0
6	-6.1	-3.1	0.0	0.0
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
NPH=	6.00			
Dist - ft	Vert	Calculated		
		Milligauss		
-200	3.28	0.01		
-195	3.28	0.01		
-190	3.28	0.01		
-185	3.28	0.01		
-180	3.28	0.01		
-175	3.28	0.01		
-170	3.28	0.01		
-165	3.28	0.01		
-160	3.28	0.01		
-155	3.28	0.02		



-150	3.28	0.02		
-145	3.28	0.02		
-140	3.28	0.02		
-135	3.28	0.02		
-130	3.28	0.02		
-125	3.28	0.02		
-120	3.28	0.03		
-115	3.28	0.03		
-110	3.28	0.03		
-105	3.28	0.03		
-100	3.28	0.04		
-95	3.28	0.04		
-90	3.28	0.05		
-85	3.28	0.05		
-80	3.28	0.06		
-75	3.28	0.07		
-70	3.28	0.08		
-65	3.28	0.09		
-60	3.28	0.10		
-55	3.28	0.12		
-50	3.28	0.15		
-45	3.28	0.18		
-40	3.28	0.23		
-35	3.28	0.30		
-30	3.28	0.40		
-25	3.28	0.56		
-20	3.28	0.85		
-15	3.28	1.39		
-10	3.28	2.56		
-5	3.28	5.16		
0	3.28	7.81		
5	3.28	5.16		
10	3.28	2.56		
15	3.28	1.39		
20	3.28	0.85		
25	3.28	0.56		
30	3.28	0.40		

35	3.28	0.30		
40	3.28	0.23		
45	3.28	0.18		
50	3.28	0.15		
55	3.28	0.12		
60	3.28	0.10		
65	3.28	0.09		
70	3.28	0.08		
75	3.28	0.07		
80	3.28	0.06		
85	3.28	0.05		
90	3.28	0.05		
95	3.28	0.04		
100	3.28	0.04		
105	3.28	0.03		
110	3.28	0.03		
115	3.28	0.03		
120	3.28	0.03		
125	3.28	0.02		
130	3.28	0.02		
135	3.28	0.02		
140	3.28	0.02		
145	3.28	0.02		
150	3.28	0.02		
155	3.28	0.02		
160	3.28	0.01		
165	3.28	0.01		
170	3.28	0.01		
175	3.28	0.01		
180	3.28	0.01		
185	3.28	0.01		
190	3.28	0.01		
195	3.28	0.01		
200	3.28	0.01		